GOVERNMENT OF ANDHRA PRADESH

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

Andhra Pradesh :: AMARAVATI

Globally Competitive

CURRICULUM (C-20)

For Polytechnic Diploma Courses in Andhra Pradesh

3 YEAR (REGULAR) DIPLOMA IN

MECHANICAL ENGINEERING

CURRICULUM -2020
(C-20)

3 YEAR (REGULAR)
DIPLOMA IN MECHANICAL ENGINEERING

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(C-20)

FOR DIPLOMA COURSES IN ANDHRA PRADESH

PREAMBLE

The proposed programme intends to develop a skilled technician to support the industries both nationally or globally. It also helps to kindle the spirit of entrepreneurship with necessary skills and theoretical inputs aligning with the National policy of 'Make in India'. The programme also provides for accomplishing higher education goals for those who wish to enrich their theoretical concepts further.

The State Board of Technical Education and Training, (SBTET) AP, has been offering Diploma programmes to meet the above said aspirations of the stake holders: industries, students, academia, parents and the society at large. As such, it has been the practice of SBTET, A.P., to keep the curriculum abreast with the advances in technology through systematic and scientific analysis of current curriculum and bring out an updated revised version at regular intervals. Accordingly the SBTET, AP under the aegis of the Department of Technical Education, Andhra Pradesh in it's 57^{th} Board Meeting held on 05-02-2019 (vide item no: 18) resolved to update the Polytechnic Curriculum C-16 with the guidance of National Institute of Technical Teachers Training & Research (NITTTR), Extension Centre, Vijayawada (ECV), to be implemented with effect from the academic year '20-21.

Analysis of Curriculum C-16 (SWOT analysis) started in the month of June-2019. Feedback was collected from all stake holders: Students, Lecturers, Senior Lecturers, Head of Sections and Principals for all programmes for this purpose. A series of workshops with subject experts followed in the subsequent weeks and the draft curricula were prepared for every programme. Finally, an interactive session with representatives from industries, academia and subject experts was held on 04.01.2020 for thorough perusal and critique of draft curricula; and the suggestions received thus received from Industrialists and academia have been recorded , validated by another set of experienced subject teachers from the Department of Technical education for incorporation into the Curriculum C-20.

The design of new Curricula for the different diploma programmes has thus been finalised with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, and duly reviewed by Expert Committee constituted of academicians and representatives from industries. Thus, the primary objective of the curriculum change is to produce employable technicians in the country by correlating the growing needs of the industries with relevant academic input.

The outcome based approach as given by NBA guidelines has been followed throughout the design of this curriculum is designed to meet the requirements of NBA Accreditation, too.

The revised New Curriculum i.e., Curriculum–2020 (C-20) is approved by BoG of SBTET for its implementation with effect from 2020-21.

Highlights of Curriculum C-20:

1. Duration of course for regular Diploma and for sandwich Diploma is 3 years and 3½ years respectively.

2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months Industrial training has been introduced for 3 years Diploma Courses and 1 year Industrial Training is introduced for 3 ½ years Sandwich Diploma courses.
4. Updated subjects relevant to the industry are introduced in all the Diploma courses.
5. CISCO course content has been incorporated into the ECE and CME programmes for certification from CISCO in lieu of industrial training when students are unable to get Industrial Training placement in any industry.
6. The policy decisions taken at the State and Central level with regard to environmental science are implemented by including relevant topics in Chemistry. This is also in accordance with the Supreme Court guidelines issued in Sri Mehta's case.
7. Keeping in view the increased need of communication skills which is playing a major role in the success of Diploma Level students in the Industries, emphasis is given for learning and acquiring listening, speaking, reading and writing skills in English. Further as emphasized in the meetings, Communication Skills lab and Life Skills lab are continuing for all the branches.
8. CAD specific to the branch has been given emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
9. Upon reviewing the existing C-16 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In C-20 curriculum, more emphasis is given to the practical content in Laboratories and Workshops, thus strengthening the practical skills.
10. With increased emphasis for the student to acquire Practical skills, the course content in all the subjects is thoroughly reviewed and structured as outcome based than the conventional procedure based.
11. Curricula of Laboratory and Workshops have been thoroughly revised based on the suggestions received from the industry and faculty, for better utilization of the equipment available in the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to confirm to the field requirements of industry.
12. An exclusive section for assessing Higher order Thinking skills (HOTS) has been introduced in summative evaluation.

Acknowledgements:

It is pertinent to acknowledge the support of the following in the making of Curriculum C-20. A series of workshops in three phases were conducted by NITTTR, AP Extension Centre, Vijayawada involving faculty from Polytechnics, Premier Engineering Colleges & Industries to analyze the Previous C-16 Curriculum and to design C-20 Curriculum under the guidance of Dr. C. R. Nagendra Rao, Professor & Head, NITTTR-ECV. The efforts & support extended by NITTTR to bring out final Curriculum C-20 by incorporating needs, aspiration & expectations of all stake holders is highly appreciated and gratefully acknowledged.

The Members of the working group are grateful to Sri Dr. Pola Bhaskara I.A.S., Commissioner of Technical Education & Chairman of SBTET, AP and Sri M.M. Nayak, I.A.S.,former Special Commissioner of Technical Education & Chairman of SBTET, AP. and Smt. G. Jaya Lakshmi, I.A.S., Principal Secretary, Department of Skill Development and Training and Sri G. Anantha Ramu, I.A.S., former Principal Secretary, Department of Skill Development and Training for their guidance and valuable inputs during process of revising, modifying and updating the Curriculum C-20.

The Members acknowledge with thanks the guidance & inspiration provided by by Sri K.Vijaya Bhaskar, Secretary, SBTET, Andhra Pradesh and Sri V.S. Dutt, former Secretary, SBTET, Andhra Pradesh and other officials of Directorate of Technical Education and the

State Board of Technical Education, Andhra Pradesh, experts from industry, academia from the universities and higher learning institutions and all teaching fraternity from the Polytechnics who are directly or indirectly involved in preparation of the curricula.

RULES AND REGULATIONS OF C-20 CURRICULUM

1 DURATION AND PATTERN OF THE COURSES

All the Diploma programs run at various institutions are of AICTE approved 3 years or 3½ years duration of academic instruction.

All the Diploma courses are run on year wise pattern in the first year, and the remaining two or two & half years are run in the semester pattern. In respect of few courses like Diploma in Bio-Medical course, the training will be in the seventh semester. Run-through system is adopted for all the Diploma Courses, subject to eligibility conditions.

2 PROCEDURE FOR ADMISSION INTO THE DIPLOMA COURSES:

Selection of candidates is governed by the Rules and Regulations laid down in this regard from time to time.

a) Candidates who wish to seek admission in any of the Diploma courses will have to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET) conducted by the State Board of Technical Education and Training, Andhra Pradesh, Vijayawada.

Only the candidates satisfying the following requirements will be eligible to appear for the Common Entrance Test for admissions into Polytechnics (POLYCET).

b) The candidates seeking admission should have appeared for S.S.C examination, conducted by the Board of Secondary Education, Andhra Pradesh or equivalent examination thereto, at the time of applying for the Common Entrance Test for admissions into Polytechnics (POLYCET). In case of candidates whose results of their Qualifying Examinations is pending, their selection shall be subject to production of proof of their passing the qualifying examination in one attempt or compartmentally at the time of admission.

c) Admissions are made based on the merit obtained in the Common Entrance Test (POLYCET) and the reservation rules stipulated by the Government of Andhra Pradesh from time to time.

d) For admission into the following Diploma Courses for which entry qualification is 10+2, candidates need not appear for POLYCET. A separate notification will be issued for admission into these courses.

i). D.HMCT ii).D. Pharmacy

3 MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

4 PERMANENT IDENTIFICATION NUMBER (PIN)

A cumulative / academic record is to be maintained of the Marks secured in sessional work and end examination of each year for determining the eligibility for promotion etc., A Permanent Identification Number (PIN) will be allotted to each admitted candidate to maintain academic records.

5 NUMBER OF WORKING DAYS PER SEMESTER / YEAR:

a) The Academic year for all the Courses shall be in accordance with the Academic Calendar.

b) The Working days in a week shall be from Monday to Saturday

c) There shall be 7 periods of 50 minutes duration each on all working days.

d) The minimum number of working days for each semester / year shall be 90 / 180 days excluding examination days. If this prescribed minimum is not achieved due to any reason, special arrangements shall be made to conduct classes to complete the syllabus.

6 ELIGIBILITY (ATTENDANCE TO APPEAR FOR THE END EXAMINATION)

a) A candidate shall be permitted to appear for the end examination in all subjects, if he or she has attended a minimum of 75% of working days during the year/Semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester or 1st year may be granted on medical grounds.

c) A stipulated fee shall be payable towards condonation for shortage of attendance.

d) Candidates having less than 65% attendance shall be detained.

e) Students whose shortage of attendance is not condoned in any semester / 1st year and not paid the condonation fee in time are not eligible to take their end examination of that class and their admissions shall stand cancelled. They may seek re-admission for that semester / 1st year when offered in the next subsequent academic semester/year.

f) For INDUSTRIAL TRAINING:

i) During Industrial Training the candidate shall put in a minimum of 90% attendance.

ii) If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training at his own expenses.

7 READMISSION

Readmission shall be granted to eligible candidates by the respective Principal/ Regional Joint Director.

a) (i) Within 15 days after commencement of class work in any semester (Except Industrial Training).

(ii) For Industrial Training: before commencement of the Industrial training.

b) Within 30 days after commencement of class work in any year (including D. Pharmacy course or first year course in Engineering and Non Engineering Diploma streams).

Otherwise such cases shall not be considered for readmission for that semester / year and are advised to seek readmission in the next subsequent eligible academic year.

The percentage of attendance of the readmitted candidates shall be calculated from the first day of beginning of the regular class work for that year / Semester, as officially announced by CTE/SBTET but not from the day on which he/she has actually reported to the class work.

8 SCHEME OF Evaluation

a) First Year

THEORY Courses: Each Course carries Maximum marks of 80 with examination of 3 hours duration, along with internal assessment for Maximum of 20 marks. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

Laboratory Courses: There shall be 40 Marks for internal assessment i.e. sessional marks for each practical Course with an end examination of 3 hours duration carrying 60 marks. However, there are no minimum marks prescribed for sessionals.

b) III, IV, V, VI and VII Semesters:

THEORY Courses: End semester evaluation shall be of 3 hours duration and for a maximum of 80 marks.

Laboratory Courses: Each Course carry 60/30 marks of 3hours duration 40/20 sessional marks.

9 INTERNAL ASSESSMENT SCHEME

a) **Theory Courses**: Internal assessment shall be conducted for awarding Sessional marks on the dates specified. **Three unit tests shall be conducted for I year students and two Unit Tests for semesters.**

Internal Assessment shall be of 90 minutes duration and for a maximum of 40 marks for each test

The average of marks of all the test, reduced to 20 shall be taken as final Sessional in any case.

b) **Practical Courses**:

(i) **Drawing Courses:**

The award of Sessional marks for internal Assessment shall be as given in the following table:

Distribution of Marks for the Internal Assessment Marks			
First Year (Total:40 Marks)		**Semesters (Total:40 Marks)**	
Max:20 Marks	Max:20 Marks	Max:20 Marks	Max:20 Marks
From the Average of THREE Unit Tests.	From the Average of Assessment of Regular Class work Exercises.	From the Average of TWO Unit Tests.	From the Average of Assessment of Regular Class work Exercises.

- **For first year engineering drawing each unit test will be conducted for a duration of 2 hours with maximum marks of 40.**
- **(Part - A : 4 questions x 5 marks = 20 Marks ; Part –B: 2 questions x 10 marks = 20 marks).**
- **For the semester drawing examinations, Two Unit tests shall be conducted as per the Board End Examination Question Paper Pattern.**

- **All Drawing exercises are to be filed in serial order and secured for further scrutiny by a competent authority**

(ii) Laboratory Courses:

Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40 marks in each practical Course.

Evaluation for Laboratory Courses, other than Drawing courses:

i. Instruction (teaching) in laboratory courses (except for the course on Drawing) here after shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in SBTET website.
ii. Internal assessment for Laboratory shall be done on the basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP & NITTTR- ECV and posted in AP, SBTET website.

iii. Question paper for End semester Evaluation shall also be task/s based and shall be prepared and distributed by SBTET as done in case of theory courses be prepared as per SBTET rules in vogue.

c) Internal assessment in Labs / workshops / Survey field work etc., during the courseof study shall be done and sessional marks shall be awarded by the concerned Teacher.

d) For practical examinations, except in drawing, there shall be two examiners. External examiner shall be appointed by the Principal in consultation with respective Head of Section preferably choosing a qualified person from in the order of preference.
i) Nearby Industry
ii) Govt / Semi Govt organization like R & B, PWD, PR, Railways, BSNL, APSRTC, APSEB etc.
iii) Govt / University Engg College.
iv) HoDs from Govt.Polytechnic
Internal examiner shall be the person concerned with internal assessment as in (c) above. The end examination shall be held along with all theory papers in respect of drawing.

e) Question Paper for Practicals: Question paper should cover (the experiments / exercise prescribed to test various) skills like handling, manipulating, testing, trouble shooting, repair, assembling and dismantling etc., from more than one experiment / exercise

f) Records pertaining to internal assessment marks of both theory and practical Courses are to be maintained for official inspection.

g) **In case of Diploma programs *having* Industrial Training, Internal Assessment and Summative Evaluation**, shall be done as illustrated in the following table:

<table>
<tr><th>Assessment no</th><th>Upon completion of</th><th>By</th><th>Based on</th><th>Max Marks</th></tr>
<tr><td>1</td><td>12 weeks</td><td rowspan="2">1.The faculty concerned (Guide) and
2. Training in charge (Mentor) of the industry</td><td rowspan="2">Learning outcomes as given in the scheme of assessment ,for Industrial Training</td><td>120</td></tr>
<tr><td>2</td><td>22 weeks</td><td>120</td></tr>
<tr><td rowspan="3">3.Final summative Evaluation</td><td rowspan="3">24 week</td><td rowspan="3">1.The faculty member concerned,
2.HoD concerned and
3.An external examiner</td><td>1.Demonstration of any one of the skills listed in learning outcomes</td><td>30</td></tr>
<tr><td>2.Training Report</td><td>20</td></tr>
<tr><td>3.Viva Voce</td><td>10</td></tr>
<tr><td colspan="4" align="right">TOTAL</td><td>300</td></tr>
</table>

h) Each staff member including Head of Section shall be assigned a batch of students 10 to 15 for making assessment during industrial training.

10 MINIMUM PASS MARKS

THEORY EXAMINATION:
For passing a theory Course, a candidate has to secure a minimum of 35% in end examination and a combined minimum of 35% of both Sessional and end examination marks put together.

PRACTICAL EXAMINATION:
For passing a practical Course, a candidate has to secure a minimum of 50% in end examination and a combined minimum of 50% of both sessional and practical end examination marks put together. In case of D.C.C.P., the pass mark for typewriting and short hand is 45% in the end examination. There are no sessional marks for typewriting and Shorthand Courses of D.C.C.P course.

INDUSTRIAL TRAINING:
a) Monitoring
Similar to project work each teacher may be assigned a batch of 10-15 students irrespective of the placement of the students to facilitate effective monitoring of students learning during industrial training.
b) Assessment
The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks. And also student has to secure 50% marks in final summative assessment at institution level.

11. PROVISION FOR IMPROVEMENT

Improvement is allowed only after he / she has completed all the Courses from First Year to Final semester of the Diploma.

a) Improvement is allowed in any 4 (Four) Courses of the Diploma.
b) The student can avail of this improvement chance **ONLY ONCE**, that too within the succeeding two examinations after the completion of Diploma. However, the duration including Improvement examination shall not exceed **FIVE** years from the year of first admission.
c) No improvement is allowed in Practical / Lab Courses or Project work or Industrial Training assessment. However, improvement in drawing Course(s) is allowed.
d) If improvement is not achieved, the marks obtained in previous Examinations hold good.
e) Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
f) Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
g) All the candidates who wish to appear for improvement of performance shall deposit the original Marks Memos of all the years / Semesters and also original Diploma Certificate to the Board. If there is improvement in performance of the current examination, the revised

Memorandum of marks and Original Diploma Certificate will be issued, else the submitted originals will be returned.

12. RULES OF PROMOTION FROM 1ST YEAR TO 3rd, 4th, 5th, 6th and 7th SEMESTERS:

A) For Diploma Courses of 3 Years duration

i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds up to 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training, AP from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training AP from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she

a) Puts the required percentage of attendance in the 4th semester

b) Should not have failed in more than four Courses in 1st year

<u>For IVC & ITI Lateral Entry Students:</u>

a) A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester

b) A candidate is eligible to appear for the 4th semester examination if he/she clears at least two Courses in third semester.

iv) A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester examination if he/she

a) Puts the required percentage of attendance in the 5th semester

b) Should get eligibility to appear for 4th Semester examination.

The first backlog exam in 5th semester will be conducted only in instant/supplementary diploma examination.

<u>For IVC& ITI Lateral Entry students</u>:

a) Puts the required percentage of attendance in the 5th semester

v) A candidate shall be sent to Industrial training provided he/she puts in the required percentage of attendance in the 4th semester and pay the examination fee/ promotion fee as prescribed by SBTET.

A candidate is eligible to appear for Industrial Training assessment (Seminar/Viva-voce)

a) Puts the required percentage of attendance, i.e., 90% in 6th semester Industrial Training

For IVC & ITI Lateral Entry students:

a) Puts the required percentage of attendance, ie., 90% in 6th semester Industrial Training.

b) should get eligibility to appear for 5th Semester Examination.

B) For Diploma Courses of 3 ½ Years duration (MET/ CH/ CHPP/ CHPC/ CHOT/ TT):

i. A candidate shall be permitted to appear for 1st year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the 1st year and pays the examination fee. A candidate who could not pay the 1st year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate, who could not pay the 3rd semester exam fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester exam if he/she

a). Puts the required percentage of attendance in the 4th semester

b). Should not have failed in more than Four backlog Courses of 1st year.

For IVC & ITI Lateral Entry students:

a) Puts the required percentage of attendance in the 4th semester

iv. A candidate shall be promoted to 5th semester industrial training provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

v. Promotion from 5th to 6th semester is automatic (i.e., from 1st spell of Industrial Training to 2nd spell) provided he/she puts the required percentage of attendance, which in this case ie.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.

vi. A candidate shall be promoted to 7th semester provided he / she puts the required percentage of attendance in the 6th semester and pays the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 7th semester.

vii. A candidate shall be promoted to 7th semester of the course provided he/she has successfully completed both the spells of Industrial Training.

A candidate is eligible to appear for 7th semester examination if he/she

a) Puts in the required percentage of attendance in the 7th semester

b) Should get eligibility to appear for 4th semester Examination.

<u>For IVC & ITI Lateral Entry students</u>:

a) Puts in the required percentage of attendance in the 7th semester

b) Should not have failed more than four backlog Courses of 3rd Semester

C) For Diploma Courses of 3 ½ Years duration (BM):

The same rules which are applicable for conventional courses also apply for this course. The industrial training in respect of this course is restricted to one semester (6 months) after the 6th semester (3 years) of the course.

i. A candidate shall be permitted to appear for first year examination provided he / she puts in 75% attendance (which can be condoned on Medical grounds upto 10%) i.e. attendance after condonation on Medical grounds should not be less than 65% and pay the examination fee.

ii. A candidate shall be promoted to 3rd semester if he/she puts the required percentage of attendance in the first year and pays the examination fee. A candidate who could not pay the first year examination fee has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 3rd semester.

iii. A candidate shall be promoted to 4th semester provided he/she puts the required percentage of attendance in the 3rd semester and pay the examination fee. A candidate who could not pay the 3rd semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 4th semester.

A candidate is eligible to appear for the 4th semester examination if he/she

a) Puts in the required percentage of attendance in the 4th semester

b) Should not have failed in more than Four backlog Courses of 1st year

<u>For IVC & ITI Lateral Entry Students:</u>

A candidate is eligible to appear for the 4th semester examination if he/she puts the required percentage of attendance in the 4th semester

iv. A candidate shall be promoted to 5th semester provided he / she puts the required percentage of attendance in the 4th semester and pays the examination fee. A candidate, who could not pay the 4th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 5th semester.

A candidate is eligible to appear for the 5th semester exam if he/she

a) Puts in the required percentage of attendance in the 5 th semester.

b) Should get eligibility to appear for 4th Semester examination.

<u>For IVC & ITI Lateral Entry students</u>:

a) Puts in the required percentage of attendance in the 5th semester.

b) Should not have failed in more than Four backlog Courses of 3rd Semester.

v. A candidate shall be promoted to 6th semester provided he/she puts in the required percentage of attendance in the 5th semester and pays the examination fee.

A candidate who could not pay the 5th semester examination fee, has to pay the promotion fee as prescribed by State Board of Technical Education and Training from time to time before commencement of 6th semester.

A candidate is eligible to appear for 6th semester examination

a) Puts in the required percentage of attendance in 6th semester and
b) should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance in 6th semester.
b) Should get eligibility to appear for 5th Semester Examination.

vi. A candidate shall be promoted to 7th semester provided he/she puts in the required percentage of attendance in 6th semester and pay the examination fee. A candidate, who could not pay the 6th semester examination fee, has to pay the promotion fee prescribed by SBTET from time to time before commencement of the 7th semester (Industrial Training).

A candidate is eligible to appear for 7th semester Industrial Training assessment (Seminar/Viva-voce) if he/she

a) Puts in the required percentage of attendance, ie., 90% in 7th semester Industrial Training
b) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

a) Puts in the required percentage of attendance, ie., 90% in 7th semester Industrial Training.
b) Should get eligibility to appear for 5th Semester Examination.

Important Note:

Seminar/Viva-voce should not be conducted for Not-Eligible Candidates, till the candidate gets eligibility. However, the record of internal Assessment for Industrial Training for 260 marks shall be maintained at Institution Level for all candidates and the data is to be uploaded only for eligible candidates. For not eligible candidates the data is to be uploaded as and when the candidate gets eligibility.

OTHER DETAILS

a) In case a candidate does not successfully complete the Industrial training, he / she will have to repeat the training at his / her own cost.
b) The First spell of Industrial training shall commence 10 days after the completion of the last theory examination of 4th Semester.
c) The Second spell of Industrial training shall commence within 10 days after the completion of first spell of Industrial training.

13. STUDENTS PERFORMANCE EVALUATION

Successful candidates shall be awarded the Diploma under the following divisions of pass.

a) First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
b) First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.

c) Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.

   i. The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of I year marks + 100% of 3rd and subsequent Semesters.

   ii. In respect IVC & ITI Lateral Entry candidates who are admitted directly into diploma course at the 3rd semester (i.e., second year) level the aggregate of (100%) marks secured at the 3rd and subsequent semesters of study shall be taken into consideration for determining the overall percentage of marks secured by the candidates for award of class/division.

d) Second Class shall be awarded to all students, who fail to complete the Diploma in the regular 3 years/ 3 ½ years and four subsequent examinations, from the year of first admission.

14. EXAMINATION FEE SCHEDULE:

The examination fee should be as per the notification issued by State Board of Technical Education and Training, AP from time to time.

15. STRUCTURE OF EXAMINATION QUESTION PAPER:

I. Formative assessment (Internal examination)

a) For theory Courses:

Three unit tests for first year and two unit tests for semesters shall be conducted with a duration of 90 minutes for each test for maximum marks of 40. It consists of part A and Part B.

Part A contains five questions and carries 16 marks. Among these five questions first question consists of four objective items like one word or phrase answer/filling-in the blanks/true or false etc with one mark for each question. The other four questions are short answer questions and carry three marks each.

Part B carries 24 marks and consists of three questions with internal choice ie., Either/Or type , and each question carries 8 marks.

The sum of marks of 3 tests for I year and 2 tests for semesters shall be reduced to 20 marks in each Course for arriving at final sessional marks.

b) For drawing Courses:

For I year:

Three unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted for first year. It consists of part A and Part B.

Part A consists four questions for maximum marks of 16 and each question carries four marks (4×4 marks=16 marks).

Part B carries maximum marks of 24 and consists of five questions while the student shall answer any three questions out of these five questions. Each question in this part carries a maximum marks of 8, (3×8 marks=24 marks).

The sum of marks obtained in 3 unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

For semester: Two unit tests with duration of 90 minutes and for maximum marks of 40 marks shall be conducted. The sum of marks obtained in 2 unit test marks shall be reduced to 20 marks for arriving at final sessional marks. Remaining 20 marks are awarded by the Course teacher based on the student's performance during regular class exercise.

c) For Laboratory /workshop: 50% of total marks for the Course shall be awarded based on continuous assessment of the student in laboratory/workshop classes and the remaining 50% shall be based on the sum of the marks obtained by the students in two tests.

II. Summative assessment (End examination)

The question paper for theory examination is patterned in such a manner that the Weightage of periods/marks allotted for each of the topics for a particular Course be considered. End Examination paper is of 3 hours duration.

a) **Each theory paper consists of Section 'A', 'B' and 'C'**.
Section 'A' with Max marks of 30, contains 10 short answer questions. All questions are to be answered and each carries 3 marks, i.e., 10 x 3 = 30.

Section 'B' with Max marks of 40 contains 5 essay type questions including Numerical questions (without any divisions in the question), with internal choice(Either/or type), each carrying 8 marks, i.e., Max. Marks: 5 x 8 = 40.

Section 'C' with Max marks of 10 contains single essay type, Higher order Thinking skills question (HoTs)including Numerical questions, without choice (without any divisions in the question),

Thus the total marks for theory examination shall be: 80.

b) **For Engineering Drawing Course (107) consist of section 'A' and section 'B'**.

Section 'A' with max marks of 20, contains four (4) questions. All questions in section 'A' are to be answered to the scale and each carries 5 marks, ie. 4 x 5=20.

Section 'B' with max marks of 40, contains six (6) questions. The student shall answer any four (4) questions out of the above six questions and each question carries 10 Marks, i.e., 4 x 10 = 40.

c) **Practical Examinations**

For Workshop practice and Laboratory Examinations, Each student has to pick up a question paper distributed by Lottery System.

Max. Marks for an experiment / exercise	:	50
Max. Marks for VIVA-VOCE	:	10
Total Max. Marks	:	60

In case of practical examinations with 50 marks, the marks shall be distributed as

Max. Marks for an experiment / exercise	:	25

Max. Marks for VIVA-VOCE : 05

Total Max. Marks : 30

In case of any change in the pattern of question paper, the same shall be informed sufficiently in advance to the candidates.

d) **Note: Evaluation for Laboratory Courses, other than Drawing courses**:

I. Instruction (teaching) in laboratory courses (except for the course on Drawing) hereafter shall be task/competency based as delineated in the Laboratory sheets, prepared by SBTET, AP and posted in its website.

II. Internal assessment for Laboratory shall be done on basis of task/s performed by the student as delineated in the laboratory sheets, prepared by SBTET, AP and posted in its website.

III. Question paper for End semester Evaluation shall be prepared as per SBTET rules in vogue.

16. ISSUE OF MEMORONDUM OF MARKS

All candidates who appear for the end examination will be issued memorandum of marks without any payment of fee. However candidates who lose the original memorandum of marks have to pay the prescribed fee to the Secretary, State Board of Technical Education and Training, A.P. for each duplicate memo from time to time.

17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA Programmes:

Maximum period for completion of the diploma courses is twice the duration of the course from the date of First admission (includes the period of detention and discontinuation of studies by student etc) failing which they will have to forfeit the claim for qualifying for the award of Diploma (They will not be permitted to appear for examinations after that date). This rule applies for all Diploma courses of 3 years and 3 ½ years of engineering and non-engineering courses.

18. ELIGIBILITY FOR AWARD OF DIPLOMA

A candidate is eligible for award of Diploma Certificate if he / she fulfil the following academic regulations.

i. He / She pursued a course of study for not less than 3 / 3 ½ academic years & not more than 6 / 7 academic years.

ii. He / she have completed all the Courses.

Students who fail to fulfil all the academic requirements for the award of the Diploma within 6 / 7 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

For IVC & ITI Lateral Entry students:

i. He / She pursued a course of study for not less than 2 / 2 ½ academic years & not more than 4 / 5 academic years.

ii. He / she has completed all the Courses.

Students who fail to fulfil all the academic requirements for the award of the Diploma within 4 / 5 academic years from the year of admission shall forfeit their seat in the course & their seat shall stand cancelled.

19. ISSUE OF PHOTO COPY OF VALUED ANSWER SCRIPT, RECOUNTING& REVERIFICATION:

A) FOR ISSUE OF PHOTO COPIES OF VALUED ANSWER SCRIPTS

I. A candidate desirous of applying for Photo copy of valued answer script/s should apply within prescribed date from the date of the declaration of the result.

II. Photo copies of valued answer scripts will be issued to all theory Courses and Drawing Course(s).

III. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.

IV. No application can be entertained from third parties.

B) <u>FOR RE-COUNTING(RC) and RE-VERIFICATION(RV) OF THE VALUED ANSWER SCRIPT</u>

i. A candidate desirous of applying for Re-verification of valued answer script should apply within prescribed date from the date of the declaration of the result.

ii. Re-verification of valued answer script shall be done for all theory Courses' and Drawing Course(s).

iii. The Re-verification committee constituted by the Secretary, SBTETAP with Course experts shall re-verify the answer scripts.

I. **RE-COUNTING**

The Officer of SBTET will verify the marks posted and recount them in the already valued answer script. The variations if any will be recorded separately, without making any changes on the already valued answer script. The marks awarded in the original answer script are maintained (hidden).

II. RE-VERIFICATION

(i) The Committee has to verify the intactness and genuineness of the answer script(s) placed for Re-verification.

(ii) Initially single member shall carry out the re-verification.

(iii) On re-verification by single member, if the variation is less than 12% of maximum marks, and if there is no change in the STATUS in the result of the candidate, such cases will not be referred to the next level ie., for 2-Tier evaluation.

(iv) On re-verification by a single member, if the variation is more than 12% of maximum marks, it will be referred to 2-Tier evaluation.

(v) If the 2-Tier evaluation confirms variation in marks as more than 12% of maximum marks, the variation is considered as follows:

a) If the candidate has already passed and obtains more than 12% of the maximum marks on Re-verification, then the variation is considered.

b) If the candidate is failed and obtains more than 12% of the maximum marks on Re-verification and secured pass marks on re-verification, then the status of the candidate changes to PASS.

c) If a candidate is failed and obtains more than 12% of the maximum marks on Re-verification and if the marks secured on re-verification are still less than the minimum pass marks, the status of the candidate remain FAIL only.

(vii) After Re-verification of valued answer script the same or change if any therein on Re-verification, will be communicated to the candidate.

(viii) On Re-verification of Valued Answer Script if the candidate's marks are revised, the fee paid by the candidate will be refunded or else the candidate has to forfeit the fee amount.

Note: No request for Photo copies/ Recounting /Re-verification of valued answer script would be entertained from a candidate who is reported to have resorted to Malpractice in that examination.

20. MAL PRACTICE CASES:

If any candidate resorts to Mal Practice during examinations, he / she shall be booked and the Punishment shall be awarded as per SBTETAP rules and regulations in vogue.

21. DISCREPANCIES/ PLEAS:

Any Discrepancy /Pleas regarding results etc., shall be represented to the SBTETAP within one month from the date of issue of results. Thereafter, no such cases shall be entertained in any manner.

22. ISSUE OF DUPLICATE DIPLOMA

If a candidate loses his/her original Diploma Certificate and desires a duplicate to be issued he/she should produce written evidence to this effect. He / she may obtain a duplicate from the Secretary, State Board of Technical Education and Training, A.P., on payment of prescribed fee and on production of an affidavit signed before a First Class Magistrate (Judicial) and non-traceable certificate from the Department of Police. In case of damage of original Diploma Certificate, he / she may obtain a duplicate certificate by surrendering the original damaged certificate on payment of prescribed fee to the State Board of Technical Education and Training, A.P.

In case the candidate cannot collect the original Diploma within 1 year from the date of issue of the certificate, the candidate has to pay the penalty prescribed by the SBTET AP from time to time.

23. ISSUE OF MIGRATION CERTIFICATE AND TRANSCRIPTS:

The Board on payment of prescribed fee will issue these certificates for the candidates who intend to prosecute Higher Studies in India or Abroad.

24. The following specific changes are discussed and incorporated in C20 Syllabus:

(i) A new subject Theory of Machines is introduced in the V-Semester.

(ii) Project work is introduced as a practical subject in V-Semester to apply theoretical knowledge to practical work situations.

(iii) Minimum pass mark of 50% is fixed in the Summative assessment of M-601 Industrial Training subject.

(iv) The following new topics are introduced to suit the present industrial needs.

- Rapid Prototype manufacturingChapterin CAM subject.
- Drafting/Analysis software packages in CAD Lab.
- Alternative fuelsChapterin Energy Sources & Power Plant Engineering subject.

25. GENERAL

i. The Board may change or amend the academic rules and regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students, for whom it is intended, with effect from the dates notified by the competent authority.

ii. All legal matters pertaining to the State Board of Technical Education and Training, AP are within the jurisdiction of Vijayawada.

iii. In case of any ambiguity in the interpretation of the above rules, the decision of the Secretary, SBTET, A.P is final.

C-20 CURRICULUM FOR DME
WITH INDUSTRIAL TRAINING IN FINAL SEMESTER

VISION

Striving continuously in pursuit of excellence in imparting knowledge with skills in Mechanical Engineering at diploma level to improve the opportunities in employment and higher learning.

MISSION

M1	Use of technology enhanced tools and techniques by motivated and qualified faculty for enhancement of knowledge, understanding of principles, concepts and latest trends in mechanical engineering.
M2	Modernization of workshops and laboratories as per the curriculum specified by the State Board of Technical Education, Andhra Pradesh.
M3	Conduct of laboratories, guest lectures, industrial visits and industrial training for better understanding of critical concepts of Mechanical Engineering.
M4	Provide opportunities for developing multidisciplinary skills, communication skills, professional attitude and ethics.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Fundamental knowledge of mathematics, Basic sciences and basic interdisciplinary engineering to apply day to day challenges in the field of mechanical engineering.
PEO2	Knowledge in the principles, concepts, and techniques in mechanical engineering area to solve contemporary issues.
PEO3	Applications of the principles, concepts, and techniques in mechanical engineering area to solve contemporary issues and gain on hand experience.
PEO4	Effective Communication on activities regarding planning, designing, manufacturing, and servicing functions with engineering community.

PROGRAMME OUTCOMES (POs)

PO1	**Basic and Discipline Specific Knowledge:** To apply knowledge of mathematics, science and engineering fundamentals and engineering specialization to Engineering Problems.
PO2	**Problem Analysis:** Identify and analyse well-defined engineering problems using codified standard methods mechanical engineering problems for meaningful solutions
PO3	**Design/Development of Solutions:** Design solutions for well defined technical problems and assist with the design of systems components or processes to meet specific needs.
PO4	**Engineering tools, Experimentation and Testing:** Apply modern engineering tools and appropriate techniques to conduct standard tests and measurements.
PO5	**Engineering Practices for Society, Sustainability and Environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
PO6	**Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well defined engineering activities.
PO7	**Life-long Learning:** Ability to analyse individual needs and engaging updating in the context of technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1	Ability to employ in fields of engineering such as design, testing, manufacturing, processing, safety, quality control, and other business sectors.
PSO2	Ability to progress through advanced degree or certificate programs or participates in continuing education in engineering, business, and/or other professionally related fields.
PSO3	Achieve positions of increased responsibility within the organizations.

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
I YEAR

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M-101	English	3	-	90	3	20	80	100
M-102	Engineering Mathematics-I	5	-	150	3	20	80	100
M-103	Engineering Physics	4	-	120	3	20	80	100
M-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
M-105	Engineering Mechanics	4	-	120	3	20	80	100
M-106	Workshop Technology	4	-	120	3	20	80	100
PRACTICAL								
M-107	Engineering Drawing	-	6	180	3	40	60	100
M-108	Basic Workshop Practice	-	6	180	3	40	60	100
M-109	109-A Physics Lab 109-B Chemistry Lab	-	3	90	3	40	60	100
M-110	Computer Fundamentals Lab Practice	-	3	90	3	40	60	100
TOTAL		**24**	**18**	**1260**		**280**	**720**	**1000**

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M- 301	Engineering Mathematics - II	4	-	60	3	20	80	100
M -302	Engineering Materials	4	-	60	3	20	80	100
M -303	Basic Electrical& Electronics Engineering	4	-	60	3	20	80	100
M-304	Basic Thermodynamics	4	-	60	3	20	80	100
M-305	Strength of Materials	4	-	60	3	20	80	100
M-306	Production Technology-I	4	-	60	3	20	80	100
PRACTICAL								
M-307	Machine Drawing	-	6	90	3	40	60	100
M-308	Material Testing and Metallography Lab Practice	-	3	45	3	40	60	100
M-309	Fuels Laboratory Practice		3	45	3	40	60	100
M-310	Electrical Engineering Lab Practice	-	3	45	3	40	60	100
M-311	Workshop Practice -I	-	3	45	3	40	60	100
TOTAL		**24**	**18**	**630**		**320**	**780**	**1100**

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M – 401	Engineering Mathematics - III	3	-	45	3	20	80	100
M – 402	Design of Machine Members	5	-	75	3	20	80	100
M – 403	Hydraulics & Fluid Power Systems	5	-	75	3	20	80	100
M – 404	Heat Power Engineering-I	5	-	75	3	20	80	100
M – 405	Energy Sources and power plant Engineering	4	-	60	3	20	80	100
M – 406	Production Technology -II	5	-	75	3	20	80	100
PRACTICAL								
M – 407	Production Drawing	-	3	45	3	40	60	100
M – 408	Communication Skills Lab Practice	-	3	45	3	40	60	100
M – 409	Thermal Engineering Lab Practice	-	3	45	3	40	60	100
M – 410	Hydraulics & Fluid Power Systems Lab Practice	-	3	45	3	40	60	100
M-411	Workshop Practice- II	-	3	45	3	40	60	100
TOTAL		**27**	**15**	**630**		**320**	**780**	**1100**

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M-501	Industrial Management and Entrepreneurship	5	-	75	3	20	80	100
M-502	Industrial Engineering and Estimation & Costing	5	-	75	3	20	80	100
M-503	Theory of Machines	4	-	60	3	20	80	100
M-504	Heat Power Engineering-II	4	-	60	3	20	80	100
M-505	Refrigeration and Air Conditioning	5	-	75	3	20	80	100
M-506	Computer Aided Manufacturing Systems	4	-	60	3	20	80	100
PRACTICAL								
M-507	507-A CAD Lab Practice 507-B CAM Lab Practice	-	3+3	45+45	3	20 20	30 30	100
M-508	Life skills Lab Practice	-	3	45	3	40	60	100
M-509	R&AC Lab Practice	-	3	45	3	40	60	100
M-510	Project Work	-	3	45	3	40	60	
TOTAL		**27**	**15**	**630**		**280**	**720**	**1000**

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI Semester

INDUSTRIAL TRAINING

SI.No.	Course	Duration	Scheme of Evaluation		
			Assessment	Nature	Max. Marks
1	Industrial Training	6 months	1.First Assessment at Industry (After 12 Weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			2.Second Assessment at the Industry (After 22 weeks)	Assessment of Learning outcomes by both the faculty and training Mentor of the industry	120
			Final Summative assessment at institution level	Training Report	20
				Demonstration of any one of the skills listed in learning outcomes	30

				Viva Voce	***10***
				TOTAL MARKS	***300***

FIRST YEAR

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
I YEAR

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M-101	English	3	-	90	3	20	80	100
M-102	Engineering Mathematics-I	5	-	150	3	20	80	100
M-103	Engineering Physics	4	-	120	3	20	80	100
M-104	Engineering Chemistry & Environmental Studies	4	-	120	3	20	80	100
M-105	Engineering Mechanics	4	-	120	3	20	80	100
M-106	Workshop Technology	4	-	120	3	20	80	100
PRACTICAL								
M-107	Engineering Drawing	-	6	180	3	40	60	100
M-108	Basic Workshop Practice	-	6	180	3	40	60	100
M-109	109-A Physics Lab 109-B Chemistry Lab	-	3	90	3	40	60	100
M-110	Computer Fundamentals Lab Practice	-	3	90	3	40	60	100
TOTAL		**24**	**18**	**1260**		**280**	**720**	**1000**

English

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
M-101	English	3	90	20	80

S. No.	Unit Title	No of Periods	COs Mapped
1	English for Employability	8	CO1, CO2, CO3, CO4
2	Living in Harmony	8	CO1, CO2, CO3, CO4
3	Connect with Care	8	CO1, CO2, CO3, CO4
4	Humour for Happiness	8	CO1, CO2, CO3, CO4
5	Never Ever Give Up!	8	CO1, CO2, CO3, CO4
6	Preserve or Perish	9	CO1, CO2, CO3, CO4
7	The Rainbow of Diversity	8	CO1, CO2, CO3, CO4
8	New Challenges- Newer Ideas	8	CO1, CO2, CO3, CO4
9	The End Point First!	8	CO1, CO2, CO3, CO4
10	The Equal Halves	8	CO1, CO2, CO3, CO4
11	Dealing with Disaster	9	CO1, CO2, CO3, CO4
Total Periods		**90**	

Course Objectives	To improve the skills of English Language use by enriching vocabulary and learning accurate structures for effective communication.
	To comprehend themes for value based living in professional and personal settings.

CO No.	Course Outcomes
CO1	Applies perceptions of themes related to societal responsibility of adolescents towards their surroundings.

CO2	Demonstrates knowledge of form and function of 'grammar items' and use them in both academic and everyday situations.
CO3	Demonstrates effective English communication skills with competence in listening, speaking, reading and writing in academic, professional and everyday contexts.
CO4	Displays positivity and values of harmonious living in personal and professional spheres as reflected through communication.

CO-PO Matrix

Course Code C-101	**Course Title: English Number of Course Outcomes: 4**				**No. of Periods: 90**
POs	**Mapped with CO No.**	**CO Periods Addressing PO in Column 1**		**Level of Mapping (1,2,3)**	**Remarks**
		Number	**Percentage**		
PO1		Not directly Applicable for English course, however activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.			
PO2					
PO3					
PO4					
PO5	CO1, CO2, CO3, CO4	20	22		>50%: Level 3 21-50%: Level 2 Up to 20%: Level 1
PO6	CO1, CO2, CO3, CO4	52	58		
PO7	CO1, CO2, CO3, CO4	18	20		

Level 3 – Strongly Mapped
Level 2- Moderately Mapped
Level 1- Slightly Mapped

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO 1					✓	✓	✓
CO 2					✓	✓	✓
CO3					✓	✓	✓
CO 4					✓	✓	✓

NOTE: CO-PO groups shall be fulfilled through activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

Blue Print of Question Paper:

S. No.	**Name of the Unit**	**Periods Allocated**	**Weightage Allocate**	**Marks Wise Distribution of Weightage**	**Question Wise Distribution of Weightage**	**CO's Mapped**

			d	R	U	Ap	An	R	U	Ap	An	
1	English for Employability	8	17	3	8*			1	1*	1*		CO1, CO2, CO3, CO4
2	Living in Harmony	8		3				1				CO1, CO2, CO3, CO4
3	Connect with Care	8				3						CO1, CO2, CO3, CO4
4	Humour for Happiness	8	14		3	8*			1	1*		CO1, CO2, CO3, CO4
5	Never Ever Give Up!	8			3				1			CO1, CO2, CO3, CO4
6	Preserve or Perish	9	14		8*	3			1*	1		CO1, CO2, CO3, CO4
7	The Rainbow of Diversity	8				3	10*			1		CO1, CO2, CO3, CO4
8	New Challenges - Newer Ideas	8	35		8*	8*+ 3+3+ 3			1*	4	1*	CO1, CO2, CO3, CO4
9	The End Point First!	8										CO1, CO2, CO3, CO4
10	The Equal Halves	8										CO1, CO2, CO3, CO4
11	Dealing with Disasters	9										CO1, CO2, CO3, CO4
TOTAL		90	80	6	30	34	10	2	5	8	1	

PART-A: 10 Questions 3 marks each =30 Marks — All Questions are compulsory : 60 minutes
PART-B: 5 Questions 8 marks each =40 Marks — Internal choice : 90 minutes
Part-C: 1 Question 10 marks =10 Marks (Higher Order Question) — No choice, one compulsory question : 30 minutes

NOTE: * indicates questions can be given from any of the corresponding lessons in the blue print.

Question Paper Pattern for Unit Tests

Part A: 16 marks: 4 questions with 1 mark each (FIB, True/false, one word/phrase, etc.)
4 questions with 3 marks each (short answer/ descriptive/ applicative questions)

Part B: 24 marks: 3 questions 8 marks each with internal choice

Learning Outcomes

1. English for Employability

1.1. Explain the need for improving communication in English for employability

1.2. Use adjectives and articles effectively while speaking and in writing

1.3. Write simple sentences

2. Living in Harmony
2.1. Develop positive self-esteem for harmonious relationships
2.2. Use affixation to form new words
2.3. Use prepositions and use a few phrasal verbs contextually

3. Connect with Care
3.1. Use social media with discretion
3.2. Speak about abilities and possibilities
3.3. Make requests and express obligations
3.4. Use modal verbs and main verbs in appropriate form
3.5. Write short dialogues for everyday situations

4. Humour for Happiness
4.1. Explain the importance of humour for a healthy living
4.2. Improve vocabulary related to the theme
4.3. Display reading and speaking skills
4.4. Frame sentences with proper Subject – Verb agreement
4.5. Explain the features of a good paragraph and learn how to gather ideas as a preliminary step for writing a good paragraph.

5. Never Ever Give Up!
5.1. Practice to deal with failures in life.
5.2. Use the present tense form for various every day communicative functions such as speaking and writing about routines, professions, scientific descriptions and sports commentary.
5.3. Write paragraphs with coherence and other necessary skills.

6. Preserve or Perish
6.1. Describe the ecological challenges that we face today and act to save the environment.
6.2. Narrate / Report past events.
6.3. Develop vocabulary related to environment.
6.4. Write e-mails.

7. The Rainbow of Diversity
7.1. Illustrate and value other cultures for a happy living in multi-cultural workspace
7.2. use different types of sentences
7.3. Ask for or give directions, information, instructions
7.4. Use language to express emotions in various situations
7.5. Write letters in various real life situations

8. New Challenges – Newer Ideas
8.1. Explain the functional difference between Active Voice and Passive Voice
8.2. Use Passive Voice to speak and write in various contexts
8.3. List the major parts and salient features of an essay
8.4. Explain latest innovations and get motivated

9. The End Point First!
9.1. Illustrate the importance of setting a goal in life
9.2. Report about what others have said both in speaking and writing
9.3. Write an essay following the structure in a cohesive and comprehensive manner

9.4. Apply the words related to Goal Setting in conversations and in life

10. The Equal Halves

10.1. Value the other genders and develop a gender-balanced view towards life
10.2. Identify the use of different conjunctions in synthesising sentences
10.3. Write various types of sentences to compare and contrast the ideas
10.4. Apply the knowledge of sentence synthesis in revising and rewriting short essays
10.5. Develop discourses in speech and writing

11. Dealing with Disasters

11.1. Speak and write about different kinds of disasters and the concept of disaster management
11.2. Generate vocabulary relevant to disaster management and use it in sentences
11.3. Analyze an error in a sentence and correct it
11.4. write different kinds of reports

Textbook: INTERACT (A Textbook for I Year English) - Published by SBTET, AP

Reference Books:

Martin Hewings	: Advanced Grammar in Use, Cambridge University Press
Murphy, Raymond	: English Grammar in Use, Cambridge University Press
Sidney Greenbaum	: Oxford English Grammar, Oxford University Press
Wren and Martin (Revised byN.D.V. Prasad Rao)	: English Grammar and Composition, Blackie ELT Books, S. Chand and Co.
Sarah Freeman	: Strengthen Your Writing, Macmillan

STATE BOARD OF TECHNICAL EDUCATION –A.P

C20- M-101-ENGLISH

UNIT TEST-1

Time: 90 minutes **Max. Marks: 40**

PART-A **4X4= 16 marks**

Instructions: Answer all the questions. Each question carries FOUR Marks.

1. Rewrite / Fill in the blank as directed. Each question carries ½ Mark.

(CO2)

a) Write the antonym of 'cruel'
b) Write the synonym of 'love'
c) Give prefix to 'adventure'.
d) Give suffix to ' liberate'
e) It is _______ universal truth. (Fill in with suitable article)
f) The boy is fond ____ ice-cream. (Fill in the blank with proper preposition)
g) He ____not like sweets. (Fill in the blank with correct primary auxiliary verb.)
h) We ________ respect our national flag. (Fill in with a proper modal verb)

2. Rewrite the sentences as directed. Each question carries One mark. 4X1=4 Marks

(CO2)

a) No other metal is so useful as iron. (Change into superlative degree)
b) Very few students are so clever as Ramesh. (Change into comparative degree)
c) Guess the contextual meaning of the italicized word in the following sentence.
"The CBI officer has *interrogated* the bank employees in connection with the scam."
d) only sings plays Prasanth not also well but cricket. (Rearrange the jumbled words)

3. Fill in the blanks with proper form of the verb given in brackets. 4X1 = 4 marks

(CO2)

The IPSGM _________(hold) in our college last month. Nearly all the colleges in our zone ______(participate) in the event. The prizes ________ (distribute) by the district collector. Next year, Government Polytechnic, Vijayawada __________ (conduct) the games meet.

4. Rewrite the following sentences after making necessary corrections: 4X 1= 4 Marks

(CO3)

a) The police has arrested the culprit.
b) Three hundred miles are a long distance.
c) The Principal along with the Heads of Sections have visited the laboratories.
d) Either he or I is to blame.

PART-B **3X8=24 Marks**

Instructions: Answer all the questions and each question carries EIGHT marks.

5. Write a dialogue of at least five turns between a shopkeeper and customer about buying a mobile phone.

(CO3)

6. Make an analysis and write a paragraph in around 100 words about your strengths and weaknesses in learning and using English and also the measures to improve it.

(CO3)

7. Write a paragraph in about 100 words on how to overcome low esteem and negativity.

(CO3, CO4)

STATE BOARD OF TECHNICAL EDUCATION –A.P

C20-M-101-ENGLISH

UNIT TEST-II

Time: 90 minutes **Max. Marks: 40**

PART-A **4X4= 16 Marks**

Instructions: Answer all the questions. Each question carries FOUR marks.

1. Match the words in column A with their corresponding meanings in column B **(CO2)**

Column A	Column B
a) Deserve	i) continuous
b) hidden	ii) protect
c) Preserve	iii) worthy
d) Incessant	iv) praise
	v) unseen
	vi) affection

2. Rewrite as directed: **(CO3)**

a) You ask your Mom to give you another chocolate. (Change into a request)
b) The baby fell down and got injured. (Change into an exclamatory sentence)
c) The match was very interesting. (Frame a question using 'how')
d) Hemanth submitted his project report last week. (Frame Yes-No question)

3. Fill in the blanks with appropriate forms of verbs given in brackets: **(CO2)**

a) The Sun _______ (set) in the west.
b) Balu _______ (sing) for over fifty years in the films.
c) We __________ (see) a camel on the road yesterday.
d) They ________(enter) the stadium before the gates were closed.

4. Change the voice of the following: **(CO2)**

a) Marconi invented the radio.
b) Sravanthi has been offered a job.
c) Pragathi can type the letter.
d) The Chief Guest will be received by the Final year students.

PART-B **3X8=24 Marks**

Answer all the questions. Each question carries EIGHT marks.

5. Write a letter to your younger brother motivating him to deal with failures and hurdles in life.

(CO3)

6. Write an essay in around120 words on the role of robots in the modern world.

(CO3)

7. Read the following passage and answer the questions that follow:

(CO3)

The greatest enemy of mankind, as people have discovered, is not science, but war. Science merely reflects the social forces by which it is surrounded. It was found that when there is peace, science is constructive when there is war, science is perverted to destructive end. The weapons which science gives us do not necessarily create war. These make war increasingly more terrible. Until now, it has brought us on the doorstep of doom. Our main problem, therefore, is not to curb science, but to substitute law for force, and international government for anarchy in the relations of one nation with another. That is a job in which everybody must participate, including the scientists. Now we are face to face with these urgent questions: Can education and tolerance, understanding and creative intelligence run fast enough to keep us side by side without our mounting capacity to destroy? That is the question which we shall have to answer, one way or the other, in this generation. Science must help us in the answer, but the main decision lies within ourselves. The hour is late and our work has scarcely begun.

a. What is the chief enemy of man?
b. What does science reflect?
c. When is science perverted?
d. What makes war more terrible?
e. Why do we need international government?
f. What are the four aspects that may stop destruction?
g. Have we really started our work to fight the problem discussed?
h. Pick the word from the passage that would mean: ‘replace with other one’

STATE BOARD OF TECHNICAL EDUCATION –A.P

C20-M-101-ENGLISH

UNIT TEST-III

Time: 90 minutes **Max. Marks: 40**

PART-A **4X4 = 16 Marks**

Instructions: Answer all the questions. Each question caries Four marks.

1. Give the meaning of the word in italics:

(CO3)

a) When the girls laughed in the class, the teacher was *furious.*
b) He was *rusticated* from the school for his misbehavior.
c) Vikramaditya was a *benevolent* Indian King.
d) We should not show any *discrimination* between boys and girls.

2. Change the speech of the following:

(CO2)

a) He said, "I am sorry."
b) The teacher said to the boys, "Why are you late?"
c) Sushma said that she had submitted her report recently.
d) Pratap requested Priya to give him her pen.

3. Rewrite as directed:

(CO2)

a) Though he was weak, he took the test. (change into a simple sentence)
b) You must work hard to achieve success. (change into a complex sentence)
c) If you run fast, you will catch the bus. (change into a compound sentence)
d) The fog disappeared when the Sun rose. (Split into two simple sentences)

4. Locate eight errors from the following passage and correct them.

(CO2)

Once upon a time there live a king who was very kind to his people. In his council of ministers, there is a wise man. He had a son called Sumanth who was a educated and highly learned. Once the wise minister fall sick. All the physicists in the country could not heal him. Then Sumanth will go in search of medicine in Himalayas. He bring the special medicinal roots to cure his father's sickness. Sumanth looked before his father carefully and healed him. The king rewarded Sumanth with rich gifts.

PART- B **3X8 = 24 Marks**

Instructions: Answer all the questions and each one carries eight marks.

5. Read the following paragraph and make notes first and then its summary.

(CO3)

Astronauts are people who travel on space ships. They need to have a very clean home. They travel far from Earth. We need clean kitchens everywhere on earth and in space. Astronauts have to solve two problems: how to get food and how to keep their spaceship clean. Here is how they solved the food problem. At first, the astronauts took tubes of food with them into space. They would squeeze a tube and eat semi-liquid food. It did not taste great, but since they did not need to take dishes or silverware with them, they had no dishes to wash. Today's spaceships have a bigger menu. Astronauts can eat from bowls. In fact, they take cereal and other standard foods with them. The foods are packaged in special containers to keep them fresh. They use knives, forks, and spoons. One unusual item on their table is a pair of scissors. They use the scissors to open the food packages. They can eat right from the package. They have a kitchen on the spaceship. Its oven can heat food to 170 degrees. The kitchen has water and sets of meals that come on trays. The astronauts choose their menu before they go into space. They take a lot of food with them. The astronauts keep bread and fresh fruits and vegetables in a special food locker. How do they keep the kitchen clean? They do not have to worry about mice or other rodents. They make sure that there are no rodents before the ship leaves. But sometimes mice travel on the ship. Those mice are part of experiments. They live in cages. How do astronauts keep their trays clean? That is another health problem the astronauts solve. They need to stay healthy in space. To carry a lot of water to wash trays would be a lot of extra weight. They pack wet wipes in plastic bags. They use them to clean trays. So, their kitchen is clean and they stay healthy.

6. Write an essay in about 120 words on the importance of goal setting and your short and long term goals.

(CO3,CO4)

7. Write a report about the bush fire that raged in Australia recently by using the following clues: forest, natural disaster, wild fire, dried leaves, no rain fall, wild animals, burnt alive, loss of flora and fauna, fire fighters, uncontrollable, moderate rains, environmental pollution, measures to protect...etc.

(CO3)

STATE BOARD OF TECHNICAL EDUCATION- A.P
Model Question Paper
C20-M-101- ENGLISH

Time: 3hrs **Max.Marks:80**

PART-A **10X3=30 Marks**

Instructions: Answer all the questions. Each question carries Three marks.

1. a) Fill in the blanks with suitable articles:

(CO2)

I have seen _____________ European at ____________local market.

b) Fill in with proper form of adjective given in the bracket:

(CO2)

China is the ___________country in the world. (populous, more populous, most populous)

d) i) Choose the synonym from the following for the word : 'filthy'

(CO3)

dirty / clean / hygienic / tidy

ii) Choose the antonym from the following for the word: 'exterior'

(CO3)

external / internal / open / interior

2. a) i) Give prefix for the word: 'popular'

(CO2)

ii) Write suffix for the word : 'king'

(CO2)

b) He was married ______ her ______ January 2015. (Fill in with appropriate preposition)

(CO3)

c) Match the words in column A with their corresponding meanings in column B:

(CO2)

Column-A	**Column-B**
i) Dynamic	a) tasty
ii) Gloomy	b) active
	c) sad
	d) proud

3. a) The old man *hunted* for his spectacles. (Give the contextual meaning of the word in italics)

(CO3)

b) The committee / have submitted / its report / to the President. (identify the part which contains an error)

(CO3)

c) Recently has a scooter purchased Shanthi. (Rearrange the jumbled words to make a meaningful sentence.)

(CO3)

4. a) Use the following primary auxiliary verb in sentence of your own:

(CO2)

' does'

b) Fill in the blank with proper modal auxiliary verb based on the clue in the bracket:

(CO2)

Harish ___________ speak four languages. (ability)

c) Rakesh wants two hundred rupees from his father. (Write the sentence how he requests hisFather)

(CO2)

5. Fill in the blanks with suitable form of the verb given in brackets:

(CO2)

a) He ______ (go) for a walk daily.
b) The bus ________ (arrive) just now.
c) We _______ (live) in Chennai since 2005.

6. Change the voice of the following sentences:

(CO2)

a) English is spoken all over the world.
b) They watched a movie yesterday.
c) The Chief Minister will inaugurate the exhibition.

7. a) It is a beautiful rainbow. (Change into an exclamatory sentence)

(CO3)

b) C.V. Raman won the Nobel Prize in 1930. (Frame a question using 'When')

(CO3)

c) He can swim across the river. (change into 'Yes / No' question)

(CO3)

8. Change the speech of the following:

(CO2)

a) He said, "I will go to Delhi tomorrow."
b) Ravi said to Ashok, " Where are you going?"
c) She told him to mind his own business.

9. Rewrite as directed:

(CO2)

a) In spite of being busy he attended the meeting. (Rewrite the sentence using 'though')
b) She is poor. She is honest. (combine the two sentences using 'but')
c) On seeing the tiger, he climbed a tree. (split into two simple sentences)

10. Rewrite the following sentences after making necessary corrections:

(CO2)

a) We have gone to picnic yesterday.
b) Suresh watched T.V when I went to his house.
c) They left Gujarat before the earthquake occurred.

PART-B **5X8=40**

Instructions: Answer the following questions. Each question carries EIGHT marks.

11. Write a paragraph in about 100 words on what you do daily.

(CO3,CO4)

OR

Write a paragraph in about 100 words on the uses and misuses of social media.

12. Construct a dialogue of at least five turns between an American and you about places worth visiting in your city.

(CO3,CO4)

OR

Compose a dialogue of at least five turns between two friends, one favouring homemade food and the other, fast foods.

13. Write a letter to your parents about your preparation for year-end examinations. **(CO3,CO4)**

OR

Write a letter to the editor of a newspaper about the inconvenience caused due to loud speakers in your area.

14. Write an essay in about 120 words on measures to prevent water pollution.

OR

Write an essay in about 120 words on importance of gender equality.

15. Read the following passage and answer the questions that follow:

(CO3)

A farmer in ancient China had a neighbour who was a hunter, and who owned ferocious and poorly trained hunting dogs. They jumped over the fence frequently and chased the farmer's lambs. The farmer asked his neighbour to keep his dogs in check, but this fell on deaf ears. One day the dogs again jumped the fence, attacked and severely injured several of the lambs.

The farmer had had enough, and went to town to consult a judge who listened carefully to the story and said: "I could punish the hunter and instruct him to keep his dogs chained or lock them up. But you would lose a friend and gain an enemy. Which would you rather have, friend or foe for a neighbour?" The farmer replied that he preferred a friend. “Alright, I will offer you a solution that keeps your lambs safe, and which will keep your a neighbour a friend." Having heard the judge's solution, the farmer agreed.

Once at home, the farmer immediately put the judge's suggestions to the test. He took three of his best lambs and presented them to his neighbour's three small sons, who were beside themselves with joy and began to play with them. To protect his son's newly acquired playthings, the hunter built a strong kennel for his dogs. Since then, the dogs never again bothered the farmer's lambs. Out of gratitude for the farmer's generosity toward his sons, the hunter often shared the game he had hunted with the farmer. The farmer reciprocated by sending the hunter the cheese he had made. Within a short time the neighbours became good friends.

a) What kind of dogs does the neighbor have?
b) When did the farmer consult the judge?
c) What would be the consequence if the judge punished the neighbor?
d) What was the solution suggested by the judge?
e) What did the neighbour’s sons do with the gifts they received?
f) How did the dogs stop bothering the farmer’s lambs?
g) What items are exchanged happily between the two neighbours?
h) Pick the word from the passage that would mean: ‘a closed shelter for dogs’.

OR

Read the following short poem and answer the questions that follow:

Crisp in the winter’s morning,
Softly all through the night,

What is this without warning,
Falling and white?

I have never seen snow,
But I can imagine it quite –
Not how it tastes, but I know,
It falls and is white.

One morning I'll open the door,
To bring in the morning's milk,
And all around there'll be snow –
Fallen and still.

How I'll roll in the stuff!
How I'll tumble and spin!
Until the neighbours cry,
Enough!And send me back in.

Q.1. What is the poem about?

2. How does snow fall?

3. Did you ever touch snow? How did you feel?

4. a) Pick the word from the poem that means 'slip and fall'

b) Write the antonym for the word 'soft'

SECTION – C **1X10=10 Marks**

16. Write a report on the blood donation camp organized by International Red Cross Society in your college. Use the following clues: date, time, place, arrangements, donors, equipment, doctors, response, sponsors, snacks, volunteers, help others, save lives…etc.

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
M-102	Engineering Mathematics-I	5	150	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Algebra	31	CO1
2	Trigonometry	44	CO2
3	Co-ordinate Geometry	23	CO3
4	Differential Calculus	33	CO4
5	Applications of Differentiation	19	CO4, CO5
	Total Periods	**150**	

Course Objectives	(i) To apply the principles of Algebra, Trigonometry and Co-Ordinate Geometry to real-time problems in engineering. (ii) To comprehend and apply the concept of Differential Calculus in engineering applications.

Course Outcomes	CO1	Identify various functions, resolve partial fractions and solve problems on matrices.
	CO2	Solve problems using the concept of trigonometric functions, their inverses and complex numbers.
	CO3	Find the equations and properties of straight lines, circles and conic sections in coordinate system.
	CO4	Evaluate the limits and derivatives of various functions.
	CO5	Evaluate solutions for engineering problems using differentiation.

ENGINEERING MATHEMATICS – I
COMMON TO ALL BRANCHES

Learning Outcomes

UNIT - I

C.O. 1 Identify various functions, resolve partial fractions and solve problems on matrices.

L.O. 1.1 Define Set, ordered pairs and Cartesian product - examples.

1.2 Explain Relations and functions – examples

1.3 Find Domain & Range of functions – simple examples.

1.4 Classify types of functions (into, many-to-one, one-one, onto and bijective).

1.5 Define inverse functions - examples.

1.6 Define rational, proper and improper fractions of polynomials.

1.7 Explain the procedure of resolving rational fractions of the type mentioned below into partial fractions

$$i)\ \frac{f(x)}{(ax+b)(cx+d)} \qquad ii)\ \frac{f(x)}{(ax+b)^2(cx+d)}$$

$$iii)\ \frac{f(x)}{(x^2+a^2)(bx+c)} \qquad iv)\ \frac{f(x)}{(x^2+a^2)(x^2+b^2)}$$

1.8 Define a matrix and order of a matrix.

1.9 State various types of matrices with examples (emphasis on 3rd order square matrices).

1.10 Compute sum, scalar multiplication and product of matrices. Illustrate the properties of these operations such as associative, distributive, commutative properties with examples and counter examples.

1.11 Define the transpose of a matrix and write its properties;

1.12 Define symmetric and skew-symmetric matrices with examples Resolve a square matrix into a sum of a symmetric and skew- symmetric matrices and provide examples.

1.13 Define determinant of a square matrix, minor, co-factor of an element of a 3x3 square matrix with examples. Expand the determinant of a 3 x 3 matrix using Laplace expansion formula. State and apply the properties of determinants to solve problems.

1.14 Distinguish singular and non-singular matrices. Define multiplicative inverse of a matrix and list properties of adjoint and inverse. Compute adjoint and multiplicative inverse of a square matrix.

1.15 Solve system of 3 linear equations in 3 unknowns using Cramer's rule and matrix inversion method.

UNIT - II

C.O.2 Solve problems using the concept of trigonometric functions, their inverses and complex numbers.

L.O. 2.1 Define trigonometric ratios of any angle.

2.2 List the values of trigonometric ratios at specified values.

2.3 Draw graphs of trigonometric functions.

2.4 Explain periodicity of trigonometric functions.

2.5 Define compound angles and state the formulae of sin(A±B), cos(A±B), tan(A±B) and cot(A±B).

2.6 Give simple examples on compound angles to derive the values of $\sin 15^0$, $\cos 15^0$, $\sin 75^0$, $\cos 75^0$, $\tan 15^0$, $\tan 75^0$ etc.

2.7 Derive identities like $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$ etc.

2.8 Solve simple problems on compound angles.

2.9 Derive the formulae of multiple angles 2A, 3A etc and sub multiple angles A/2 in terms of angle A of trigonometric functions.

2.10 Derive useful allied formulas like $\sin^2 A = (1-\cos 2A)/2$ etc.

2.11 Solve simple problems using the above formulae

Syllabus for Unit test-I completed

2.12 Derive the formulae on transforming sum or difference of two trigonometric ratios into a product and vice versa, examples on these formulae.

2.13 Solve problems by applying these formulae to sum or difference or product of three or more terms.

2.14 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.

2.15 Define inverses of six trigonometric functions along with their domains and ranges.

2.16 Derive relations between inverse trigonometric functions so that given $A = \sin^{-1}x$, express angle A in terms of other inverse trigonometric functions with examples.

2.17 State various properties of inverse trigonometric functions and identities like

$\sin^{-1}x + \cos^{-1}x = \dfrac{\pi}{2}$ etc.

2.18 Apply formulae like $\tan^{-1}x + \tan^{-1}y = \tan^{-1}\left(\dfrac{x+y}{1-xy}\right)$, *where* $x \geq 0, y \geq 0, xy < 1$ etc., to solve Simple problems.

2.19 Explain what is meant by solutions of trigonometric equations and find the general solutions of sin x=k, cos x =k and tan x=k with appropriate examples.

2.20 Solve models of the type $a \sin^2 x + b \sin x + c = 0$, $a \cos x + b \sin x = c$ etc., and problems using simple transformations.

2.21 State sine rule, cosine rule, tangent rule and projection rule.

2.22 Explain the formulae for sin A/2, cos A/2, tan A/2 and cot A/2 in terms of semi-perimeter s and sides a,b,c and solve problems.

2.23 List various formulae for the area of a triangle.

2.24 Solve problems using the above formulae.

2.25 Define Sinh x, cosh x and tanh x and list the hyperbolic identities.

2.26 Represent inverse hyperbolic functions in terms of logarithms.

2.27 Define complex number, its modulus , conjugate and list their properties.

2.28 Define the operations on complex numbers with examples.

2.29 Define amplitude of a complex number.

2.30 Represent the complex number in various forms like modulus-amplitude (polar) form, Exponential (Euler) form with examples.

2.31 Write DeMoivre's theorem (without proof) and illustrate with simple examples.

UNIT - III

Coordinate Geometry

C.O. 3 Find the equations and properties of straight lines, circles and conic sections in coordinate system.

L.O. 3.1 Write the different forms of a straight line – general form, point-slope form, slope-intercept form, two-point form, intercept form and normal form or perpendicular form.

3.2 Solve simple problems on the above forms.

3.3 Find distance of a point from a line, acute angle between two lines, intersection of two non parallel lines and distance between two parallel lines.

3.4 Define locus of a point and define a circle.

3.5 Write the general equation of a circle and find the centre and radius.

3.6 Find the equation of a circle given (i) centre and radius, (ii) two ends of a diameter (iii) Centre and a point on the circumference (iv) three non collinear points.

3.7. Define a conic section.

3.8 Explain the terms focus, directrix, eccentricity, axes and latus rectum of a conic with illustrations.

3.9 Find the equation of a conic when focus, directrix and eccentricity are given.

3.10 Describe the properties of Parabola, Ellipse and Hyperbola in standard forms whose axes are along co-ordinate axes and solve simple examples on above.

Syllabus for Unit test-II completed

C.O.4 Evaluate the limits and derivatives of various functions.

L.O. 4.1 Explain the concept of limit and meaning of $\lim_{x \to a} f(x) = l$ and state the properties of limits.

4.2 Evaluate the limits of the type $\lim_{x \to l} \frac{f(x)}{g(x)}$ and $\lim_{x \to \infty} \frac{f(x)}{g(x)}$

4.3 Mention the Standard limits $\lim_{x \to a} \frac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to 0} \frac{\tan x}{x}$, $\lim_{x \to 0} \frac{a^x - 1}{x}$, $\lim_{x \to 0} \frac{e^x - 1}{x}$, $\lim_{x \to 0} (1+x)^{\frac{1}{x}}$, $\lim_{x \to \infty} \left(1 + \frac{1}{x}\right)^x$ (without proof) and solve the problems using these standard limits.

4.4 Explain the concept of continuity of a function at a point and on an interval with some examples whether a given function is continuous or not.

4.5 State the concept of derivative of a function y = f(x) – definition, first principle as $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ and also provide standard notations to denote the derivative of a function.

4.6 State the significance of derivative in scientific and engineering applications.

4.7 Find the derivatives of elementary functions like x^n, a^x, e^x, log x, sin x, cos x, tanx, Secx, Cosecx and Cot x using the first principles.

4.8 Find the derivatives of simple functions from the first principle .

4.9 State the rules of differentiation of sum, difference, scalar multiplication, product and quotient of functions with illustrative and simple examples.

4.10 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples.

4.11 Find the derivatives of Inverse Trigonometric functions and examples using the Trigonometric transformations.
4.12 Explain the method of differentiation of a function with respect to another function and also differentiation of parametric functions with examples.
4.13 Find the derivatives of hyperbolic functions.
4.14 Explain the procedures for finding the derivatives of implicit function with examples.
4.15 Explain the need of taking logarithms for differentiating some functions with examples like $[f(x)]^{g(x)}$.
4.16 Explain the concept of finding the higher order derivatives of second and third order with examples.
4.17 Explain the concept of functions of several variables, partial derivatives and difference between the ordinary and partial derivatives with simple examples.
4.18 Explain the definition of Homogenous function of degree n.
4.19 Explain Euler's theorem for homogeneous functions with applications to simple problems.

C.O. 5 Evaluate solutions for engineering problems using differentiation.

L.O. 5.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve y=f(x) at any point on the curve.
5.2 Explain the concept of derivative to find the slope of tangent and to find the equation of tangent and normal to the curve y=f(x) at any point on it.
5.3 Find the lengths of tangent, normal, sub-tangent and sub normal at any point on the curve y=f(x) .
5.4 Explain the derivative as a rate of change in distance-time relations to find the velocity and acceleration of a moving particle with examples.
5.5 Explain the derivative as a rate measurer in the problems where the quantities like volumes, areas vary with respect to time- illustrative examples.
5.6 Define the concept of increasing and decreasing functions.
5.7 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.
5.8 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable- simple problems yielding maxima and minima.
5.9 Solve problems on maxima and minima in applications like finding areas, volumes etc.
5.10 Apply the concept of derivatives to find the errors and approximations in simple problems.

Syllabus for Unit test-III completed

CO/PO – Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2				3	2	3
CO2	3	3	3	2				3	3	1
CO3	3	2	2	1				3	2	2
CO4	3	3	2	2				3	2	1
CO5	3	3	3	3				3	3	3
Avg	**3**	**2.6**	**2.5**	**2**				**3**	**2.4**	**2**

3 = Strongly mapped (High), **2 =**moderately mapped (Medium), **1 =**slightly mapped (Low)

Note:

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

PSO1: An ability to understand the concepts of basic mathematical concepts and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.

PSO2: An ability to solve the Engineering problems using latest software tool, along with analytical skills to arrive at faster and appropriate solutions.

PSO3: Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

PO- CO – Mapping strength

<table>
<tr><th rowspan="2">PO no</th><th rowspan="2">Mapped with CO no</th><th colspan="2">CO periods addressing PO in column I</th><th rowspan="2">Level
(1,2 or 3)</th><th rowspan="2">Remarks</th></tr>
<tr><th>No</th><th>%</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3,CO4,CO5</td><td>150</td><td>100%</td><td>3</td><td rowspan="7">>40% Level 3 Highly addressed

25% to 40% Level 2 Moderately addressed

5% to 25% Level 1 Low addressed

<5% Not addressed</td></tr>
<tr><td>2</td><td>CO1, CO2, CO3,CO4,CO5</td><td>138</td><td>92%</td><td>3</td></tr>
<tr><td>3</td><td>CO1, CO2, CO3,CO4,CO5</td><td>133</td><td>88.6%</td><td>3</td></tr>
<tr><td>4</td><td>CO1, CO2, CO3,CO4,CO5</td><td>120</td><td>80%</td><td>3</td></tr>
<tr><td>PSO 1</td><td>CO1, CO2, CO3,CO4,CO5</td><td>150</td><td>100%</td><td>3</td></tr>
<tr><td>PSO 2</td><td>CO1, CO2, CO3,CO4,CO5</td><td>135</td><td>90%</td><td>3</td></tr>
<tr><td>PSO 3</td><td>CO1, CO2, CO3,CO4,CO5</td><td>125</td><td>83.3%</td><td>3</td></tr>
</table>

COMMON TO ALL BRANCHES

COURSE CONTENT

Unit-I

Algebra

1. Relations and Functions:

Define Set, Ordered pairs, Cartesian product, Relations, functions, domain & range of functions. Describe types of functions (in-to, many-to-one, one-one, onto and bijective) and inverse functions – examples.

2. Partial Fractions:

Define rational, proper and improper fractions of polynomials. Resolve rational fractions in to their partial fractions covering the types mentioned below.

$$i)\quad \frac{f(x)}{(ax+b)(cx+d)} \quad ii)\quad \frac{f(x)}{(ax+b)^2(cx+d)}$$

$$iii)\quad \frac{f(x)}{(x^2+a^2)(bx+c)} \quad iv)\quad \frac{f(x)}{(x^2+a^2)(x^2+b^2)}$$

3. Matrices:

Definition of a matrix, types of matrices-examples, algebra of matrices-equality of two matrices, sum, scalar multiplication and product of matrices. Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a square matrix-Laplace's expansion, properties of determinants. Singular and non-singular matrices-Adjoint and multiplicative inverse of a square matrix- examples-System of linear equations in 3 variables-Solutions by Cramers's rule and Matrix inversion method-examples.

Unit-II

Trigonometry

4. Trigonometric ratios:

Definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.

5. Compound angles:

Formulas of sin(A±B), cos(A±B), tan(A±B),cot(A±B),and related identities with problems.

6. Multiple and sub multiple angles:

Formulae for trigonometric ratios of multiple angles 2A, 3A and sub multipleangles A/2 with problems.

7. Transformations of products into sums or differences and vice versa simple problems

8. Inverse trigonometric functions:

Definition, domains and ranges-basic properties- problems.

9. Trigonometric equations:

Concept of a solution, principal value and general solution of trigonometric equations: sinx =k , cosx= k, tanx =k, where k is a constant. Solutions of simple quadratic equations, equations involving usage of transformations- problems.

10.Properties of triangles:

Relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- problems.

11. Hyperbolic functions:

Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.

12. Complex Numbers:

Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitue (polar) form , Exponential form (Euler form) of a complex number- Problems. DeMoivre's theorem.

UNIT-III

Coordinate geometry

13. Straight lines: various forms of straight lines, angle between lines, perpendicular distance from a point, distance between parallel lines-examples.

14. Circle: locus of a point, Circle, definition-Circle equation given (i) centre and radius, (ii) two ends of a diameter (iii) centre and a point on the circumference (iv) three non collinear points - general equation of a circle – finding centre, radius.

15. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. properties of parabola, ellipse and hyperbola in standard forms.

UNIT-IV

Differential Calculus:

16. Concept of Limit- Definition- Properties of Limits and Standard Limits -Simple Problems- Continuity of a function at a point- Simple Examples only.

17. Concept of derivative- Definition (first principle)- different notations-derivatives of elementary functions- problems. Derivatives of sum, product, quotient, scalar multiplication of functions - problems. Chain rule, derivatives of inverse trigonometric functions, derivative of a function with respect to another function, derivative of parametric functions, derivative of hyperbolic, implicit functions, logarithmic differentiation – problems in each case. Higher order derivatives - examples – functions of several variables - partial differentiation, Euler's theorem-simple problems.

UNIT-V

Applications of Derivatives:

18. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, sub tangent and subnormal to the curve at any point - problems.

19. Physical applications of the derivative – velocity, acceleration, derivative as a rate measure –Problems.

20. Applications of the derivative to find the extreme values – Increasing and decreasing functions, finding the maxima and minima of simple functions - problems leading to applications of maxima and minima.

21. Using the concept of derivative of a function of single variable, find the absolute error, relative and percentage errors and approximate values due to errors in measuring.

Textbook:

Engineering Mathematics-I, a textbook for first year diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. Shanti Narayan, A Textbook of matrices, S.Chand &Co.
2. Robert E. Moyer & Frank Ayers Jr., Schaum's Outline of Trigonometry, 4^{th} Edition, Schaum's Series
3. M.Vygodsky, Mathematical Handbook, Mir Publishers, Moscow.
4. Frank Ayers & Elliott Mendelson, Schaum's Outline of Calculus, Schaum's Series

Engineering Mathematics – I

Blue print

S. No	Chapter/ Unit title	No of Periods		Weightage Allotted	Marks wise distribution of weight age				Question wise distribution of weight age				COs mapped
	Unit - I : Algebra	**Theory**	**Practice**		**R**	**U**	**Ap**	**An**	**R**	**U**	**Ap**	**An**	
1	Relations and Functions	4	2	3	0	3	0	0	0	1	0	0	**CO 1**
2	Partial Fractions	3	2	3	0	3	0	0	0	1	0	0	**CO 1**
3	Matrices and Determinants	10	10	11	3	0	8	0	1	0	1	0	**CO 1**
	Unit - II : Trigonometry												
4	Trigonometric Ratios	1	1	0	0	0	0	0	0	0	0	0	**CO2**
5	Compound Angles	3	2	3	3	0	0	0	1	0	0	0	**CO2**
6	Multiple and Submultiple angles	4	4	3	0	3	0	0	0	1	0	0	**CO2**
7	Transformations	3	3	8	0	8	0	0	0	1	0	0	**CO2**
8	Inverse Trigonometric Functions	3	2										
9	Trigonometric Equations	3	2	8	0	0	8	0	0	0	1	0	**CO2**
10	Properties of triangles	3	2										
11	Hyperbolic Functions	1	1	0	0	0	0	0	0	0	0	0	**CO2**
12	Complex Numbers	4	2	3	3	0	0	0	1	0	0	0	**CO2**
	Unit III : Co-ordinate Geometry												
13	Straight Lines	4	2	3	3	0	0	0	1	0	0	0	**CO3**
14	Circle	3	2	8	0	8	0	0	0	1	0	0	**CO3**
15	Conic Sections	8	4										
	Unit – IV : Differential Calculus												
16	Limits and Continuity	4	2	3	0	3	0	0	0	1	0	0	**CO4**

17	Differentiation	17	10	14	3	11	0	0	1	2	0	0	**CO4**
	Unit - V : Applications of Differentiation												
18	Geometrical Applications	3	2	10	0	0	0	10	0	0	0	1	**CO5**
19	Physical Applications	2	2										
20	Maxima and Minima	3	4										
21	Errors and Approximations	2	1										
Total		**89**	**61**	**80**	**15**	**39**	**16**	**10**	**5**	**8**	**2**	**1**	

R: Remembering Type : 15 Marks
U: understanding Type : 39 Marks
Ap: Application Type : 16 Marks
An: Analysing Type : 10 Marks

Engineering Mathematics – I
Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O. 1.1 to L.O. 2.11
Unit Test-II	From L.O. 2.12 to L.O. 3.10
Unit Test-III	From L.O.4.1 to L.O. 5.10

Unit Test I **C –20**

State Board of Technical Education and Training, A. P

First Year

Subject name: **Engineering Mathematics-I**

Sub Code: **M-102**

Time : 90 minutes Max.marks:40

Part-A **16Marks**

Instructions: **(1) Answer all questions.**

(2) First question carries four marks and the remaining questions carry three marks each.

1. Answer the following.

a. If $f(x)=x^2$ and domain $=\{-1,0,1\}$, then find range. **(CO1)**

b. If $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$, then find 3A.**(CO1)**

c. Write the value of $Sin120^0$ **(CO2)**

d. Write the formula for $\tan 2A$ in terms of $\tan A$ **(CO2)**

2. If $f:R\to R$ is defined by $f(x)=3x-5$, then prove that $f(x)$ is onto. **(CO1)**

3. If $A=\begin{bmatrix}1 & 3\\ 4 & -9\end{bmatrix}$, $B=\begin{bmatrix}2 & 4\\ -3 & 1\end{bmatrix}$ then find $2A+3B$ **(CO1)**

4. Prove that $Sin^2 45^0 - Sin^2 15^0 = \frac{\sqrt{3}}{4}$ **(CO2)**

5. Prove that $\frac{\sin 2A}{1-\cos 2A}=\cot A$ **(CO2)**

Part-B **3×8=24**

Instructions: **(1) Answer all questions.**

(2) Each question carries eight marks

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Resolve $\frac{2x}{(x-1)(x-3)}$ into partial fractions. **(CO1)**

or

B) Resolve $\frac{x+4}{x^2-3x+2}$ into partial fractions. **(CO1)**

7. A) Using Cramer's rule to solve

$x-y+z=2, 2x+3y-4z=-4, 3x+y+z=8$ **(CO1)**

or

B) Prove that $\begin{vmatrix} bc & b+c & 1 \\ ca & c+a & 1 \\ ab & a+b & 1 \end{vmatrix} = (a-b)(b-c)(c-a)$ **(CO1)**

8. A) Find the adjoint of Matrix $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 5 \\ 2 & 7 & -4 \end{bmatrix}$ **(CO1)**

or

B) If $A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 7 & 9 \\ -2 & 1 & 3 \end{bmatrix}$; $B = \begin{bmatrix} 3 & 1 & -5 \\ 2 & 1 & 4 \\ 0 & 3 & 1 \end{bmatrix}$, find AB and BA and verify if $AB = BA$.

(CO1)

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Unit Test II **C –20**

State Board of Technical Education and Training, A. P

First Year

Subject name: **Engineering Mathematics-I**

Sub Code: **M- 102**

Time : 90 minutes Max.marks:40

Part-A **16Marks**

Instructions: **(1) Answer all questions.**

(2) First question carries four marks and the remaining questions carry three marks each.

1. Answer the following.

   a. $\sin C+\sin D=2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$: State TRUE/FALSE **(CO2)**

   b. If $z=2+3i$, then find $|z|$ **(CO2)**

   c. $\sinh x=\frac{e^{x}-e^{-x}}{2}$: State TRUE/FALSE **(CO2)**

   d. Write the eccentricity of rectangular hyperbola. (CO3)

2. Express $(3-4i)(7+2i)$ in terms of $a+ib$ **(CO2)**
3. Find the perpendicular distance from $(1,1)$ to the line $2x+3y-1=0$ (CO3)
4. Find the angle between lines $2x-y+3=0$ and $x+y-2=0$ **(CO3)**
5. Find the centre and radius of the circle $x^2+y^2-2x+4y-4=0$ **(CO3)**

Part-B **3×8=24**

Instructions: **(1) Answer all questions.**

(2) Each question carries eight marks

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Prove that $\frac{\sin 2\theta+\sin 4\theta+\sin 6\theta}{\cos 2\theta+\cos 4\theta+\cos 6\theta}=\tan 4\theta$. **(CO2)**

   or

   B) Prove that $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$ **(CO2)**

7. A) Solve $2\sin^2\theta-\sin\theta-1=0$ **(CO2)**

   or

   B) In any ΔABC, If $\underline{|B}=60^0$ then $\frac{c}{a+b}+\frac{a}{b+c}=1$ **(CO2)**

8. A) Find the equation of circle with $(2,3)$ and $(6,9)$ as the end points of diameter and also find centre and radius of circle. **(CO3)**

   Or

   B) Find the equation of ellipse whose focus is $(1,-1)$, directrix is $x-y+3=0$ and eccentricity is1/2. **(CO3)**

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Unit Test III **C –20**

State Board of Technical Education and Training, A. P

First Year

Subject name: **Engineering Mathematics-I**

Sub Code: **M-102**

Time : 90 minutes Max.marks:40

Part-A **16Marks**

Instructions: **(1) Answer all questions.**

(2) First question carries four marks and the remaining questions carry three marks each.

1. Answer the following.

   a. Find $\lim_{x \to 1} \frac{x^2+1}{x+5}$ **(CO4)**

   b. $\lim_{\theta \to 0} \frac{\sin 2\theta}{\theta} = 2$: State TRUE/FALSE **(CO4)**

   c. $\frac{d}{dx}\left(3\tan^{-1} x\right) = ?$ **(CO4)**

   d. Formula for percentage error in x is __________ **(CO5)**

2. Evaluate $\lim_{x \to 2} \frac{x^5-32}{x^2-4}$ **(CO4)**

3. Find the derivative of $3\tan x - 4\log x + 7^x$ w.r.t. x **(CO4)**

4. Differentiate $x^2 \sin x$ w.r.t. x **(CO4)**

5. Find the derivative of $\frac{2x+3}{3x+4}$ **(CO4)**

Part-B **3×8=24**

Instructions: **(1) Answer all questions.**

(2) Each question carries eight marks

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Find the derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ w.r.t. $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$. **(CO4)**

   or

   B) Find $\frac{dy}{dx}$ if $y = x^{\cos x}$ **(CO4)**

7. A) Verify Euler's theorem when $u(x, y) = \frac{x^4+y^4}{x-y}$ **(CO4)**

   or

   B) Find the equation of tangent and normal to the curve $3y = x^2 - 6x + 17$ at $(4,3)$ **(CO5)**

8. A) Circular patch of oil spreads on water and the area is growing at the rate of $8\,sqcm/\min$. How fast is the radius increasing when radius is $5cm$. **(CO5)**

   or

   B) Find the maxima and minima values of $f(x) = x^3 - 6x^2 + 9x + 15.$ **(CO5)**

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END-EXAM MODEL PAPERS

STATE BOARD OF TECHNICAL EDUCATION, A.P

ENGINEERING MATHEMATICS C- 102

TIME : 3 HOURS **MODEL PAPER- I** **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks. **10x3=30M**

1. If $A=\left\{0,\frac{\pi}{6},\frac{\pi}{4},\frac{\pi}{3},\frac{\pi}{2}\right\}$ and $f:A\to B$ is a function such that $f(x)=\cos x$, then find the range of f.

CO 1

2. Resolve the function $\frac{x}{(x-1)(x-2)}$ into partial fractions.

CO 1

3. If $A=\begin{bmatrix}3 & 9 & 0\\ 1 & 8 & -2\end{bmatrix}$ and $B=\begin{bmatrix}4 & 0 & 2\\ 7 & 1 & 4\end{bmatrix}$, find $A+B$ and $A-B$. **CO1**

4. Show that $\frac{\cos 16^0+\sin 16^0}{\cos 16^0-\sin 16^0}=\tan 61^0.$

CO2

5. Prove that $\frac{\sin 2\theta}{1-\cos 2\theta}=\cot\theta.$

CO2

6. Find the modulus of the complex number $\left(\frac{1-i}{2+i}\right)$.

CO2

7. Find the distance between parallel lines $x+2y+3=0$ and $x+2y+8=0.$

CO3

8. Find $\lim_{x\to 0}\frac{\sin 77x}{\sin 11x}$.

CO4

9. Differentiate $3\tan x-4\log x-7x^2$ w.r.t. x.

CO4

10. If $x=at^2, y=2at$, then find $\frac{dy}{dx}$.

CO4

PART-B

Answer All questions. Each question carries EIGHT marks. **5x8=40M**

11 A) Find the inverse of the matrix $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$. **CO1**

Or

B) Solve the system of equations $x+y+z=6, x-y+z=2$ and $2x-y+3z=9$ by Cramer's rule. **CO1**

12 A) If $\cos x+\cos y=\frac{3}{5}$ and $\cos x-\cos y=\frac{2}{7}$, then show that

$21\tan\left(\frac{x-y}{2}\right)+10\cot\left(\frac{x+y}{2}\right)=0.$ **CO2**

Or

B) If $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\pi$ then show that $x+y+z=xyz.$

CO2

13 A) Solve $\sqrt{3}\cos\theta-\sin\theta=1.$ **CO2**

Or

B) In any ΔABC, Show that $\cot\frac{A}{2}+\cot\frac{B}{2}+\cot\frac{C}{2}=\frac{s^2}{\Delta}.$ **CO2**

14 A) Find the equation of the circle with $(4,2)$ and $(1,5)$ as the two ends of its diameter and also find its centre and radius. **CO3**

Or

B) Find the centre, vertices, equation of axes, lengths of axes, eccentricity, foci, equations of directrices and length of latus rectum of the ellipse $4x^2+16y^2=1.$ **CO3**

15 A) Find the derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ w.r.t. $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ **CO4**

Or

B) If $u=\tan^{-1}\left(\frac{x^3-y^3}{x+y}\right)$, then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u.$ **CO4**

PART-C

Answer the following question. Question carries TEN marks. **1x10=10M**

16. The sum of two numbers is 24. Find them so that the sum of their squares is minimum. **CO5**

STATE BOARD OF TECHNICAL EDUCATION, A.P

ENGINEERING MATHEMATICS C- 102

TIME : 3 HOURS **MODEL PAPER- II** **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks. **10x3=30M**

1. If $f: R \to R$ is a bijective function such that $f(x) = ax + b$, then find $f^{-1}(x)$.

CO 1

2. Resolve the function $\frac{1}{(x+1)(x-2)}$ into partial fractions.

CO 1

3. If $A = \begin{bmatrix} 0 & -1 & 3 \\ 1 & 0 & 7 \\ -3 & x & 0 \end{bmatrix}$ is a skew-symmetric matrix, find the value of x.

CO 1

4. Find the value of $\sin^2 82\frac{1}{2}^0 - \sin^2 22\frac{1}{2}^0$.

CO2

5. Prove that $\frac{\cos 3A}{2\cos 2A - 1} = \cos A$.

CO2

6. Find the conjugate of the complex number $(3-2i).(4+7i)$

CO2

7. Find the equation of the line passing through the points $(1,2)$ and $(3,-4)$.

CO3

8. Find $\lim_{x\to 2} \frac{x^5 - 32}{x-2}$.

CO4

9. Differentiate $\sqrt{x} - \sec x + \log x$ w.r.t. x.

CO4

10. If $u(x, y) = x^3 - 3axy + y^3$, then find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$.

CO4

PART-B

Answer All questions. Each question carries EIGHT marks. 5x8=40M

11 A) Show that $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a).$ **CO1**

Or

B) Solve the system of equations $x+2y+3z=6, 3x-2y+4z=5$ and $x-y-z=-1$ using matrix inversion method. **CO1**

12 A) Prove that $\dfrac{\sin 2\theta + \sin 4\theta + \sin 6\theta}{\cos 2\theta + \cos 4\theta + \cos 6\theta} = \tan 4\theta.$ **CO2**

Or

B) Prove that $\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{7} + \tan^{-1}\frac{1}{8} = \frac{\pi}{4}.$ **CO2**

13 A) Solve $2\cos^2\theta - 3\cos\theta + 1 = 0.$ **CO2**

Or

B)In any $\Delta \mathrm{ABC}$, Show that $\sum a^3 \cos(B-C) = 3abc.$ **CO2**

14 A) Find the equation of the circle passing through the points $(0,0),(6,0)$ and $(0,8)$. **CO3**

Or

B) Find the equation of the rectangular hyperbola whose focus is $(1,2)$ and directrix is $3x+4y-5=0.$ **CO3**

15 A) If $\sin y = x\sin(a+y)$, then prove that $\dfrac{dy}{dx} = \dfrac{\sin^2(a+y)}{\sin a}.$ **CO4**

Or

B) If $y = \tan^{-1} x$, then prove that $(1+x^2)y_2 + 2xy_1 = 0.$ **CO4**

PART-C

Answer the following question. Question carries TEN marks. 1x10=10M

16 Show that the semi-vertical angle of the cone of maximum volume and of given slant height is $\tan^{-1}\sqrt{2}.$ **CO4**

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
M-103	Engineering Physics	4	120	20	80

S. No	Unit Title/Chapter	No of Periods	COs Mapped
1	Units and Dimensions	08	CO1
2	Elements of Vectors	12	CO1
3	Dynamics	12	CO2
4	Friction	10	CO2
5	Work, Power and Energy	12	CO3
6	Simple harmonic motion	12	CO3
7	Heat and Thermodynamics	12	CO4
8	Sound	10	CO4
9	Properties of matter	10	CO5
10	Electricity and Magnetism	12	CO5
11	Modern physics	10	CO5
Total		**120**	

Course Title: Engineering Physics	
Course Objectives	1. To familiarize with the concepts of Physics involved in the process of various Engineering, Industrial and Daily life Applications. 2. To understand and apply the basic principles of physics in the field of engineering and technology to familiarize certain natural phenomenon occurring in the day to day life 3. To reinforce theoretical concepts by conducting relevant experiments/exercises

Course Outcomes	CO1	Explain S.I units and dimensions of different physical quantities, basic operations among vector quantities.
	CO2	Explain the motion of objects moving in one dimension and two dimensions, the causes of motion and hindrance to the motion of the objects especially with respect to friction.
	CO3	Explain the mechanical energy of bodies like PE, KE and conservation law of energy, the properties of simple harmonic motion.
	CO4	Explain gas laws, ideal gas equation, Isothermal and adiabatic processes, Specific heats, to study the laws of thermodynamics. Causes, consequences and methods to minimise noise pollution, explain beats, Doppler effect, Reverberation, echoes.
	CO5	Explain certain properties of solids, liquids like elastic properties, viscosity and surface tension. Explain Ohm's law, to study Kirchoff's laws, to study the principle of Wheatstone's bridge and its application to meter bridge. To study the magnetic force and understand magnetic field. To compute magnetic field strength on axial and equatorial lines of a bar magnet. To familiarise with modern topics like photoelectric effect, optical fibres, superconductivity and nanotechnology.

COS, POS, PSOS MAPPING

- **POs mapping strength (as per given table)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3					1		1	1	1
CO2	3		2					1	1	
CO3	3		2					1		
CO4	3	2			2				2	2
CO5	3			2			2	1	1	

3 = strongly mapped 2= moderately mapped 1= slightly mapped

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
i) Seminars ii) Tutorials iii) Guest lectures iv) Assignments v) Quiz competitions vi) Industrial visits vii) Tech Fest viii) Mini project ix) Group discussion x) Virtual classes xi) Library visit for e-books

Learning Outcomes

1.0 Concept of Units and dimensions

1.1 Explain the concept of Units, Physical quantity, Fundamental physical quantities and Derived physical quantities
1.2 Define unit, fundamental units and derived units, State SI units with symbols
1.3 State Multiples and submultiples in SI system, State Rules of writing S.I. units, State advantages of SI units
1.4 Define Dimensions, Write Dimensional formulae of physical quantities
1.5 List dimensional constants and dimensionless quantities
1.6 State the principle of homogeneity of dimensions
1.7 State the applications and limitations of dimensional analysis
1.8 Errors in measurement, Absolute error, relative error, percentage error, significant figures
1.9 Solve problems

2.0 Concept of Elements of Vectors

2.1 Explain the concept of scalars, Vectors and give examples
2.2 Represent vectors graphically, Classify the Vectors, Resolve the vectors
2.3 Determine the resultant of a vector by component method, represent a vector in Space using unit vectors (i, j, k)
2.4 State and explain triangle law, parallelogram law, and polygon law of addition of Vectors
2.5 Define Dot product of two vectors with examples (Work done, Power), mention the Properties of dot product
2.6 Define cross product of two vectors with examples (Torque, Linear velocity) Mention the properties of Cross product.
2.7 Solve the related numerical problems

3.0 Concept of Dynamics

3.1 Write the equations of motion in a straight line. Explain the acceleration due to Gravity.
3.2 Explain vertical motion of a body and derive expressions for a) Maximum Height, b) Time of ascent, c) time of descent, and d) time of flight
3.3 Derive height of a tower when a body projected vertically upwards from the top of a tower.
3.4 Explain projectile motion with examples
3.5 Explain horizontal projection and derive an expression for the path of a projectile in horizontal projection
3.6 Explain oblique projection and derive an expression for it. Derive formulae for a) Maximum Height b) time of ascent c) time of descent and d) time of flight e) Horizontal Range, f) Maximum range
3.7 Define force, momentum, angular displacement, angular velocity, angular acceleration, angular momentum, moment of inertia, torque
3.8 Solve the related numerical problems

4.0 Concept of Friction

4.1 Define friction and classify the types of friction.
4.2 Explain the concept of normal reaction.
4.3 State the laws of friction.
4.4 Define coefficients of friction, Angle of friction and angle of repose.
4.5 Derive expressions for acceleration of a body on a rough inclined plane. (Upwards and downwards)
4.6 List the advantages and disadvantages of friction.
4.7 Mention the methods of minimizing friction.
4.8 Explain why it is easy to pull a lawn roller than to push it.
4.9 Solve the related numerical problems.

5.0 Concepts of Work, Power, and Energy

5.1 Define the terms Work, Power and Energy. State SI units and dimensional Formulae.
5.2 Define potential energy and give examples, derive an expression for potential energy.
5.3 Define Kinetic energy and give examples, derive an expression for kinetic energy.
5.4 State and derive Work-Energy theorem.
5.5 Derive the relation between Kinetic energy and momentum.
5.6 State the law of conservation of energy and verify it in the case of a freely falling body.
5.7 Solve the related numerical problems.

6.0 Concepts of Simple harmonic motion

6.1 Define Simple harmonic motion, Give examples, state the conditions.
6.2 Explanation of uniform circular motion of a particle is a combination of two Perpendicular S.H.M.s.
6.3 Derive expressions for displacement, velocity, acceleration, Frequency, Time period of a particle executing SHM.
6.4 Define phase of SHM.
6.5 Define Ideal simple pendulum and derive expression for time period of simple pendulum.
6.6 State the laws of motion of simple pendulum.
6.7 Solve the related numerical problems.

7.0 Concept of heat and thermodynamics

7.1 Explain the concept of expansion of gases
7.2 State and explain Boyle's and Charles laws.
7.3 Define absolute zero temperature, absolute scale of temperature
7.4 Define ideal gas and distinguish from real gas
7.5 Derive Ideal gas equation. Define specific gas constant and universal gas constant, write S.I unit and dimensional formula. Calculate the value of R.
7.6 Explain why universal gas constant is same for all gases
7.7 State and explain isothermal process and adiabatic process
7.8 State first and second laws of thermodynamics and state applications
7.9 Define specific heats and molar specific heats of a gas, Derive C_P-C_V =R
7.10 Solve the relevant numerical problems

8.0 Concept of Sound

8.1 Concept of the sound, Wave motion. (Longitudinal and transverse wave)
8.2 Distinguish between musical sound and noise.
8.3 Explain noise pollution and state SI unit for intensity level of sound.
8.4 Explain causes, effects and methods of minimizing of noise pollution.
8.5 Explain the phenomenon of beats state the applications.
8.6 Define Doppler Effect, list the applications.
8.7 Define reverberation and reverberation time and write Sabine's formula.
8.8 Define and explain echoes state its applications.
8.9 State conditions of good auditorium.
8.10 Solve the related numerical problems.

9.0 Concepts of properties of matter

9.1 Explain the terms elasticity, stress, strain and types of stress and strain.
9.2 State and explain Hooke's law.
9.3 Definitions of Modulus of elasticity, Young's modulus(Y), Bulk modulus (K), Rigidity modulus (n),Poisson's ratio (σ),
9.4 Define surface tension and give examples.
9.5 Explain Surface tension with reference to molecular theory.
9.6 Define angle of contact and capillarity and write formula for Surface Tension.
9.7 Explain the concept of viscosity, give examples, write Newton's formula.
9.8 Define co-efficient of viscosity and write its units and dimensional formula and State Poiseulle's equation for Co-efficient of viscosity.
9.9 Explain the effect of temperature on viscosity of liquids and gases.
9.10 Solve the related numerical problems.

10. Concepts of Electricity and Magnetism

10.1 Explain Ohm's law in electricity and write the formula.
10.2 Define specific resistance, conductance and state their units.
10.3 Explain Kichoff's laws.
10.4 Describe Wheatstone's bridge with legible sketch.
10.5 Describe Meter Bridge for the determination of resistivity with a circuit diagram.
10.6 Explain the concept of magnetism. State the Coulomb's inverse square law of Magnetism.
10.7 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force.
10.8 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field.
10.9 Derive equations for Magnetic induction field strength at a point on the axial line and on the equatorial line of a bar magnet.
10.10 Solve the related numerical problems

11.0 Concepts of modern physics

11.1 State and explain Photo-electric effect and Write Einstein's photo electric Equation.
11.2 State laws of photo electric effect.
11.3 Explain the Working of photo electric cell, write its applications.
11.4 Recapitulation of refraction of light and its laws, critical angle, total Internal Reflection.
11.5 Explain the principle and working of Optical fiber, mention different types of Optical fiber, state the applications.
11.6 Define super conductor and super conductivity and mention examples.
11.7 State the properties of super conducting materials and list the applications.
11.8 Nanotechnology definition, nano materials, applications.

COURSECONTENT

1. Units and Dimensions:

Introduction, Physical quantity, Fundamental and Derived quantities, Fundamental and Derived units, SI units, Multiples and Sub multiples, Rules for writing S.I. units, Advantages of SI units. Dimensions and Dimensional formulae, Dimensional constants and Dimensionless quantities, Principle of homogeneity, Advantages and limitations of dimensional analysis, Errors in measurement, Absolute error, relative error, percentage error, significant figures, Problems.

2. Elements of Vectors:

Scalars and Vectors, Types of vectors (Proper Vector, Null Vector, Unit Vector, Equal, Negative Vector, Like Vectors, Co-Initial Vectors, Co-planar Vectors and Position Vector).Addition of vectors, Representation of vectors, Resolution of vectors, Parallelogram, Triangle and Polygon laws of vectors, Subtraction of vectors, Dot and Cross products of vectors-Problems.

3. Dynamics

Introduction-Concept of acceleration due to gravity-Equations of motion for a freely falling body and for a body thrown up vertically- Projectiles- Horizontal and Oblique projections- Expressions for maximum height, time of flight, range-Define force, momentum, angular displacement, angular velocity, angular acceleration, angular momentum, moment of inertia, torque–problems.

4. Friction:

Introduction to friction- Causes- Types of friction- Laws of friction- Angle of repose-Angle of friction- rough inclined plane- Advantages and disadvantages of friction-Methods of reducing friction–Problems.

5. Work, Power and Energy:

Work, Power and Energy- Definitions and explanation- potential energy- kinetic energy- Derivations of Potential and Kinetic energies-K.E and Momentum relation - Work-Energy theorem- Law of Conservation of energy- Problems.

6. **Simple Harmonic Motion:**

Introduction- Conditions of SHM- Definition- Examples- Expressions for displacement, velocity, acceleration, Time period, frequency and phase in SHM- Time period of a simple pendulum- Laws of simple pendulum-seconds pendulum-Problems.

7. **Heat and Thermodynamics:**

Expansion of Gases, Boyle's law, absolute scale of temperature- Charles laws- Ideal gas equation- Universal gas constant- Differences between gas constant(r) and universal gas constant(R),Isothermal and adiabatic processes, Laws of thermodynamics, Specific heats - molar specific heats of a gas -Different modes of transmission of heat ,laws of thermal conductivity, Coefficient of thermal conductivity-Problems.

8. **Sound:**

Sound- Nature of sound- Types of wave motion -musical sound and noise- Noise pollution – Causes &effects- Methods of reducing noise pollution- Beats- Doppler effect- Echo- Reverberation-Reverberation time-Sabine 's formula-Conditions of good auditorium-Problems.

9. **Properties of matter**

Definition of Elasticity –Definition of stress and strain -the units and dimensional formulae for stress and strain-The Hooke's law-Definitions of Modulus of elasticity, Young's modulus(Y), Bulk modulus(K), Rigidity modulus (n),Poisson's ratio (σ), relation between Y, K, n and σ(equations only no derivation)

Definition of surface tension-Explanation of Surface tension with reference to molecular theory - Definition of angle of contact -Definition of capillarity -The formula for surface tension based on capillarity - Explanation of concept of Viscosity - Examples for surface tension and Viscosity - Newton's formula for viscous force- Definition of co-efficient of viscosity- The effect of temperature on viscosity of liquids and gases - Poiseuille's equation for Co-efficient of viscosity- The related numerical problems.

10. **Electricity & Magnetism:**

Ohm's law and explanation, Specific resistance, Kirchoff's laws, Wheatstone's bridge, Meter bridge, Coulomb's inverse square law, magnetic field, magnetic lines of force, magnetic induction field strength- magnetic induction field strength at a point on the axial line - magnetic induction field strength at a point on the equatorial line–problems.

11. **Modern Physics;**

Photoelectric effect –Einstein's photoelectric equation-laws of photoelectric effect- photoelectric cell–Applications of photo electric effect- Total internal reflection- fiber optics- -principle and working of an optical fiber-types of optical fibers - Applications of optical fibers- superconductivity–applications-Nanotechnology definition, nano materials, applications

REFERENCEBOOKS

1. Telugu Academy (English version)	Intermediate physics Volume-I & 2
2. Dr. S. L. Guptha and Sanjeev Guptha	Unified physics Volume 1,2,3 and 4
3. Resnick& Holiday	Text book of physics Volume I
4. Dhanpath Roy	Text book of applied physics
5. D.A Hill	Fiber optics
6. XI & XII Standard	NCERT Text Books

➢ **Model Blue Print with Weightage for Blooms category and questions for chapter and Cos mapped**

S. No	Unit Title/Chapter	No of Periods	Weight age of marks	Marks wise distribution of Weightage				Question wise distribution of Weightage				Mapped with CO
				R	U	Ap	An	R	U	Ap	An	
1	Units and Dimensions	08	03	3	0	0	0	1	0	0	0	CO1
2	Elements of Vectors	12	11	3	8	0	0	1	1	0	0	CO1
3	Dynamics	12	11	3	8	0	0	1	1	0	*	CO2
4	Friction	10	11	3	0	8	0	1	0	1	0	CO2
5	Work, Power and Energy	12	11	3	8	0	0	1	1	0	0	CO3
6	Simple harmonic motion	12	11	3	8	0	0	1	1	0	*	CO3
7	Heat and Thermodynamics	12	11	0	8	3	0	0	1	1	*	CO4
8	Sound	10	11	0	8	3	0	0	1	1	0	CO4
9	Properties of matter	10	08	0	8	0	0	0	1	0	0	CO5
10	Electricity and Magnetism	12	14	6	0	8	0	2	0	1	0	CO5
11	Modern physics	10	08	0	8	0	0	0	1	0	0	CO5
Total		**120**	**110**	**24**	**64**	**22**	**0**	**8**	**8**	**4**	*** 10**	

***One question of HOTs for 10 marks from any of the unit title 3 or 6 or 7**

➢ **Table specifying the scope of syllabus to be covered for Unit Tests**

Unit Test	**Learning outcomes to be covered**
Unit Test – 1	From 1.1 to 4.9
Unit Test – 2	From 5.1 to 7.10
Unit Test – 3	From 8.1 to 11.8

➢ **Model question paper for Unit Tests I,II,III with COs mapped**

UNIT TEST –I

Model Question Paper (C-20)

ENGINEERING PHYSICS (M-103)

TIME: 90 minutes Total Marks: 40

PART-A **16 Marks**

Instructions: (1) Answer all questions.

(2) First question carries 4 marks and others carry 3 marks each.

(3) Answers for the Question numbers 2 to 5 should be brief and straight to the point and shall not exceed five simple sentences.

1. i) The dimensional formula of force is ___________ **(CO1)**

   ii) Which of the following is a scalar **(CO1)**

   a) force b) work c) displacement d) velocity

   iii) we can add a scalar to a vector (Yes / No) **(CO1)**

   iv) Friction is a self-adjusting force. [True / False] **(CO2)**

2. Define dot product. Give one example. **(CO1)**

3. A force of 150 N acts on a particle at an angle of 30° to the horizontal. Find the horizontal and vertical components of force. **(CO1)**

4. Define projectile. Give two examples. **(CO2)**

5. It is easier to pull a lawn roller than to push it. Explain **(CO2)**

PART—B **3x8=24**

Instructions: (1) Answer all questions. Each question carries 8marks.

(2) Answer should be comprehensive and the criteria for evaluation is content but not the length of the answer.

6) (A) Derive an expression for magnitude and direction of resultant of two Vectors using parallelogram law of vectors **(CO1)**

OR

(B) Write any four properties of dot product and any four properties of Cross product **(CO1)**

7) (A) Show that path of a projectile is a parabola in case of oblique Projection. **(CO2)**

OR

(B) Derive the expression for range and time of flight of a projectile **(CO2)**

8) (A) State and explain polygon law of vector addition with a neat diagram **(CO1)**

OR

(B) Derive the equation for acceleration of a body on a rough inclined plane **(CO2)**

UNIT TEST –II
Model Question Paper (C-20)
ENGINEERING PHYSICS (M–103)

TIME: 90 minutes Total Marks: 40

PART –A **16 Marks**

Instructions: (1) Answer all questions.
(2) First question carries 4 marks and others carry 3 marks each.
(3) Answers for the Question numbers 2 to 5 should be brief and Straight to the point and shall not exceed five simple sentences.

1) i) The value of 100^0 C is equal to ___________ in Kelvin scale of temperature **(CO4)**
ii) Write the S.I unit of power **(CO3)**
iii) A simple pendulum be used in artificial satellite (Yes / No) **(CO3)**
iv) Specific heat of a gas is constant for all gases in nature [True / False] **(CO4)**

2. Derive the relation between momentum and kinetic energy **(CO3)**
3. A girl is swinging by sitting in a swing, how the frequency changes if she stands in the swing. **(CO3)**
4. Write the physical significance of universal gas constant. **(CO4)**
5. A body is projected in to the air in the vertically upward direction, find the height at which its potential and kinetic energies are equal. **(CO3)**

PART—B **3x8=24 Marks**

Instructions: (1) Answer all questions. Each question carries 8marks.
(2) Answer should be comprehensive and the criteria for evaluation is content but not the length of the answer.

6) (A) State the law of conservation of energy and verify it in case of a freely falling body. **(CO3)**

(OR)

(B) State and prove work energy theorem. **(CO3)**

7) (A) Define ideal simple pendulum and derive the equation for time period of a simple pendulum **(CO3)**

OR

(B) State the conditions for S.H.M, derive the equation for velocity for a Particle in S.H.M. **(CO3)**

8) (A) Define ideal gas, show that for an ideal gas the difference in specific heats is equal to universal gas constant **(CO4)**

(OR)

(B) State gas laws and derive the ideal gas equation **(CO4)**

UNIT TEST –III
Model Question Paper (C-20)
ENGINEERING PHYSICS (M–103)

TIME: 90 minutes Total Marks: 40

PART –A **16 Marks**

Instructions: (1) Answer all questions.
(2) First question carries 4 marks and others carry 3 marks each.
(3) Answers for the Question numbers 2 to 5 should be brief and straight to the point and shall not exceed five simple sentences.

1) i) Photo electric cell converts light energy in to ___________ energy **(CO5)**
ii) What is elastic limit ?**(CO5)**
iii) SI unit of Specific resistance is ------------ **(CO5)**
iv) Inside a bar magnet magnetic line of force will travel from North pole to South pole [True / False] **(CO5)**
2. Distinguish between Musical sound and Noise **(CO4)**
3. What is the effect of temperature on Viscosity of liquids and gases**(CO5)**
4. The values of resistances P, Q, R are 50 Ω, 10Ω, 15 Ω respectively in the balanced condition of Wheatstone bridge, find the unknown resistance**(CO5)**
5. What is nanotechnology and write any two uses. **(CO5)**

PART—B **3x8=24 Marks**

Instructions: (1) Answer all questions. Each question carries 8marks.
(2) Answer should be comprehensive and the criteria for evaluation is content but not the length of the answer.

6) (A) Explain Surface Tension based on the molecular theory **(CO5)**

(OR)

(B)Define Reverberation and Reverberation Time. Derive Sabine formula for reverberation time. **(CO4)**

7) (A) Derive the balancing condition of Wheatstone bridge with neat circuit Diagram. **(CO5)**

(OR)

(B) Derive an expression for the magnetic induction field strength at a point on the equatorial line of a bar magnet. **(CO5)**

8) (A) Describe an experiment to determine the specific resistance of a wire using meter bridge. **(CO5)**

(OR)

(B) Explain the principle and working of an optical fiber. **(CO5)**

BOARD DIPLOMA EXAMINATION, (C–20)
FIRST YEAR EXAMINATION
M–103, ENGINEERING PHYSICS

Time : 3 hours] [Total Marks : 80M

PART—A **3×10=30**

Instructions: (1) Answer all questions.
(2) Each question carries three marks.
(3) Answers should be brief and straight to the point and shall not exceed five simple Sentences.

1. Write the dimensional formula of the following physical quantities **(CO1)**
   (a) Velocity (b) Force (c) Angular momentum
2. Write any three properties of scalar product. **(CO1)**
3. Define projectile. Give two examples. **(CO2)**
4. It is easier to pull a lawn roller than to push it. Explain. **(CO2)**
5. Define potential energy and kinetic energy. **(CO3)**
6. For a body in simple harmonic motion velocity at mean position is 4m/s, if the time period is 3.14 s, find its amplitude. **(CO3)**
7. State first and second laws of thermodynamics. **(CO4)**
8. Write any three conditions of good auditorium **(CO4)**
9. Define ohmic and non-ohmic conductors. **(CO5)**
10. State Coulomb's inverse square law of magnetism. **(CO5)**

PART—B **8 ×5= 40**

Instructions: (1) Each question carries eight marks.
(2) Answers should be comprehensive and the criterion for valuation is the content But not the length of the answer.

11. A) Derive an expression for magnitude and direction of the resultant of two vectors using Parallelogram law of vectors. OR **(CO1)**
    B) Show that path of a projectile is parabola in case of oblique projection and derive expression for maximum height. **(CO2)**
12. A) Derive expression for acceleration of a body sliding downwards on a rough inclined plane. OR **(CO2)**
    B) Verify the law of conservation of energy in case of a freely falling body. **(CO3)**
13. A) Derive an expression for velocity and acceleration of a particle performing simple harmonic Motion. OR **(CO3)**
    B) Define ideal gas and derive ideal gas equation. **(CO4)**
14. A) Two tuning forks A and B produce 4 beats per second. On loading B with wax 6 beats are produced. If the quantity of wax is reduced the number of beats drops to 4. If the frequency of A is 326 Hz, find the frequency of B. **(CO4)**

    OR

    B) Explain surface tension based on molecular theory. Write three examples of surface tension. **(CO5)**
15. A) Derive an expression for balancing condition of Wheat stone's bridge with a neat circuit diagram. **(CO5)**

    OR

    B) Explain principle and working of optical fibers. Write any three applications. **(CO5)**

PART C **1 x 10 = 10**

16) Derive relationship between molar specific heat of a gas at constant pressure C_p and molar specific heat of a gas at constant volume C_v and hence show that C_p is greater than C_v. **(CO4)**

Course code	Course Title	No. of Periods per week	Total No. of Periods	Marks for FA	Marks for SA
M-104	Engineering Chemistry and Environmental Studies	4	120	20	80

S.No	Unit Title/Chapter	No of Periods	COs Mapped
1	Fundamentals of Chemistry	18	CO1
2	Solutions	10	CO1
3	Acids and bases	10	CO1
4	Principles of Metallurgy	8	CO1
5	Electrochemistry	16	CO2
6	Corrosion	8	CO2
7	Water Treatment	10	CO3
8	Polymers	12	CO4
9	Fuels	6	CO4
10	Chemistry in daily life	6	CO4
11	Environmental Studies	16	CO5
	Total	**120**	

- **Course Objectives**

Course Title: Engineering Chemistry & Environmental Studies	
Course Objectives	1. To familiarize with the concepts of chemistry involved in the process of various Engineering Industrial Applications. 2. To know the various natural and man-made environmental issues and concerns with an interdisciplinary approach that include physical, chemical, biological and socio cultural aspects of environment. 3. To reinforce theoretical concepts by conducting relevant experiments/exercises

➢ **Course outcomes**

Course Outcomes	CO1	Explain Bohr`s atomic model, chemical bonding, mole concept, acids and bases, P^H metallurgical process and alloys
	CO2	Explain electrolysis, Galvanic cell, emf and corrosion
	CO3	Explain the chemistry involved in the treatment of water by advanced method
	CO4	Synthesise of Plastics, rubber and applications of fuel chemical compounds used in our daily life.
	CO5	Explain the causes, effects and control methods of air and water pollution and measures to protect the environment

Course code M-104	**Engg. Chemistry and Environmental studies No of Cos;5**				**No Of periods 120**
POs	**Mapped with CO No**	**CO periods addressing PO in Col 1 NO**	**%**	**Level 1,2,3**	**remarks**
PO1	CO1,CO2,CO3, CO4,CO5	60	50%	3	>40% level 3 (highly addressed) 25% to 40% level2(moderately addressed 5% to 25% level1 (Low addressed < 5%(not addressed)
PO2	CO1,CO2	13	10.8%	1	
PO3	CO2,CO3	10	8.3%	1	
PO4	CO1	10	8.3%	1	
PO5	CO4,CO5	15	12.5	1	
PO6					
PO7	CO4	12	10%	1	

➢ COs-POs mapping strength (as per given table)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1		1				1	1	
CO2	3	1	2					1	1	
CO3	3		2							
CO4	3				1		2			
CO5	3				3			1		

3 = strongly mapped
2= moderately mapped
1= slightly mapped

Note: The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitions vi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes xi) Library visit for e-books

➢ **Model Blue Print with Weightage for Blooms category and questions for each chapter and COs mapped**

S.No	Unit Title/Chapter	No of Periods	Weight age of marks	Marks wise distribution of Weightage				Question wise distribution of Weightage				Mapped with CO
				R	U	Ap	An	R	U	Ap	An	
1	Fundamentals of Chemistry	18	19	8	8	3		1	1	1		CO1
2	Solutions	10	11	0	0	8	3			1	1	CO1
3	Acids and bases	10	11	0	8	0	3		1		1	CO1
4	Principles of Metallurgy	8	8	8	0	0		1				CO1
5	Electrochemistry	16	11	8	3	0		1	1		*	CO2
6	Corrosion	8	8	0	8	0			1			CO2
7	Water Treatment	10	11	8	3	0		1	1			CO3
8	Polymers	12	11	3	8	0		1	1		*	CO4
9	Fuels	6	3	3	0	0		1				CO4
10	Chemistry in daily life	6	3	0	0	3				1		CO4
11	Environmental Studies	16	14	3	11	0		1	2			CO5
Total		**120**	**110**	**12**	**6**	**6**	**6**	**20**	**35**	**5**	*** 10**	

***One question of HOTs for 10 marks from any of the unit title 5 or 8**

Upon completion of the course the student shall be able to learn out

ENGINEERINGCHEMISTRY AND ENVIRONMENTAL STUDIES

1.0 Atomic structure

1.1 Explain the charge, mass of fundamental particles of an atom (electron, proton and neutron) and the concept of atomic number and mass number.

1.2 State the Postulates of Bohr's atomic theory and its limitations.

1.3 Explain the significance of four Quantum numbers.

1.4 Explain 1.Aufbau principle, 2 Pauli's exclusion principle 3 Hund's rule.

1.5 Define Orbital of an atom and draw the shapes of s, p and d- Orbitals.

1.6 Write the electronic configuration of elements up to atomic number 30

1.7 Explain the significance of chemical bonding

1.8 Explain the Postulates of Electronic theory of valency

1.9 Define and explain Ionic and Covalent bonds with examples of NaCl , MgO, $*H_2$,$*O_2$ and $*N_2$. (* Lewis dot method)

1.10 List out the Properties of Ionic compounds and covalent compounds and distinguish between their properties.

1.11 Structures of ionic solids-define a) Unit cell b) co-ordination number and the structures of NaCl and CsCl unit cells.

2.0 Solutions

2.1 Define the terms 1.Solution, 2.Solute and 3.Solvent

2.2 Classify solutions based on physical state and solubility

2.3 Define mole and problems on mole concept.

2.4 Define the terms 1. Atomic weight, 2.Molecular weight and 3. Equivalent weight and calculate Molecular weight and Equivalent weight of the given acids.(HCl,H_2SO_4,H_3PO_4)Bases ($NaOH$, $Ca(OH)_2$, $Al(OH)_3$) and Salts ($NaCl$, Na_2CO_3, $CaCO_3$)

2.5 Define molarity and normality and numerical problems on molarity and normality

a) Calculate the Molarity or Normality if weight of solute and volume of solution are given

b) Calculate the weight of solute if Molarity or normality with volume of solution are given

c) Problems on dilution to convert high concentrated solutions to low concentrated Solutions.

3.0 Acids and bases

3.1 Explain Arrhenius theory of Acids and Bases and give the limitations of Arrhenius theory of Acids and Bases.

3.2 Explain Bronsted–Lowry theory of acids and bases and give the limitations of Bronsted–Lowry theory of acids and bases.

3.3 Explain Lewis theory of acids and bases and give the limitations of Lewis theory of acids and bases.

3.4 Explain the Ionic product of water

3.5 Define pH and explain P^H scale and solve the Numerical problems on pH(Strong Acids and Bases)

3.6 Define and explain buffer solution and give the examples of buffer solutions.

3.7 State the application of buffer solutions.

4.0 Principles of Metallurgy

4.1 List out the Characteristics of Metals and non-metals

4.2 Distinguish between Metals and Non-metals

4.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Flux5.Slag

4.4 Describe the methods of concentration of Ore; 1.Handpicking, 2.Levigation and 3. Froth Floatation

4.5 Describe the methods involved in extraction of crude metal- Roasting, Calcination and Smelting.

4.6 Explain the purification of Copper by Electrolytic Refining

4.7 Define an Alloy and Write the composition and uses of the following alloys. 1. Brass 2. Germen silver 3. Nichrome.

5.0 Electrochemistry

5.1 Define the terms1. Conductor 2. Semiconductor 3.Insulator, 4.Electrolyte5.Non–electrolyte.Give two examples each.

5.2 Distinguish between metallic conduction and Electrolytic conduction

5.3 Explain electrolysis by taking example fused NaCl

5.4 Explain Faraday's laws of electrolysis

5.5 Define 1.Chemical equivalent (E) 2.Electrochemicalequivalent (e) and their relation.

5.6 Solve the Numerical problems on Faraday's laws of electrolysis and applications of electrolysis (Electro plating)

5.7 Define Galvanic cell and explain the construction and working of Galvanic cell.

5.8 Distinguish between electrolytic cell and galvanic cell

5.9 Explain the electrode potentials and standard electrode potentials

5.10 Explain the electrochemical series and its significance

5.11 Explain the emf of a cell and solve the numerical problems on emf of the cell based on standard electrode potentials.

6.0 Corrosion

6.1 Define the term corrosion.

6.2 state the Factors influencing the rate of corrosion

6.3 Describe the formation of a) composition cell b) stress cell c)concentration cell during corrosion.

6.4 Define rusting of iron and explain the mechanism of rusting of iron.

6.5 Explain the methods of prevention of corrosion
a)Protective coatings (anodic and cathodic coatings)
b) Cathodic protection (Sacrificial anode process and Impressed–voltage process)

7. 0 Water Treatment

7.1 Define soft water and hard water with respect to soap action.

7.2 Define and classify the hardness of water.

7.3 List out the salts that causing hardness of water (with Formulae)

7.4 State the disadvantages of using hard water in industries.

7.5 Define Degree of hardness and units of hardness (mg/L) or(ppm).

7.6 Explain the methods of softening of hard water: a) Ion-exchange process, b)Permutit process or zeolite process

7.7 State the essential qualities of drinking water.

7.8 Chemistry involved in treatment of water (Coagulation, Chlorination, deflouridation)

7.9 Explain Osmosis and Reverse Osmosis with examples.

7.10 State the applications of Reverse Osmosis.

8.0 Polymers

8.1 Explain the concept of polymerisation

8.2 Describe the methods of polymerization a)addition polymerization of ethylene
b)condensation polymerization of Bakalite(Only flow chart)

8.3 Define thermoplastics and thermosetting plastics with examples.

8.4 Distinguish between thermo plastics and thermosetting plastics

8.5 List the Characteristics of plastics and state the disadvantages of using plastics.

8.6 State the advantages of plastics over traditional materials.

8.7 Explain the methods of preparation and uses of the following plastics:
1. PVC, 2.Teflon, 3. Polystyrene 4. Nylon 6,6

8.8 Explain processing of Natural rubber and write the structural formula of Natural rubber.

8.9 List the Characteristics of raw rubber

8.10 Define and explain Vulcanization and List out the Characteristics of Vulcanized rubber.

8.11 Define the term Elastomer and describe the preparation and uses of the following synthetic rubbers a) Buna-s and b)Neoprene rubber.

9.0 Fuels

9.1 Define the term fuel

9.2 Classify the fuels based on physical state and based on occurrence.

9.3 List the characteristics of good fuel.

9.4 State the composition and uses of gaseous fuels.
a)water gas b) producer gas, c) natural gas, d) Coal gas, e)Biogas.

10.0 Chemistry in daily life

10.1 Give the basic chemical composition, applications, health aspects and pollution impacts of
a) soaps, and detergents b) vinegar c) Insect repellents d) activated charcoal e) Soft drinks

11.0 ENVIRONMENTALSTUDIES

11.1 Define the term environment and explain the scope and importance of environmental studies

11.2 Define the segments of environment 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere,

11.3 Define the following terms 1)Pollutant, 2).Pollution, 3).Contaminant, 4)receptor, 5)sink, 6) particulates, 7)dissolved oxygen (DO), 8)Threshold limit value (TLV), 9).BOD,10).COD 11) eco system12)Producers13)Consumers 14) Decomposers with examples
11.4 State the renewable and non renewable energy sources with examples.
11.5 Explain biodiversity and threats to biodiversity
11.6 Define air pollution and classify the air pollutants-based on origin and physical state of matter.
11.7 Explain the causes, effects of air pollution on human beings, plants and animals and control methods of air pollution.
11.8 State the uses of forest resources.
11.9 Explain causes and effects of deforestation
11.10 Explain the causes and effects of the following
1.) Greenhouse effect, 2) Ozone layer depletion and 3) Acid rain
11.11 Define Water pollution, explain the causes, effects and control methods of Water pollution.

COURSE CONTENT

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES

1. Fundamentals of Chemistry

Atomic Structure: Introduction - Fundamental particles – Bohr's theory – Quantum numbers –Aufbau principle - Hund's rule - Pauli's exclusion Principle- Orbitals, shapes of s, p and d orbitals - Electronic configurations of elements

Chemical Bonding: Introduction – types of chemical bonds – Ionic and covalent bond with examples–Properties of Ionic and Covalent compounds- structures of ionic crystals (NaCl and CsCl).

2. Solutions

Introduction of concentration methods – mole concept, molarity and normality – Numerical problems on mole, molarity and normality.

3. Acids and Bases

Introduction – Theories of acids and bases and limitations – Arrhenius theory- Bronsted – Lowry theory – Lewis acid base theory – Ionic product of water- pH related numerical problems–Buffer solutions, action of buffer and its applications.

4. Principles of Metallurgy

Characteristics of Metals and non-metals –Distinguish between Metals and Non-metals, Define the terms i) Metallurgy ii) ore iii) Gangue iv) flux v) Slag - Concentration of Ore –Hand picking, Levigation, Froth floatation – Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of brass, German silver and nichrome.

5. Electrochemistry

Conductors, semiconductors, insulators, electrolytes and non-electrolytes – electrolysis – Faraday's laws of electrolysis-application of electrolysis(electroplating) -numerical problems on Faraday's laws – Galvanic cell – standard electrode potential – electrochemical series–emf and numerical problems on emf of a cell .

6. Corrosion

Introduction - factors influencing corrosion - composition, stress and concentration cells– rusting of iron and its mechanism – prevention of corrosion by coating methods, cathodic protection methods.

7. Water technology

Introduction–soft and hard water–causes of hardness–types of hardness –disadvantages of hard water – degree of hardness (ppm and mg/lit) – softening methods – permutit process – ion exchange process– qualities of drinking water –Chemistry involved in treatment of water (Coagulation, Chlorination, defluoridation) - Osmosis, Reverse Osmosis –Applications of Reverse osmosis.

8. Polymers

Introduction – polymerization – types of polymerization – addition, condensation with examples – plastics – types of plastics – advantages of plastics over traditional materials- Disadvantages of using plastics – Preparation and uses of the following plastics i).PVC ii) Teflon iii) Polystyrene iv) .Nylonn 6,6 –Processing of natural rubber - Vulcanization – Elastomers- Preparation and applications of Buna-s, Neoprene rubbers.

9. Fuels

Definition and classification of fuels–characteristics of good fuel-composition and uses of gaseous fuels.

10. Chemistry in daily life

Basic composition, applications, health aspects and pollution impacts of soaps and detergents, vinegar, insect repellents, soft drinks, activated charcoal.

11. **ENVIRONMENTALSTUDIES**

Introduction– environment –scope and importance of environmental studies – important terms related to environment– renewable and non-renewable energy sources–Concept of ecosystem – Biotic components –Forest resources – Deforestation -Biodiversity and its threats-Air pollution – causes-effects–Global environmental issues – control measures – Water pollution – causes – effects – control measures.

REFERENCEBOOKS

1.	Telugu Academy	Intermediate chemistry Vol 1&2
2.	Jain & Jain	Engineering Chemistry
3.	O.P. Agarwal,	Hi- Tech. Engineering Chemistry
4.	Sharma	Engineering Chemistry
5.	A.K. De	Engineering Chemistry

Table specifying the scope of syllabus to be covered for unit test 1, unit test 2 and unit test 3

Unit Test	**Learning outcomes to be covered**
Unit Test - 1	From 1.1 to 3.7
Unit Test - 2	From 4.1 to 7.10
Unit Test - 3	From 8.1 to 11.11

Model question paper for Unit Test with Cos mapped

UNIT TEST –I

Model Question Paper (C-20)

ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES (104)

TIME: 90 minutes Total Marks: 40

PART-A **16 Marks**

Instructions: (1) Answer all questions.
(2) First question carries 4 marks and each of rest carries 3 marks.
(3) Answers for Q.No. 2 to 5 should be brief and straight to the point and shall not exceed five simple sentences.

1. a. Number of neutrons in $_{11}Na^{23}$ is ---------- **(CO1)**
   b. The molarity and normality of HCl is the same (True or False) **(CO1)**
   c. What is the p^H range of base? **(CO1)**
   d. Graphite is a good conductor of electricity (Yes or No) **(CO1)**

2. Distinguish between orbit and orbital. **(CO1)**
3. Define Covalent bond. Explain the formation of covalent bond in Oxygen and Nitrogen molecules**.** **(CO1)**
4. Define mole. Calculate the number of moles present in 50 gm of $CaCO_3$ and 9.8 gm of H_2SO_4. **(CO1)**
5. Define P^H. Calculate the P^H of 0.001M HCl and 0.01M NaOH solution. **(CO1)**

PART – B **3x8M = 24M**

Answer either (A) or (B) from each questions from Part-B.
Each question carries 8 marks.

6. A) Explain Postulations of Bhor's atomic theory. Give its limitations. **(CO1)**

(OR)

B) Explain the significance of Quantum numbers. **(CO1)**

7. A) Express molarity normality with mathematical equation. Calculate the molarity and normality of 10gm of NaOH present in 500 ml solution. **(CO1)**

(OR)

B) Classify solutions based the physical state of solute and solvent and give an example each. **(CO1)**

8. A) What is buffer solution? Classify with examples and give it`s applications. **(CO1)**

(OR)

B) Explain Bronsted-Lowry theory of acids and bases. Give its limitations. **(CO1)**

UNIT TEST –II

Model Question Paper (C-20)

ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES (M-104)

TIME: 90 minutes Total Marks:40Marks

PART-A

16 Marks

Instructions: (1) Answer all questions.
(2) First question carries 4 marks and each of rest carries 3 marks.
(3) Answers for Q.No. 2 to 5 should be brief and straight to the point and shall not exceed five simple sentences.

a) Bauxite is the ore of .... metal **(CO2)**
b) What is the unit of electrochemical equivalent? **(CO2)**
c) $CaSO_4$ is the permanent hardness causing salt. (True or False) **(CO3)**
d) Write the Chemical formula of rust. **(CO2)**

1. Write any three differences between metallic conduction and electrolytic conduction**.** **(CO2)**
2. Write the composition and applications of German silver and Nichrome. **(CO1)**
3. Mention any three disadvantages of using hard water in industries. **(CO3)**
4. Define electro chemical equivalent and chemical equivalent. Give the relation between them. **(CO2)**

PART – B **3x8M = 24M**

Answer either (A) or (B) from each questions from Part-B.
Each question carries 8 marks.

5. A) What is galvanic cell? Explain construction and working of galvanic cell with neat diagram **(CO2)**

(OR)

B) State and explain Faraday`s laws of electrolysis. **(CO2)**

6. A) Explain different types of galvanic cells formed during the corrosion of metals. **(CO2)**

(OR)

B) What is hard water? Explain zeolite process of softening of hard water. **(CO3)**

7. A) Explain Froth floatation process. **(CO1)**

(OR)

B) Explain Electrolytic refining processing of copper. **(CO1)**

UNIT TEST –III

Model Question Paper (C-20)

ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES (104)

TIME: 90 minutes Total Marks:40

PART-A **16 Marks**

Instructions: (1) Answer all questions.

(2) First question carries 4 marks and each of rest carries 3 marks.

(3) Answers for Q. No. 2 to 5 should be brief and straight to the point and shall not exceed five simple sentences.

a) The monomer of PVC................ **(CO4)**

b) Sulphur is the vulcanising agent. (True/False) **(CO4)**

c) Give an example for secondary pollutant. **(CO5)**

d) Presence of ozone in stratosphere is a pollutant.(Yes/No) **(CO5)**

1. List any three characteristic properties of vulcanised rubber. **(CO4)**
2. Define primary fuel and secondary fuels give an example each. **(CO4)**
3. Mention the basic chemical composition and applications of vinegar. **(CO4)**
4. Write any three threats to the biodiversity. **(CO5)**

PART – B **3x8M = 24M**

Answer either (A) or (B) from each questions from Part-B.

Each question carries 8 marks.

5. A) A) Explain addition and condensation polymerization with an example each. **(CO4)**

   (OR)

   B) Give a method of preparation and applications of the following
   i) Buna-S ii) Neoprene **(CO4)**

6. A) What is air pollution? Explain any three causes of air pollution. **(CO5)**

   (OR)

   B) Briefly explain ozone layer depletion and green house effect. **(CO5)**

7. A) What is water pollution? Explain any three controlling methods of water pollution. **(CO5)**

   (OR)

   B) What are thermoplastics and thermo setting plastic? Write any four differences between these two plastics. **(CO4)**

Model Question Paper (C-20)

ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES (M-104)

TIME: 3hrs Total Marks:80

PART-A

Instructions: (1) Answer all questions.

(2) Each question carries 3 marks.

Answer all questions. Each question carries three marks. 3x10=30M

1. Draw the shapes of s and p orbitals. **(CO1)**
2. Define mole. Find the mole number of 10 g of $CaCO_3$ **(CO1)**
3. Define Buffer solution. Give any two examples. **(CO1)**
4. Define chemical equivalent and electrochemical equivalent. Give their relation. **(CO2)**
5. State name of the salts and their formulae that cause hardness. **(CO3)**
6. Write any three disadvantages of using plastics. **(CO4)**
7. Classify the fuels based on their occurrence. **(CO4)**
8. Mention the basic chemical composition and applications of vinegar. **(CO4)**
9. List out any three threats to biodiversity. **(CO5)**
10. Define pollutant and contaminant. Give an example each. **(CO5)**

PART – B

Each question carries eight marks. 8x5=40M

11. A) Explain Bhor's atomic theory and give its limitations. **(CO1)**

(OR)

B) Explain ionic bond formation and covalent bond formation with one example each **(CO1)**

12. A) Calculate the molarity and normality of 250 ml of sodium carbonate solution that contains 10.6 gm of sodium carbonate. **(CO1)**

(OR)

B) Explain Bronstead and Lowry theory of acids and bases. Give its limitations. **(CO1)**

13. A) Explain froth floatation and electrolytic refining of copper with neat diagrams. **(CO1)**

(OR)

B) Explain the construction and working of galvanic cell. **(CO2)**

14. A) Explain Cathode protection methods. **(CO2)**

(OR)

B) Explain ion-exchange of softening of hard water with a neat diagram. **(CO3)**

15. A) Explain addition and condensation polymerisation with an example each. **(CO4)**

(OR)

B) Explain the causes and effects of air pollution. **(CO5)**

PART –C

Question carries ten marks 10x1 =10M

16. Analyse the products formed at cathode and anode with electrode reactions during the Electrolysis of aqueous NaCl in compare with fused NaCl. **(CO2)**

Course Title	Course Code	Periods/Week	Periods per year
Engineering Mechanics	**M-105**	**04**	**120**

TIME SCHEDULE

S No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Essay Type Question (10 M)
1	Statics	20	14	2	1	1
2	Friction	20	14	2	1	
3	Geometrical Properties of sections	30	14	2	1	
4	Dynamics	20	14	2	1	
5	Simple Mechanisms & Machines	30	14	2	1	
	Total	**120**	**70+10**	**10**	**5**	**1**

Note: 10 Marks higher order question may be given from Chapter -1 or 2 or 3 or 4 or 5.

Course Objectives and Course Outcomes

Course Objectives	**Upon completion of the course the student shall be able to** Understand the basic principles of statics and dynamics of rigid bodies. Calculate the reactive forces and motion characteristics for given conditions Understand the working of simple mechanisms and machines.		
Course Outcomes	**CO1**	**M-105.1**	Explain the basic concepts of force, moment, composition and resolution of forces, equilibrium, resultant of forces and moments in coplanar force systems and applying them to analyse the real time problems
	CO2	**M-105.2**	Apply the Newton's laws of motion to the rectilinear and curvilinear motion to find the motion characteristics.
	CO3	**M-105.3**	Apply the various principles like, Work-Energy principle and Impulse – Momentum principle to solve the kinetic problems of particles
	CO4	**M-105.4**	Illustrate working principles of simple machines and functioning of simple mechanisms used in day to day needs.
	CO5	**M-105.5**	Calculate various geometric properties of areas like centriod, moment of inertia and apply them to solve the engineering problems

PO-CO Mapping

Course Code : M-105	Course Title: Engineering Mechanics	Number of Course Outcomes: 05			No. of Periods: 120
POs	**Mapped with CO No.**	**CO Periods addressing PO in Column 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1, CO2, CO3, CO4,CO5	54	45	3	**>40% Level 3 Highly addressed** **25% to 40% Level 2 Moderately Addressed** **5 to 25% Level 1 Low addressed** **<5% Not addressed**
PO2	CO1, CO2, CO3, CO4,CO5	48	40	3	
PO3	CO1, CO2, CO3, CO4,CO5	06	05	1	
PO4					
PO5					
PO6					
PO7	CO1, CO2, CO3, CO4,CO5	12	10	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	1				1	1	3	1
CO2	3	3	1				1	1	3	1
CO3	3	3	1				1	1	3	1
CO4	3	3	1				1	1	3	1
CO5	3	3	1				1	1	3	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

BLUE PRINT OF QUESTION PAPER

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Statics	20	14	3	3	8	-	1	1	1	-	CO1
2	Friction	20	14	3	3	8	-	1	1	1	-	CO1
3	Geometrical properties of Sections	30	14	3	3	8	-	1	1	1	-	CO5
4	Dynamics	20	14	3	3	8	-	1	1	1	-	CO2, CO3
5	Simple Mechanisms & Machines	30	24	3	3	8	10	1	1	1	1	CO4
Total		**120**	**80**	**15**	**15**	**40**	**10**	**05**	**05**	**05**	**1**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from Chapter -1 or 2 or 3 or 4 or 5. (Here it is taken from the Chapter – 5)

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1.0 Statics

1.1 Explain the importance of engineering mechanics in real world
1.2 Explain the concept of force
1.3 Classify the system of forces.
1.4 Explain the system of forces a) Co-planar and Non-coplanar, b) Parallel and Non-Parallel, c) Like and Unlike, d) Concurrent and Non-concurrent
1.5 Explain Composition and Resolution of force and resultant of concurrent coplanar forces.
1.6 Explain the concept of equilibrium.
1.7 State (a) parallelogram law (b) triangle law (c) polygon law of forces (d) Lames' theorem.
1.8 Problems on parallelogram law of forces.
1.9 Solve the problems on involving concurrent coplanar forces.
1.10 Explain moment of force and couple.
1.11 State the condition of equilibrium of a body acted upon by co-planar forces
1.12 State Varignon's theorem.

2.0 Friction

2.1 Explain the concept of friction
2.2 State the laws of friction
2.3 Define i) angle of friction ii) angle of repose
2.4 Identify the machine members in which friction is desirable.
2.5 Resolve the forces acting on bodies moving on horizontal plane.
2.6 Resolve the forces acting on bodies moving up on an inclined plane. Force applied (a) parallel to the plane (b)Parallel to the base (c) Inclined to the plane.
2.7 Resolve the forces acting on bodies moving down on an inclined plane. Force applied (a) parallel to the plane (b)Parallel to the base (c) Inclined to the plane.
2.8 Solve the related numerical problems of the above cases.

3.0 Geometric Properties of sections

3.1 Define the terms i) centre of gravity ii) centroid.
3.2 Write the differences among centre of gravity and centroid
3.3 State the need for finding the centroid and centre of gravity for various engineering applications.
3.4 Explain the method of determining the centroid by 'Method of moments'
3.5 Determine the position of centroid of standard sections like -T, L, I, Channel section, Z – Section.
3.6 Explain the meaning of the terms i) moment of Inertia ii) Polar moment of inertia iii) Radius of gyration.
3.7 State the necessity of finding Moment of Inertia for various engineering applications
3.8 State and derive (a) Parallel axes theorem (b) Perpendicular axes theorem
3.9 Determine Moment of Inertia and Radius of gyration for rectangular geometrical sections.
3.10 Determine MI of standard sections by applying parallel axes theorem

4.0 Dynamics

4.1 Define the terms ii) Kinematics ii) Kinetics
4.2 Classify the motion.
4.3 Define the terms i) displacement ii) velocity iii) acceleration and write equations of motion.
4.4 State the Newton's Laws of motion
4.5 Solve the problems related to the rectilinear motion of a particle
4.6 Explain the rotary motion of particle
4.7 Define the law of conservation of energy
4.8 Explain the Work-Energy principle
4.9 Define the law of conservation of momentum
4.10 Explain the Impulse –momentum equation
4.11 Solve the problems using the above principles.
4.12 Define i) centripetal force ii) centrifugal force.
4.13 Differentiate centripetal force from centrifugal force.
4.14 Solve the problems using the above principles.

5.0 Simple Mechanisms & Machines

5.1 Define the terms i) kinematic link ii)kinematic pair iii)Kinematic chain iv) Mechanism v) Machine vi) Structure vii) inversion of mechanism.
5.2 Write the classification of kinematic pairs on different criteria
5.3 Explain with legible sketches the inversions of quadric cycle chain only

5.4 Define the important terms of simple machines

a) Machine, b) Mechanical Advantage, c) Velocity Ratio, d) Efficiency

e) Ideal Machine f) Ideal Effort g) Ideal Load h) Reversibility of a machine

5.5 Illustrate the use of three classes of simple lever.

5.6 Explain how an inclined plane act as a simple machine to reduce the effort in lifting loads.

5.7 Derive expression for velocity ratio for i) wheel & axle ii) Weston Differential pulley block iii) pulleys iv) Worm & Worm wheel v) winch crabs vi) screw jack vi) rack & pinion.

5.8 Calculate the efficiency of a given machine.

5.9 Calculate the effort required to raise and lower the load on screw jack under given conditions.

5.10 Explain the law of machine.

5.11 State the conditions for self-locking .

5.12 State the conditions for reversibility.

5.13 Calculate effort lost in friction and load equivalent of friction.

5.14 Evaluate the conditions for i) maximum mechanical advantage iii) maximum efficiency of a machine.

COURSE CONTENTS:

1.0 Statics

Importance of engineering mechanics in engineering - Definition of force and its specifications - System of forces - Composition and Resolution of force - Equilibrium and Equilibrant, resultant - Statement of parallelogram law of forces, triangle law of forces, polygon law of forces and Lames' theorem - Numerical problems related to concurrent coplanar forces.

Moment of force and moment of a couple - Condition for equilibrium of a rigid body subjected to number of coplanar forces - Varignon's Principle.

2.0 Friction

Definition of static friction, dynamic friction - laws of solid and dynamic friction - angle of friction and angle of repose - Resolution of forces considering friction when a body moves on horizontal plane and inclined plane when Force applied (a) parallel to the plane (b)Parallel to the base (c) Inclined to the plane.- Numerical examples on the above cases.

3.0 Geometric Properties of Sections

Definition and explanation of the terms centre of gravity and centroid - Centroid of square, rectangle, triangle, semi-circle and trapezium (formulae only without derivations) - Centre of gravity of composite sections by analytical method only (T-Section, L-Section I-section, Z-section and channel section) - Moment of Inertia and Radius of Gyration - i) Parallel axes theorem,

ii) Perpendicular axes theorem - Calculation of Moment of Inertia a) I – Section, b) Channel Section, c) T – Section d) L – Section (Equal & unequal lengths), e) Z - section .

4.0 Dynamics

Definition of Kinematics and Kinetics - Classification of motion - Definition of displacement, velocity and acceleration – Equations of motion - Newton's Laws of motion (without derivation) - Solving the problems related to the rectilinear motion of a particle - Law of conservation of energy - Law of conservation of momentum - Work-Energy principle - Impulse–momentum equation - Solving the problems using the above principles - Definition of centripetal and centrifugal force and differences between them- Numerical problems.

5.0 Simple Mechanisms & Machines

Define the terms kinematic link, kinematic pair, Kinematic Chain, Mechanism, Machine, Structure and inversion - classification of kinematic pairs on different criteria – nature of contact, relative motion and type of closure – Explain inversions of Quadric cycle chain - Definition of simple machine, and uses of simple machine, levers and inclined plane -Fundamental terms like mechanical advantage, velocity ratio and efficiency - Expressions for VR in case of three systems of pulleys, Weston Differential pulley block, Worm and Worm wheel, Rack and pinion, Winch crabs, &Screw jack - Conditions for reversibility and self locking - Law of Simple Machine - Effort lost in friction, Load Equivalent of Friction Maximum Mechanical Advantage and Maximum Efficiency.

REFERENCE BOOKS:

1	Engineering Mechanics	Singer	B.S.Publications
2.	Engineering Mechanics	K.L. Kumar	TMH
3	Engineering Mechanics	Timoshenko	MGH
4	Mechanics of Solids	S.S. BHAVIKATTI	New Age
5	Theory of Machines	S.S. RATTAN	TMH

C-20-M-105

BOARD DIPLOMA EXAMINATIONS
D.M.E. – I YEAR EXAMINATION
MODEL QUESTION PAPER
ENGINEERING MECHANICS

Time : 3 Hours **Total Marks : 80**

PART – A **3 X 10=30**

Instructions: *Part A consists of **10** questions. Answer **all** questions and each question carries **three** marks.*

1. State the parallelogram law of forces and give the mathematical expression.
2. State laws of dynamic friction.
3. Define (a) centroid (b) centre of gravity
4. Find the moment of inertia of a rectangle of width 50 mm and depth 80 mm about its centroidal axes.
5. Define (a) centripetal force (b) centrifugal force.
6. State work-energy principle.
7. A car moving at 60 km/hr comes to rest position after moving 50m distance after applying the brakes. Find the acceleration of the car.
8. Define (a) mechanism (b) structure. Give examples for each.
9. Classify the kinematic pairs (a) based on relative motion (b) type of closure.
10. Find the velocity ratio of a third order pulley system having 4 pulleys.

PART - B

Instructions: Answer all the questions **5 X 8=40**

Each question carries EIGHT marks

11. (a) A machine weighing 1500 N is supported by two chains attached to a point on the machine. One of the chain is inclined at 30^o to the horizontal, and other chain is inclined at 45^o to the horizontal. Determine the tensions in the chains.

OR

(b) Two unequal forces inclined to one another at an angle of 120^0 have a resultant of 86.6 N, which makes an angle 30^0 with one of the forces. Find the magnitude of the two forces.

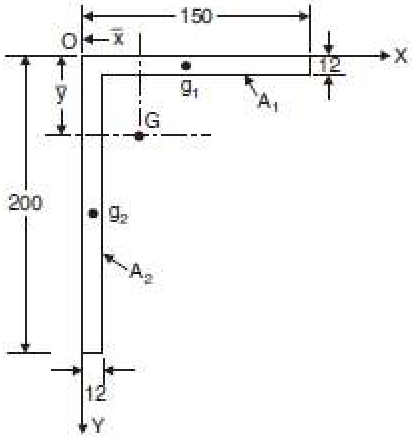
12.(a) A body of weight 1200 N is to be pulled up an inclined plane of angle 25°. The coefficient of friction between body and plane is 0·3. Draw the diagrams and find the effort required

(a) when it is parallel to the plane and (b) when it is parallel to the base.

OR

(b) A body resting on a rough horizontal plane required a pull of 18 N inclined at 30^o to the plane just to move it. It was found that a push of 22 N inclined 30^o to the plane just moved the body. Determine the weight of the body and coefficient of friction.

13. (a) Find the centroid of the unequal angle 200 × 150 × 12 mm, shown in the Figure.



OR

(b) Find the moment of inertia of a T – section having flange and web as 80 mm X 20 mm rectangles, about its centrodial axes.

14. (a) A body of mass 9 kg is moving along a smooth horizontal plane with a velocity of 15 m/s to the left when it is struck centrally by a bullet of mass 28 gram which passes right through it. The velocity of the bullet changes from 720 m/s to the right before impact to 120 m/s to the right after impact. Determine the velocity of the body just after impact.

OR

(b) Find the height of tower from the top of which an object falls freely and during the last seconds of its motion, the object travels a distance equal to 2/3 rd of the height of the tower. Take $g = 10 \text{ m/s}^2$.

15. (a) In a simple machine, whose velocity ratio is 30, a load of 2400 N is lifted by an effort of 150 N and a load of 3000 N is lifted by an effort of 180 N. Find the law of machine and calculate the load that could be lifted by a force of 200 N. Calculate also:

(i) The amount of effort wasted in overcoming the friction,

(ii) Efficiency of the machine.

OR

(b) Explain the working of Double Winch Crab with legible sketch and derive the expression for its velocity ratio.

PART - C

Instructions: Answer the following question which carries TEN marks. 1 X 10=10

16. Find the magnitude and direction of the single force that brings the following system of concurrent forces into equilibrium.

(a) 15 kN inclined at 30° towards North of East.

(b) 20 kN towards North.

(c) 25 kN towards North-West.

(d) 30 kN inclined at 40° towards South of West.

In which quadrant the direction of equilibrant lies. Justify your answer.

Table specifying the scope of syllabus to be covered for Unit Test-I , II & III.
M-105 :: ENGINEERING MECHANICS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.8
Unit Test – II	From 3.1 to 4.8
Unit Test – III	From 4.9 to 5.14

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO1, CO5
2	Statics	U	3	CO1
3	Statics	U	3	CO1
4	Friction	U	3	CO1
5	Friction	U	3	CO5
Part - B (24 marks)				
6	Statics	Ap	8	CO1
7	Friction	Ap	8	CO1
8	Friction	Ap	8	CO5

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO1, CO5
2	Centroid	U	3	CO1
3	Centroid	U	3	CO1
4	Kinematics	U	3	CO1
5	Kinematics	U	3	CO5
Part - B (24 marks)				
6	Centroid	Ap	8	CO1
7	Centroid	Ap	8	CO1
8	Kinematics	Ap	8	CO5

Unit Test - 3

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO2 – CO5
2	Kinetics	U	3	CO2
3	Kinetics	U	3	CO3
4	Simple Machines	U	3	CO4
5	Simple Machines	U	3	CO4
Part - B (24 marks)				
6	Kinetics	Ap	8	CO5
7	Simple Machines	Ap	8	CO2, CO3
8	Simple Machines	Ap	8	CO4

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-105

BOARD DIPLOMA EXAMINATION
D.M.E. – I YEAR EXAMINATION
UNIT TEST - 1
ENGINEERING MECHANICS

Time : 90 Minutes | Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4 Questions carry 3 marks each*

1. (a) State Varignon's Principle
   (b) Define Angle of Repose
   (c) State law of friction
   (d) State Parallelogram Law of Forces
2. Write the classification of forces
3. Write the conditions for equilibrium of a body subjected to coplanar non-concurrent forces
4. A body of mass 20 kg is resting on a horizontal plane. If the coefficient of friction between the plane and body is 0.25, find the magnitude of the force to be applied on the body.
5. A body of mass 30 kg is resting on a horizontal plane. A force of 25 N is pulling at an inclined angle of 30^o to the horizontal. Calculate the coefficient of friction between the plane and body.

PART – B

Instructions: *Part B consists of **3 Questions**. Each question carries 8 marks and may have sub questions.*

6. A machine weighing 1500 N is supported by two chains attached to a point on the machine. One of the chain is inclined at 30^o to the horizontal, and other chain is inclined at 45^o to the horizontal. Determine the tensions in the chains.

   OR

   Two unequal forces inclined to one another at an angle of 120^0 have a resultant of 86.6 N, which makes an angle 30^0 with one of the forces. Find the magnitude of the two forces.

7. A body of weight 1200 N is to be pulled up an inclined plane of angle 25°. The coefficient of friction between body and plane is 0·3. Draw the diagrams and find the effort required (a) when it is parallel to the plane and (b) when it is parallel to the base.

   OR

   A body resting on a rough horizontal plane required a pull of 18 N inclined at 30^o to the plane just to move it. It was found that a push of 22 N inclined 30^o to the plane just moved the body. Determine the weight of the body and coefficient of friction.

8. Find the magnitude and direction of the single force that brings the following system of concurrent forces into equilibrium.
   (a) 15 kN inclined at 30° towards North of East.
   (b) 20 kN towards North.
   (c) 25 kN towards North-West.
   (d) 30 kN inclined at 40° towards South of West.

   OR

A body resting on a rough horizontal plane required a push of 20 N inclined at 20^o to the plane just to move it. It was found that a pull of 15 N inclined 30^o to the plane just moved the body. Determine the weight of the body and coefficient of friction.

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BOARD DIPLOMA EXAMINATION,
D.M.E. – I YEAR EXAMINATION
UNIT TEST - 2
ENGINEERING MECHANICS

Time : 90 Minutes Total Marks: **40**

PART – A

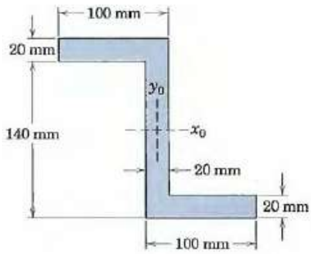
Instructions: *1st Question having 4 one mark questions, and remaining 4 Questions carry 3 marks each*

1. (a) State Parallel axes theorem
   (b) State work-energy principle
   (c) State Perpendicular axis theorem.
   (d) Write the equations of law of motions.
2. A body is freely falling from a height of 30 m. Find the velocity with which it strikes the ground.
3. A body starting from rest is moving with a velocity of 5 m/s and covered a distance of 20 m. Calculate acceleration of the body.
4. Find the centroid of a T-section having the dimensions of 80 x 60 x 10 mm.
5. Find the moment of inertia of a rectangle of width 50 mm and depth 80 mm about its centroidal axes.

PART – B

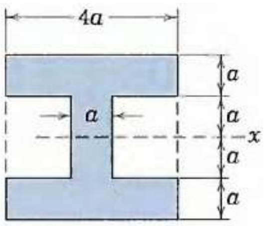
Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Determine the moment of inertia of the area shown in the fig. about its centroidal axis x_0.



(OR)

Determine the moment of inertia of the area shown in the fig. about its censorial axis x_0 and y_0.

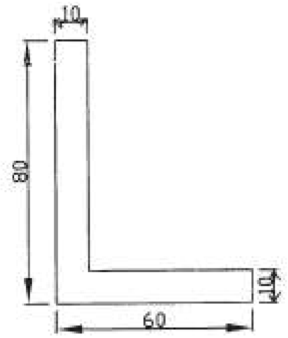


7. A stone is projected upwards with a velocity of 120 m/s. With what initial velocity should a second stone be projected upwards 2 seconds later so that it may overtake the first stone at its maximum height?

OR

Find the height of tower from the top of which an object falls freely and during the last seconds of its motion, the object travels a distance equal to 2/3 rd of the height of the tower. Take g = 10 m/s^2.

8. Find the moment of inertia of the following section about its centroidal axes :



OR

A body is moving with uniform acceleration. In the eleventh and fifteenth seconds from the commencement it moves through 7·2 m and 9·6 m respectively. Find the velocity and the acceleration with which it moves.

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BOARD DIPLOMA EXAMINATION,
UNIT TEST - 3
ENGINEERING MECHANICS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Write impulse momentum equation.
   (b) Differentiate centripetal force from centrifugal force
   (c) Define kinematic chain
   (d) Define Mechanical Advantage
2. A bullet of mass 50 gm posses a KE of 15000 joules. What is its velocity?.
3. A sphere of mass 1 kg is attached to the end of a thread of length 1.5 m. When the thread is rotated at a speed of 30 rpm, find the centrifugal force to which the sphere will be subjected.
4. Write the classification of kinematic pairs
5. Draw the wheel and axle machine.

PART – B

Instructions: *Part B consists of* ***3*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A bullet of mass 200 grams is fired horizontally with a velocity of 30 m/s from a gun of mass 100 kg. With what velocity, will the gun recoil? If the resistance to sliding of the gun is 20 N before it comes to rest, find the time taken to do so and the distance over which it moves.

OR

A body of mass 9 kg is moving along a smooth horizontal plane with a velocity of 15 m/s to the left when it is struck centrally by a bullet of mass 28 gram which passes right through it. The velocity of the bullet changes from 720 m/s to the right before impact to 120 m/s to the right after impact. Determine the velocity of the body just after impact.

7. The pitch of a screw jack is 8 mm. A load of 8 KN is to be raised by applying the effort at the end of a handle 600 mm long. Find out effort required if the efficiency is 45%.

OR

Explain the Pantograph with line diagram.

8. In a simple machine, whose velocity ratio is 30, a load of 2400 N is lifted by an effort of 150 N and a load of 3000 N is lifted by an effort of 180 N. Find the law of machine and calculate the load that could be lifted by a force of 200 N. Calculate also:
   (1) The amount of effort wasted in overcoming the friction,
   (2) Mechanical advantage, and
   (3) The efficiency.

(OR)

Explain the working of Double Purchase Winch Crab and derive the expression for its velocity

Course Title	Course Code	Periods per Week	Periods per Year
Workshop Technology	M-106	04	120

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Essay Type Question (10M)
1	Basic Workshop tools & operations					01
	(1) Carpentry	20	25	03	02	
	(2) Fitting	25				
	(3) Forging	15				
	(4) Sheet metal	12				
2	Drilling	10	14	02	01	
3	Foundry	22	17	03	01	
4	Mechanical working of metals	16	14	02	01	
	Total	**120**	**70+10**	**10**	**05**	**01**

Note: 10 Marks higher order question may be given from Chapter -1 or 2 or 3 or 4 .

Course Objectives and Course Outcomes

COURSE OBJECTIVES	Upon completion of the course the student shall be able to 1. Understand the use of basic workshop tools and its operations 2. Know the basic workshop operations such as carpentry, fitting, forging, sheet metal, drilling, Foundry and Mechanical working of metals		
COURSE OUTCOMES	CO1	M-106.1	Categorise basic workshop tools , i.e., marking and measuring tools, cutting tools etc., Explain different operations used in carpentry, fitting, forging and sheet metal.
	C02	M-106.2	Describe the process like marking, sawing, chiselling in wood working process and fitting, upsetting drawing down and punching in forging, shearing, bending, drawing, squeezing in sheet metal
	C03	M-106.3	Describe the functions of sensitive and radial drilling machines and operations on drilling machine
	C04	M-106.4	Describe the sequence of pattern making operations. Describe casting and special casting processes
	C05	M-106.5	Describe the hot working and cold working processes

PO-CO Mapping

Course Code: M-106	**Course Title: Workshop Technology** **No of COs:5**				**No. Of periods:120**
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1,CO5,	56	46.7	3	**>40% Level 3 (Highly Addressed)** **25% to 40% Level 2 (Moderately Addressed)** **5% to 25% Level 1 (Low Addressed)** **<5% Not Addressed**
PO2	CO2,	37	30.8	2	
PO3					
PO4	CO3,CO3	21	17.5	1	
PO5					
PO6					
PO7	CO6	6	5	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3							1		
CO2		2						1		
CO3				1				1		
CO4				1				1		
CO5	3							1		
CO6	3						1	1		

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of question Paper

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from Chapter -1 or 2 or 3 or 4 (Here it is taken from the chapter - 1.

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Basic Workshop tools & operations		35	06	03	16	10	2	1	2	1	CO1, CO3, CO5
	(1) Carpentry	20										
	(2) Fitting	25										
	(3) Forging	15										
	(4) Sheet metal	12										
2	Drilling	10	14	03	03	08		01	01	01		CO1, CO3
3	Foundry	22	17	06	03	08		02	01	01		CO3
4	Mechanical working of metals	16	**14**	03	03	08		01	01	01		CO1, CO2, CO5
TOTAL		**120**	**80**	**18**	**12**	**40**	**10**	**06**	**04**	**05**	**01**	

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Basic workshop tools and its operation

a. State the importance of workshop processes.
b. List the various workshop processes and explain briefly about each.

1.1 **Carpentry**

1.1.1. Identify various carpentry tools.
1.1.2. Distinguish between marking tools, measuring tools and cutting tools.
1.1.3. List work holding devices.
1.1.4. Explain wood working processes viz., sawing, chiselling and planning.
1.1.5. Explain the use of carpentry joints such as lap joint, dovetail joint, mortise and tenon joint with legible sketch
1.1.6. Explain the working of wood working machines.

1.2 **Fitting**

1.2.1. List various fitting tools.
1.2.2. Distinguish between marking and measuring tools.
1.2.3. List cutting tools.
1.2.4. List various work holding devices.
1.2.5. List various checking and measuring instruments.
1.2.6. Explain fitting operations such as marking, sawing, chipping, filing, grinding, drilling and tapping with legible sketch.

1.3 **Forging**

1.3.1. List various tools used in black-smithy.
1.3.2. List equipment used in a forging shop.
1.3.3. Explain the important smithy operations
1.3.4. Explain the working principle of machine forging
1.3.5. Explain machine forging operations such as upsetting, drawing down and punching with legible sketch
1.3.6. Explain the working principle of forging press with legible sketch.
1.3.7. List the forging defects

1.4 **Sheet Metal**

1.4.1. List various marking tools in sheet metal work
1.4.2. List various stakes
1.4.3. List various measuring tools used in sheet metal work
1.4.4. List various sheet metal joints.
1.4.5. Describe sheet metal operations such as shearing, bending drawing and squeezing
1.4.6. Differentiate between riveting, soldering & brazing

2.0 Drilling

2.1. State the working principle of drilling
2.2. List two types of drilling machines
2.3. Describe the Sensitive drilling machine with line diagram
2.4. Describe the radial drilling machine with line digram
2.5. Mention the specifications of drilling machine
2.6. Explain the nomenclature of the drill bit
2.7. Sketch the geometry of twist drill
2.8. List the functions of twist drill elements
2.9. List different operations on drilling machine

3.0 Foundry

3.1. State
   (a) Any six advantages of casting over other processes
   (b) the six limitations of casting processes
3.2. List hand moulding tools
3.3 Mention the various properties of good moulding sand and types of moulding sands
3.4 List
   (a) ingredients in foundry sand
   (b) any six types of patterns
3.5 Explain the procedure of pattern making
3.6. Identify colour codes
3.7. List the different moulding processes
3.8. State the need of core and list different types of cores
3.9. Describe the casting process with legible sketch and . Identify various a casting defects
3.10 Explain
   (a) principle and application of die casting
   (b) principle and application of hot chamber and cold chamber
   (c) principle and application of centrifugal casting
   (d) principle and application of CO_2 process
   (e) principle and application of investment casting

4.0 Mechanical working of metals

4.1. Define Mechanical working of metals
4.2. Distinguish between Cold working and Hot working
4.3. Explain working principle of hot rolling
4.4. Explain working principle of Piercing
4.5. Explain working principle of Spinning
4.6. Explain working principle of hot rolling
4.7. Explain working principle of Extrusion
4.8. Explain working principle of Drawing
4.9. Mention the advantages and disadvantages of Cold working

COURSE CONTENT

1 **Introduction**

Methods of manufacturing processes - casting, forming, metal removal processes, joining processes, surface finishing processes, basic workshop processes - carpentry, fitting, hand forging, machine forging, sheet metal work, cold and hot working of metals.

1.1 **Carpentry**

1.1.1 **Marking & measuring tools**: scales, rules, fourfold wooden rule, flexible measuring rule (tape), straight edge, try square, bevel square, combination square, marking knife, marking gauge, mortise gauge, cutting gauge, wing compass, trammel, divider, outside calliper, inside calliper, odd leg calliper, spirit level, plum bob, specifications- uses.

1.1.2 **Cutting Tools**

Saws: ripsaw, cross cut saw (hand saw), panel saw, tenon or back saw, dovetail saw, bow saw, coping saw, compass saw, pad or keyhole saw, specifications & uses.

Chisels: Firmer chisel, bevelled edge firmer chisel, parting chisel, mortise chisel, inside and outside gauges, specifications and uses.

Planes: Jack plane (wooden jack plane, metal jack plane), rough plane, smoothing plane, rebate plane, plough plane, router, spoke shave, special planes and their specifications and uses.

Boring Tools:

Gimlet, braces- wheel brace, ratchet brace, bit-shell bit, twist bit (auger bit), expansive bit, centre bit, router bit, countersink bit, drill, reamer their specifications & uses.

1.1.2 **Striking tools:**

Hammers - Warrington hammer, claw hammer, mallet, Specifications & uses.

1.1.3 **Holding devices**

Bench vice, bench stop, bench hold fast, sash cramp (bar cramp) G- cramp, Hand screw, specifications & uses.

1.1.4 **Miscellaneous tools**

Rasps and files, scraper, oilstone, glass paper, pincer, screw driver, cabinet screw driver, ratchet-screw driver, saw set, oil stone slip- specifications and uses.

1.1.5 **Carpentry Processes**

Marking, measuring, sawing, chiselling, planning, boring, grooving, Rebating & moulding.

1.1.6 **Carpentry joints**

Halving Joint, mortise and tenon joint, bridle joint, butt joint. dowel joint, tongue & groove joint, screw & slot joint, dovetail joint, corner joint.

1.1.7 **Wood working machines**

Wood working lathe (wood turning lathe), circular saw, band saw, wood planer, sanding machine, belt sander, spindle sander, disc sander and grinder, specifications and uses.

1.2 **Fitting**

1.2.1 **Cutting tools**

Chisels: Flat chisel, cross cut chisel, half round chisel, diamond point chisel, side chisel, specifications and uses.

Files: Different parts of a file – sizes and shapes - flat file, hand file, square file ,piller file ,round file, triangular file, half round files, knife edge file, needle file – specifications and uses.

Scrapers: Flat, triangular, half round scrapers, specifications & uses.

Saws: Hand hacksaw - solid frame, adjustable frame, specifications & uses, hand hacksaw blades. Power hack saw – description(horizontal reciprocating type), power hacksaw blade, specifications and uses, teeth set - saw material.

Drill bits: Flat drill, straight fluted drill, twist drill, parallel shank, tapered shank, specifications & uses.

Reamer: Hand reamer, machine reamer, straight and spiral flutes reamers, specifications and uses.

Taps: Hand taps - taper tap, plug tap and bottoming tap, specifications and uses.

Dies & Sockets: Dies- solid, adjustable - specifications and uses.

1.2.2 **Striking Tools**

Hammers: Parts, ball peen, cross peen, straight peen hammers, soft hammer, sizes, specifications and uses.

1.2.3 **Holding Devices**

Vices: Bench vice, leg-vice, hand vice, pin vice, tool maker's vice, pipe vice, care of vices, specifications and uses.

1.2.4 **Marking Tools**

Surface plate, V-block, angle plate, try square, scriber, punch, prick punch, centre punch, number punch, letter punch, specifications and uses.

1.2.5 **Miscellaneous Tools**

Screw drivers, spanners, single ended & double ended, box type, adjustable spanners, cutting pliers, nose pliers, allen keys, specifications and uses.

1.2.6 **Checking and measuring instruments**

Checking instruments:

Callipers:Outside&Inside callipers, hermaphrodite (odd leg) calliper with firm joint, spring callipers, transfer calliper sizes & uses, dividers - sizes & uses**.**

Measuring instruments:

Combination square, bevel protractor, universal bevel protractor, sine bar, universal surface gauge, engineer's parallels, slip gauges, plane gauge, feeler gauge, angle gauge, radius & template gauge, screw pitch gauge, telescopic gauges, plate & wire gauge, ring and plug gauges, snap gauges specifications & uses, vernier callipers, vernier height gauge, vernier depth gauge, micrometer - outside & inside, stick micrometer, depth micrometer, verniermicrometer, screw thread micrometer specifications and uses.

1.2.7 **Fitting Operations**

Marking, sawing, chipping, filing, scrapping, grinding, drilling, reaming, tapping and dieing.

1.3 **Forging**

1.3.1 **Hand forging tools:** Anvil, swage block, hand hammers - types; sledge hammer, specifications and uses, tongs - types, specifications & uses, chisel - hot & cold chisels specifications & uses. swages - types and sizes, fullers, flatters, set hammer, punch and drift - sizes and uses.

1.3.2 **Equipment:** Open and closed hearth heating furnaces, hand and power driven blowers, open and stock fire, fuels-charcoal, coal, oil gaseous fuels.

1.3.3 **Smith Operations:** Upsetting, drawing down, setting down, punching, drifting, bending, welding, cutting, swaging, fullering and flattering.

1.3.4 **Machine Forging:** Need of machine forging, forging hammers - spring hammer, pneumatic hammer, drop hammer, forging press, hydraulic press - line diagram, machine forging operations - drawing, upsetting, punching, tools used in machine forging.

1.3.5 **Forging defects:** Types and remedies.

1.4 **Sheet Metal Work**

1.4.1 Metals used for sheet metal work.

1.4.2 **Sheet metal hand tools**:

Measuring tools - steel rule, circumference rule, thickness gauge, sheet metal gauge, straight edge, scriber, divider, trammel points, punches, chisels, hammers, snips or shears, straight snip, double cutting shear, squaring shear, circular shear, bench & block shears.

Stakes: Double seaming stake, beak horn stake, bevel edged square stake, Hatchet stake, needle stake, blow horn stake, hollow mandrel stake, pliers (flat nose and round nose), grocers and rivet sets, soldering iron, specifications & uses.

1.4.3 **Sheet Metal Operations**

Shearing: Cutting off, parting, blanking, punching, piercing, notching, slitting, lancing, nibbling and trimming.

Bending: Single bend, double bend, straight flange, edge hem, embossing, beading, double hem or lock seam.

Drawing: Deep drawing, shallow or box drawing.

Squeezing: Sizing, coining, hobbling, ironing, riveting.

1.4.4 **Sheet Metal Joints**

Hem Joint: single hem, double hem & wired edge, seam joint -lap seam, grooved seam, single seam, double seam, dovetail seam, burred bottom seam or flanged seam.

1.4.5 **Fastening Methods**

Riveting, soldering, brazing & spot welding.

2 **Drilling**

2.1 **Type of drilling machines:** sensitive & radial drilling machines, their constructional details and specifications.

2.2 **Drill bits**: Terminology - geometry of twist drill - functions of drill elements.

2.3 **Operations:** Drilling, reaming, boring, counter boring, counter sinking, tapping, spot facing and trepanning.

3 **Foundry.**

3.1 **Introduction:** Development of foundry as a manufacturing process, advantages and limitations of casting over other manufacturing processes.

3.2 **Foundry equipment:**

Hand moulding tools: shovel, riddle, rammers, trowels, slicks, lifter, strike - off bar, sprue pin bellow, swab, gate cutter, mallet, vent rod, draw spike, rapping plate or lifting plate, pouring weight, gagger, clamps, spirit level, moulding boxes, snap box & flash box.

3.3 **Sands:** Properties of moulding sand - porosity, flowability, collapsibility, adhesiveness, cohesiveness and refractoriness.

3.4 **Types of moulding sand** : green sand, dry sand, loam sand, facing sand, backing sand, parting sand, core sand, system sand their ingredients and uses.

3.5 **Pattern making:** Materials such as wood, cast Iron, aluminium, brass, plastics their uses and relative advantages, classification of patterns such as solid (one piece), two piece and three pieces, split patterns, gate patterns and shell patterns, sequence in pattern making, pattern allowances and colour codes.

3.6 **Cores:** Need of cores, types of cores.

3.7 Casting: green sand and dry sand moulding, cement bonded moulding, shell moulding, ceramic moulding, defects in castings and their remedies.

3.8 Special casting processes: (Principles and applications only) die casting – hot chamber and cold chamber, centrifugal casting, CO_2 process, investment casting

4 **Mechanical working of metals**

4.1 **Introduction:** Hot working and cold working

4.2 **Hot working processes:** rolling - types of rolling, two high mill, three high mills, four high mills, piercing or seamless tubing, drawing or cupping, spinning, extrusion - direct or forward extrusion, indirect or backward extrusion, tube extrusion, Impact extrusion.

4.3 Effects of hot working of metals**,** advantages & limitations of hot working of metals.

4.4 **Cold working process:**

Rolling, drawing - wire drawing, tube drawing, bending, roll forming, angle bending, spinning, extrusion, squeezing, cold heading, thread rolling, peening.

4.5 Effects of cold working of metals, advantages & limitations of cold working.

REFERENCE BOOKS

1.	Production Technology	by	Jain & Gupta (Khanna Publishers)
2.	Elementary Workshop Technology	by	HazraChowdary& Bhattacharya (Media Promoters)
3.	Manufacturing Technology (VolI)	by	P N Rao (McGraw Hill)
4.	Workshop Technology Vol I & II	by	Raghuvamshi

BOARD DIPLOMA EXAMINATION,
D.M.E. – I YEAR EXAMINATION
MODEL PAPER
WORKSHOP TECHNOLOGY

Time : 3 Hours Total Marks: **80**

PART – A

Answer all questions 10 X3=30

1. List out different holding tools used in carpentry
2. List out various hand hammers used in fitting section. How do you specify them?
3. Write the difference between flattering and fullering
4. Classify various drilling machines
5. Describe most widely used drills for making holes
6. Name any six types of patterns
7. List out various types of hand-moulding tools
8. What is core? What is the purpose of core
9. What is hot working? Give three examples of hot working processes
10. Distinguish between blanking and punching?

Part B

Answer all questions 5 X 8=40 marks

11. A) Describe various types of saws used in carpentry work

(OR)

B) Explain different types of fitting operations

12. A) Explain the working of spring power hammer

(OR)

B) Explain any five sheet metal bending operations with the neat sketches

13. A) Describe Radial drilling machine with a neat sketch

(OR)

B) Describe various operations that can be performed on drilling machine

14. A) Describe the sand moulding process using a solid pattern

(OR)

B) What are the common defects of casting? State their causes and remedies

15. A) Explain in detail various types of hot extrusion methods

(OR)

B) (i) Write the differences between hot working and cold working
(ii) Explain the process of tube drawing in hot working with a neat sketch

Part C

Answer the following ONE question **1 X 10=10**

16. List out various operations to be done on wood to obtain desired shape and size and suggest the name of main tool used for the respective operation

Table specifying the scope of syllabus to be covered for Unit Test-I , II & III.
M-106 :: Workshop Technology

Unit Test	Learning Outcomes to be covered
Unit Test – I	CO1 Carpentry, Fitting
Unit Test – II	CO2,CO3 Forging, Sheet metal, Drilling
Unit Test – III	CO4,CO5,CO6Foundry, Mechanical working of metals

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Carpentry, Fitting	R,U	4	CO1
2	Carpentry	U	3	CO1
3	Carpentry	U	3	CO1
4	Fitting	U	3	CO1
5	Fitting	U	3	CO1
Part - B (24 marks)				
6	Carpentry	Ap	8	CO1
7	Fitting	Ap	8	CO1
8	Carpentry/ Fitting	Ap	8	CO1

Unit Test - 2

Q.No	Question from the topic	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Forging, Sheet metal, Drilling	R,U	4	CO2, CO3
2	Forging	U	3	CO2
3	Forging	U	3	CO2
4	Sheet metal	U	3	CO2
5	Drilling	U	3	CO3
Part - B (24 marks)				
6	Forging	Ap	8	CO2
7	Sheet metal	Ap	8	CO2
8	Drilling	Ap	8	CO3

Unit Test - 3

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Foundry, Mechanical working of metals	R,U	4	CO4, CO5
2	Foundry	U	3	CO4
3	Foundry	U	3	CO4
4	Mechanical working of metals	U	3	CO5
5	Mechanical working of metals	U	3	CO5
Part - B (24 marks)				
6	Foundry	Ap	8	CO4
7	Foundry	Ap	8	CO4
8	Mechanical working of metals	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

BOARD DIPLOMA EXAMINATION
D.M.E. – I YEAR EXAMINATION
Unit Test - 1
M-106 Workshop Technology

Time : 90 Minutes Total Marks: 40

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1.(a) Sine bar is used for (Angular measurement/linear measurement)

(b) Bench vice is a measuring device (True/False)

(c) List any two boring tools used in the carpentry shop

(d) Try square is used for marking/testing of -------------angles

2. List out any three marking tools. Write specific applications of any one

3. Draw a neat sketch of hand saw and name its parts

4. List out different types of files used in fitting section

5. List out various holding tools used in fitting section

PART – B

Instructions: Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.

6.(a). Describe any 2 carpentry joints with neat sketches

(OR)

(b) Classify wood working machines. Describe wood planer with the help of a neat sketch

7.(a) Sketch and describe an angle plate, surface plate and V-block

(OR)

(b)Explain the working principal of combination set with a neat sketch

8(a) List various fitting operations. Explain any two fitting operations

(OR)

(b) What are the different types of planes used in wood working? Describe any two planes with their respective sketches

BOARD DIPLOMA EXAMINATION

D.M.E. – I YEAR EXAMINATION

Unit Test - 2

M-106 Workshop Technology

Time : 90 Minutes Total Marks: 40

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1.(a) The shape of the Hardie hole is (Round/Suare)

(b) Drifting is the process of ------------------------the punched hole

(c)Write difference between hem and seam in sheet metal

(dTapping is the operation of cutting external threads (True/False)

2. Sketch the anvil used in Black smithy and name the parts

3. List 6 types of tongs used in forging shop

4. Draw a neat sketch of snip and label the parts

5. Draw a neat sketch of a twist drill and name the parts

PART – B

Instructions: Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.

6.(a) Name the different type of power hammers. Explain the working of spring power hammer.

(OR)

(b)Name the various heating equipment used in forging process. Explain black smith's forge

7.(a)Explain various sheet metal operations

(OR)

(b) Draw and explain five types of seams

8.(a) Describe Radial drilling machine with a neat sketch

(OR)

(b) Describe various operations that can be performed on drilling machine

BOARD DIPLOMA EXAMINATION

D.M.E. – I YEAR EXAMINATION

Unit Test - 3

M-106 Workshop Technology

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1.(a) In Green sand ,green refers to (colour/moisture content)

(b) List any two types of defects in casting

(c) Hot working operation is carried out -------------recrystallization temperature

(d)Hot piercing is used to produce seam less tubes (True/False)

2. What is core? What is the purpose of core

3. List out various types of hand-moulding tools

4. List out the hot-working processes

5. Define cold working. List out any two cold working process?

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6.(aExplain Die casting. Write the advantages and disadvantages and its applications.

(OR)

(b) Explain Centrifugal casting. Write the advantages and disadvantages and its applications.

7.(a)Describe the sand moulding process using a solid pattern

(OR)

(bExplain the properties of moulding sand

8(a)Explain in detail various types of hot extrusion methods

(OR)

(b)Write the differences between hot working and cold working

ENGINEERING DRAWING

Course Code	Course Title	No. of Periods per Week	Total No. of Periods	Marks for Formative Assessment	Marks for Summative Assessment
M-107	ENGINEERING DRAWING	06	180	40	60

TIME SCHEDULE

S.No	Chapter/Unit Title	No. of Drawing plates	Periods	Weightage of Marks	Short Answer Questions (5 M)	Essay Type Questions (10 M)
1	Importance of Engineering Drawing	--	01	-	-	-
2	Engineering Drawing Instruments	01	05	-	-	-
3	Free hand lettering & Numbering	01	06	05	1	-
4	Dimensioning Practice	01	09	05	1	-
5	Geometrical constructions	03	24	15	1	1
6	Projections of Points, Lines, Planes & Auxiliary Planes	03	21	05	1	
7	Projections of Solids	01	12	10		1
8	Sections of Solids	01	21	10	-	1
9	Orthographic Projections	01	30	10	-	1
10	Isometric Views	01	30	10	-	1
11	Development of surfaces	01	21	10	-	1
Total		**14**	**180**	**80**	**04**	**06**

Course Objectives and Course Outcomes

Course Objectives	Upon completion of the course the student shall able to understand the basic graphic skills and use them in preparation of engineering drawings, their reading and interpretation		
Course Outcomes	CO1	M-107.1	Describe the use of engineering drawing instruments
	CO2	M-107.2	Practice the conventions to be followed in engineering drawing as per BIS
	CO3	M-107.3	Draw i) basic geometrical constructions ii) engineering curves
	CO4	M-107.4	Draw the orthographic projections of i) Points ii) Lines iii) Regular Planes iv) Regular Solids V) Sections of Regular Solids
	CO5	M-107.5	Practice isometric views of machine components
	CO6	M-107.6	Draw the developments of surfaces of regular solids and use them to make the components used in daily life

PO-CO Mapping

Course Code : M-107	Course Title: ENGINEERING DRAWING Number of Course Outcomes: 06				No. of Periods: 180
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO2, CO3, CO4, CO5, CO6	50	42	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1, CO2, CO3, CO4, CO5, CO6	30	25	2	
PO3	CO1, CO2, CO3, CO4, CO5, CO6	30	25	2	
PO4					
PO5					
PO6					
PO7	CO1, CO2, CO3, CO4, CO5, CO6	10	08	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2				1	2	3	1
CO2	3	2	2				1	2	3	1
CO3	3	2	2				1	2	3	1
CO4	3	2	2				1	2	3	1
CO5	3	2	2				1	2	3	1
CO6	3	2	2				1	2	3	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

LEARNING OUTCOMES

Upon completion of the course the student shall able to

1.0 Understand the basic concepts of Engineering Drawing

1.1 State the importance of drawing as an engineering communication medium
1.2 State the necessity of B.I.S. Code of practice for Engineering Drawing.
1.3 Explain the linkages between Engineering drawing and other subjects of Mechanical Engineering

2.0 Use of Engineering Drawing Instruments

2.1 Select the correct instruments to draw the different lines / curves
2.2 Use correct grade of pencil to draw different types of lines and for different purposes
2.3 Select and use appropriate scales for a given application.
2.4 Identify different drawing sheet sizes as per I.S. and Standard Lay- outs.
2.5 Prepare Title block as per B.I.S. Specifications.
2.6 Identify the steps to be taken to keep the drawing clean and tidy.

Drawing Plate 1 : Use of Engineering Drawing Instruments

3.0 Write Free Hand Lettering and Numbers

3.1 Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
3.2 Write titles using sloping lettering and numerals of 7mm, 10mm and 14mm height
3.3 Select suitable sizes of lettering for different layouts and applications

Drawing plate 2: Exercises on Free hand lettering and numbering

4.0 Understand Dimensioning Practice

4.2 Acquaint with the conventions, notations, rules and methods of dimensioning in engineering drawing as per the B.I.S.
4.5 Dimension a given drawing using standard notations and desired system of dimensioning.

Drawing Plate 3: Exercises on Dimensioning Practice

5.0 Apply Principles of Geometric Constructions

5.1 Practice the basic geometric constructions like i) dividing a line into equal parts ii) exterior and interior tangents to the given two circles iii) tangent arcs to two given lines and arcs

5.2 Draw any regular polygon using general method when i) side length is given ii) inscribing circle radius is given iii) describing circle radius is given

5.2 Draw the conics using general and special methods,

5.3 Draw the engineering curves like i) involute ii) cycloid iii) helix

Drawing Plate -4: Having problems up to construction of polygon

Drawing Plate -5: Having problems of construction of conics

Drawing Plate -6: Having problems of construction of involute, cycloid and helix

6.0 Projections of points, lines, planes & auxiliary planes

6.1 Explain the basic principles of the orthographic projections

6.2 Visualise and draw the projection of a point with respect to reference planes (HP&VP)

6.3 Visualise and draw the projections of straight lines with respect to two references Planes (up to lines parallel to one plane and inclined to other plane)

6.4 Visualise and draw the projections of planes (up to planes perpendicular to one plane and inclined to other plane)

6.5 Draw the auxiliary views of a given engineering component

Drawing Plate -7: problems on projection of points and Lines

Drawing Plate -8: problems on projection of planes

Drawing Plate -9: problems on auxiliary planes

7.0 Draw the Projections of Solids

7.1 Visualise and draw the projections of regular solids like Prisms, Pyramids, Cylinder, Cone (up to axis of solids parallel to one plane and inclined to other plane)

Drawing plate No.10: Problems on projection of solids

8.0 Appreciate the need of Sectional Views

8.1 Identify the need to draw sectional views.

8.4 Differentiate between true shape and apparent shape of section

8.5 Draw sectional views and true sections of regular solids by applying the principles of hatching.

Drawing Plate–11: Problems on section of solids

9.0 Apply principles of orthographic projection

9.1 Draw the orthographic views of an object from its pictorial drawing.

9.2 Draw the minimum number of views needed to represent a given object fully.

Drawing Plate 12 : Problems on **orthographic projections**

10.0 Prepare pictorial drawings

10.1 identify the need of pictorial drawings.

10.2 Differentiate between isometric scale and true scale.

10.3 Prepare Isometric views from the given orthographic drawings.

Drawing plate 13: Exercise on Isometric drawings only.

11.0 Interpret Development of surfaces of different solids.

11.1 State the need for preparing development drawing.

11.2 Draw the development of simple engineering objects and their truncations (cubes, prisms, cylinders, cones, pyramid)

11.3 Prepare development of surface of engineering components like i) funnel ii) 90^0 elbow iii) Tray

Drawing plate No. 14: Problems on Development of surfaces

Competencies and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Importance of Engineering Drawing	• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
2.	Engineering Drawing Instruments	• Select the correct instruments to draw various entities in different orientation
3.	Free hand lettering & Numbering	• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
4.	Dimensioning Practice	• Dimension a given drawing using standard notations and desired system of dimensioning
5.	Geometrical construction	• Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.
6.	Projection of points, Lines, Planes & Solids	• Draw the projections of points, straight lines, planes & solids with respect to reference planes (HP& VP)
7.	Auxiliary views	• Draw the auxiliary views of a given Engineering component • Differentiate between Auxiliary view and apparent view
8.	Sections of Solids	• Differentiate between true shape and apparent shape of section • Apply principles of hatching. • Draw simple sections of regular solids
9.	Orthographic Projection	• Draw the minimum number of views needed to represent a given object fully.
10.	Isometric Views	• Differentiate between isometric scale and true scale. • Draw the isometric views of given objects,.
11.	Development of surfaces	• Prepare development of Surface of regular solids and other components like i) funnel ii) 90^0 elbow iii) Tray

COURSE CONTENTS:

NOTES:

1. **B.I.S Specification should invariably be followed in all the topics.**
2. **A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.**

1.0 The importance of Engineering Drawing

Explanation of the scope and objectives of the subject of Engineering Drawing Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 – Mention B.I.S - Role of drawing in -engineering education – Link between Engineering drawing and other subjects of study.

2.0 Engineering drawing Instruments

Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils - Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet,

3.0 Free hand lettering & numbering

Importance of lettering – Types of lettering -Guide Lines for Lettering
Practicing of letters & numbers of given sizes (7mm, 10mm and 14mm)
Advantages of single stroke or simple style of lettering - Use of lettering stencils

4.0 Dimensioning practice

Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape
description of an Engineering object -Definition of Dimensioning size description -Location of features, surface finish, fully dimensioned Drawing -Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system (SP-46-1988)-Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods-The rules for dimensioning standard, features “Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

5.0 Geometric Construction

Division of a line: to divide a straight line into given number of equal parts
Construction of tangent lines: to draw interior and exterior tangents to two circles of given radii and centre distance
Construction of tangent arcs:
i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles).
ii)Tangent arc of given radius touching a circle or an arc and a given line.
iii)Tangent arcs of radius R, touching two given circles internally and externally.
Construction of polygon: construction of any regular polygon by general method for given side length, inscribing circle radius and describing/superscribing circle radius
Conics: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci of a moving point, Eccentricity of above curves – Their Engg. Applications viz., Projectiles, reflectors, Cooling Towers, P-V Diagram of a Hyperbolic process - Construction of any conic section of given eccentricity by general method - Construction of ellipse by concentric circles method, Oblong Method and Arcs of circles method - Construction of parabola by rectangle method and Tangent method - Construction of rectangular hyperbola

General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering application, viz., Gear tooth profile, screw threads, springs etc. – their construction

6.0 Projection of points, lines and planes & auxiliary views

Classification of projections, Observer, Object, Projectors, Projection, Reference Planes, Reference Line, Various angles of projections –Differences between first angle and third angle projections

Projections of points in different quadrants

Projections of straight line -

(a) Parallel to both the planes.

(b) Perpendicular to one of the planes.

(c) Inclined to one plane and parallel to other planes

Projections of regular planes

(a) Plane parallel to one of the reference planes

(b) Plane perpendicular to HP and inclined to VP and vice versa.

Auxiliary views

Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliary views explanation of reference plane and auxiliary plane - Partial auxiliary view.

7.0 Projections of regular solids

(a) Axis perpendicular to one of the planes

(b) Axis parallel to VP and inclined to HP and vice versa.

8.0 Sections of Solids

Need for drawing sectional views – what is a sectional view - Hatching – Section of regular solids inclined to one plane and parallel to other plane

9.0 Orthographic Projections

Meaning of orthographic projection - Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object - Concept of front view, top view, and side view sketching these views for a number of engg objects - Explanation of first angle projection. – Positioning of three views in First angle projection - Projection of points as a means of locating the corners of the surfaces of an object – Use of miter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.

10.0 Pictorial Drawings

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Isometric axes, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and true scale - difference between Isometric view and Isometric projection - Isometric and non-Isometric lines -Isometric drawing of common features like rectangles, circular - shapes, non-isometric lines – Drawing the isometric views for the given orthographic projections -Use of box / offset method

11.0 Development of Surfaces

Need for preparing development of surface with reference to sheet metal work-Concept of true length of a line with reference to its orthographic projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal and parallel to the other - Development of simple solids like cubes, prisms, cylinders, cones, pyramid and truncation of these solids-Types of development: Parallel line and radial line development -Procedure of drawing development of funnels, 90^0 elbow pipes, Tray.

REFERENCE BOOKS

Engineering Graphics by P I Varghese – (McGraw-hill)
Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
Engineering Drawing by N.D.Bhatt.
T.S.M. & S.S.M on “ Technical Drawing” prepared by T.T.T.I., Madras.
SP-46-1998 – Bureau of Indian Standards.

C-20-M-107

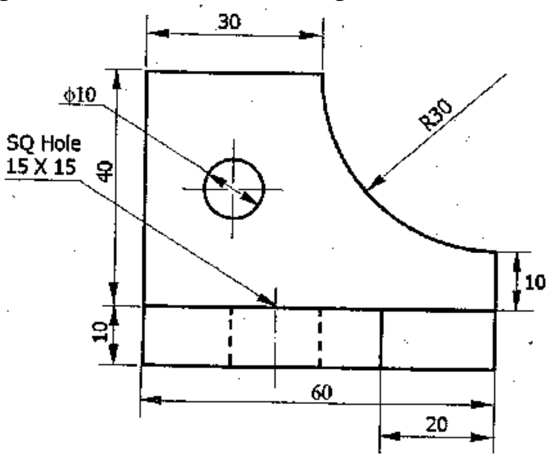
BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER
D.M.E. – I YEAR EXAMINATION
ENGINEERING DRAWING

Instructions: **01.** **All the dimensions are in mm**
02. **Use first angle projections only**
03. **Due Weightage will be given for the dimensioning and neatness**

PART – A **04 x 05=20**

01. **Answer all the questions**
02. **Each question carries FIVE marks**

01. Write the following in single stroke capital vertical lettering of size 10mm
ORTHOGRAPHIC PROJECTIONS
02. Redraw the given fig. and dimension it according to SP-46:1988.Assume suitable scale



03. Draw internal common tangents to two unequal circles of radii 26mm and 20mm.The distance between the circles is 75mm.
04. Draw the projections of a regular pentagon of side length 40 mm inclined to the H.P. by 30^0 and perpendicular to V.P. using auxiliary plane method

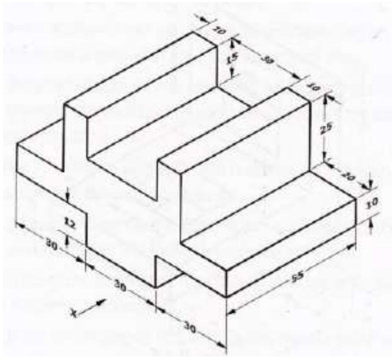
PART – B **04 X 10 = 40**

01. **Answer any FOUR of the following questions**
02. **Each question carries TEN marks**

05. Draw the involute of a circle of diameter 30 mm and also draw a tangent to the curve at a distance of 60 mm from the centre of the circle.
06. A right circular cone of height 80 mm and base radius 60 mm is resting in the H.P. on one of its generators and its axis is parallel to V.P. Draw the projections of the solid.
07. A regular hexagonal prism of height 80 mm and base side 40 mm is resting in the H.P. on its base. It is cut by an auxiliary inclined plane of 60^0 inclination passing through the axis at a distance of 30 mm from the top base. Draw the sectional views of the solid and the true section.

08. A pentagonal pyramid of height 80 mm and base side 40 mm is resting in the H.P. on its base such that one of the sides of the base is perpendicular to the V.P. It is cut by a section plane perpendicular to the V.P. and inclined to the H.P. by 60^0 and passing through the axis at a distance of 25 mm from the base. Draw the development of the lateral surface of the truncated pyramid.

09. Draw the front view, top view and left side view of the object shown in the fig.



10. Draw the isometric view of the component whose orthographic projections are given below

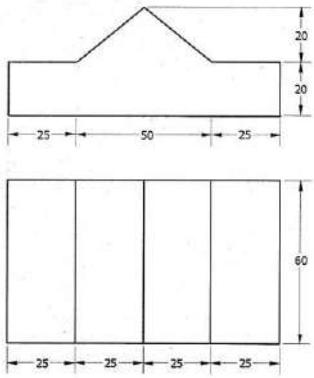


Table specifying the scope of syllabus to be covered for Unit Test-I , II & III.

M-107 :: ENGINEERING DRAWING

Unit Test - 1

Q.No	Question from the topic	Marks allocated
Part A (20 marks)		
1	Free hand lettering & Numbering	5
2	Dimensioning Practice	5
3	Geometrical constructions	5
4	Geometrical constructions	5
Part - B (20 marks)		
5	Geometrical constructions	10
6	Projections of Points, Lines, Planes & Auxiliary Planes	10

Unit Test - 2

Q.No	Question from the topic	Marks allocated
Part A (20 marks)		
1	Free hand lettering & Numbering	5
2	Dimensioning Practice	5
3	Geometrical constructions	5
4	Geometrical constructions	5
Part - B (20 marks)		
5	Orthographic Projections	10
6	Projections of Solids Sections of Solids	10

Unit Test – 3

Q.No	Question from the topic	Marks allocated
Part A (20 marks)		
1	Free hand lettering & Numbering	5
2	Dimensioning Practice	5
3	Geometrical constructions	5
4	Geometrical constructions	5
Part - B (20 marks)		
5	Isometric Views	10
6	Development of surfaces	10

C-20-M-107

BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER – UNIT TEST - 1
D.M.E. – I YEAR EXAMINATION
ENGINEERING DRAWING

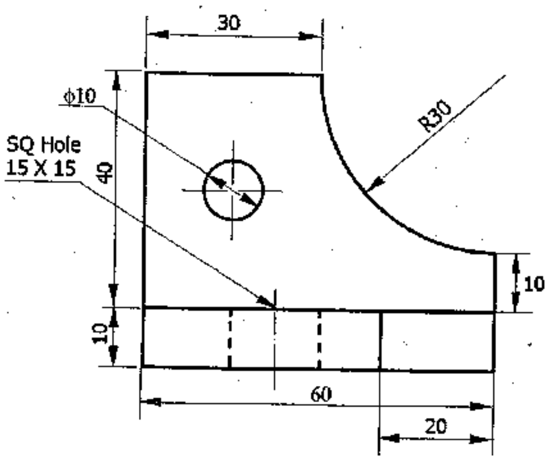
Total Marks : 40 M **Time : 2 hours**

Instructions: 01. All the dimensions are in mm
02. Use first angle projections only
03. Due Weightage will be given for the dimensioning and neatness

PART – A **04 x 05=20**

01. Answer all the questions
02. Each question carries FIVE marks

01. Write the following in single stroke capital vertical lettering of size 10mm ORTHOGRAPHIC PROJECTIONS
02. Redraw the given fig. and dimension it according to SP-46:1988.Assume suitable scale



03. Draw internal common tangents to two unequal circles of radii 26mm and 20mm.The
 distance between the circles is 75mm.
04. Inscribe a regular hexagon in a circle of diameter 50 mm.

PART – B **02 X 10 = 20**

01. Answer all questions
02. Each question carries TEN marks

05. Draw the involute of a circle of diameter 40 mm and also draw a tangent to the curve at a distance of 50 mm from the centre of the circle.

06. Draw the projections of a regular pentagon of side length 40 mm inclined to the H.P. by 30^0 and perpendicular to V.P. using auxiliary plane method.

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BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER – UNIT TEST - 2
D.M.E. – I YEAR EXAMINATION
ENGINEERING DRAWING

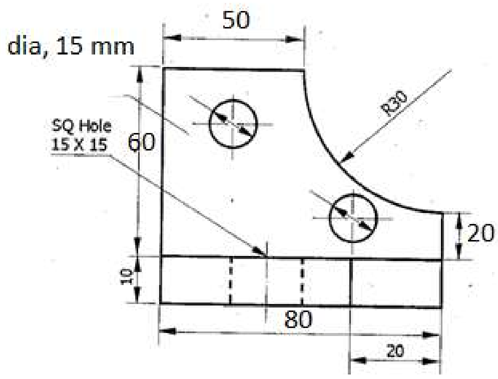
Total Marks : 40 M **Time : 2 hours**

PART – A **04 x 05=20**

01. Answer all the questions
02. Each question carries FIVE marks

01. Write the following in single stroke capital inclined lettering of size 15 mm
STATE BOARD OF TECHNICAL EDUCATION & TRAINING

02. Redraw the given fig. and dimension it according to SP-46:1988.Assume suitable scale



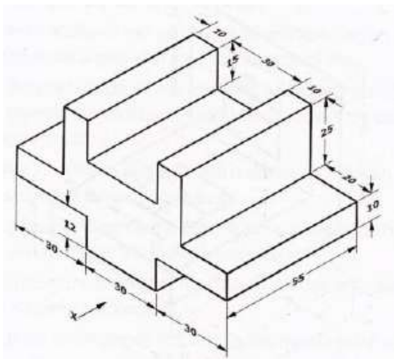
03. Draw external common tangents to two unequal circles of radii 18mm and 14mm.The distance between the circles is 66 mm.

04. Divide a line of length 70 mm into 8 equal parts.

PART – B **02 X 10 = 20**

01. Answer all questions
02. Each question carries TEN marks

05. Draw the front view, top view and left side view of the object shown in the fig.



06. A regular hexagonal prism of height 80 mm and base side 40 mm is resting in the H.P. on its base. It is cut by an auxiliary inclined plane of 60^0 inclination passing through the axis at a distance of 30 mm from the top base. Draw the sectional views of the solid and the true section.

C-20-M-107

BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER – UNIT TEST - 3
D.M.E. – I YEAR EXAMINATION
ENGINEERING DRAWING

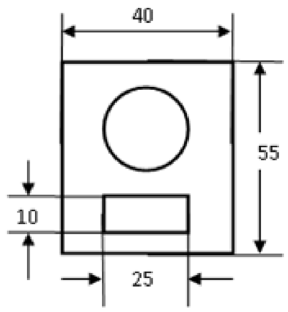
Total Marks : 40 M **Time : 2 hours**

PART – A **04 x 05=20**

01. Answer all the questions
02. Each question carries FIVE marks

01. Write the following in single stroke capital vertical lettering of size 12 mm
"GOVERNMENT OF ANDHRAPRADESH"

02. Redraw the given fig. and dimension it according to SP-46:1988.Assume suitable scale



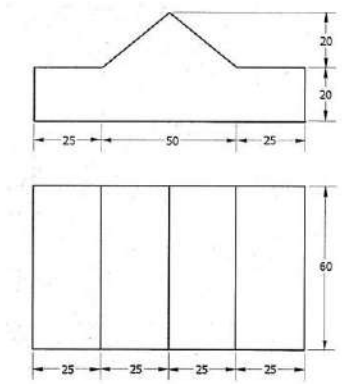
03. Construct an ellipse by concentric circles method whose major axis is 80 mm and minor axis is 50 mm.

04. Construct a regular pentagon of side 35 mm.

PART – B **02 X 10 = 20**

01. Answer all questions
02. Each question carries TEN marks

05. Draw the isometric view of the component whose orthographic projections are given below



06. A pentagonal pyramid of height 80 mm and base side 40 mm is resting in the H.P. on its base such that one of the sides of the base is perpendicular to the V.P. It is cut by a section plane perpendicular to the V.P. and inclined to the H.P. by 60^0 and passing through the axis at a distance of 25 mm from the base. Draw the development of the lateral surface of the truncated pyramid.

Subject Title	Subject Code	Periods/Week	Periods Per Year
Basic Workshop Practice	M -108	06	180

TIMESCHEDULE

S.No	Major Title	No of Periods
1.	Fitting shop	36
2.	Forging shop	39
3.	Carpentry shop	51
4.	Sheet metal work	48
5	Plumbing	06
	Total	**180**

Course Objectives and Course Outcomes

Course Objectives	**Upon completion of the course the student shall able to** (i) Familiarize tools used in Basic workshop processes (ii) Handle the tools appropriately and safely (iii) Reinforce theoretical concepts by practising relevant exercises of basic workshop processes		
Course Outcomes	CO1	M-108.1	Practice the operations in Fitting Shop
	CO2	M-108.2	Practice the operations in Forging Shop
	CO3	M-108.3	Practice the operations in Carpentry Shop
	CO4	M-108.4	Practice the operations in Sheet metal Shop
	CO5	M-108.5	Practice the operations in Plumbing

PO-CO Mapping

Course Code : M-108	**Course Title BASIC WORKSHOP PRACTICE** **Number of Course Outcomes: 06**				**No. of Periods 180**
POs	**Mapping with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1,CO2, CO3,CO4 and CO5	24	13	1	**>40% Level 3 (Highly Addressed)** **25% to 40% Level 2 (Moderately Addressed)** **5% to 25% Level 1 (Low Addressed)** **<5% Not Addressed**
PO2	CO1,CO2, CO3,CO4 and CO5	36	20	1	
PO3	CO1,CO2, CO3,CO4 and CO5	72	41	3	
PO4	CO1,CO2, CO3,CO4 and CO5	24	13	1	
PO5	CO1,CO2, CO3,CO4 and CO5	24	13	1	
PO6					
PO7					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	3	1				1		
CO2	1	1	3	1				1		
CO3	1	1	3	1				1		
CO4	1	1	3	1				1		
CO5	1	1	3	1				1		

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes:
Upon completion of the course the student shall able to

1. Perform Marking and Chipping operations on Mild steel flat of 12 mm thick
   - 1.1 Identify appropriate measuring tool
   - 1.2 Handle appropriate marking tool
   - 1.3 Handle appropriate chipping tool
   - 1.4 Mark the dimensions

2. Cutting with hack saw of MS flats of 6mm thick
   - 2.1 Check the raw material for size
   - 2.2 Fix the work piece in vice
   - 2.3 Mark the work as per given dimensions
   - 2.4 Perform dot punching
   - 2.5 Load and unload hack saw blade from its frame

3. Drilling, chamfering on a MS flat of 2 mm thick

   - 3.1 heck the raw material for size
   - 3.2 Apply the chalk on the surface and on all sides of the flat
   - 3.3 Layout the dimensions and mark the lines using dot punch
   - 3.4 Chamfer the edges through filing
   - 3.5 Locate the whole centres using odd leg callipers and centre punching
   - 3.6 Identify appropriate drill bit
   - 3.7 Load and unload drill bit from the machine

4. Tapping and Dieing on a MS flat of 2 mm thick
   - 4.1 Check the raw material for size
   - 4.2 Identify appropriate tap and die
   - 4.3 Secure the tap in the wrench
   - 4.4 Perform Tapping
   - 4.5 Hold the bar in bench vice
   - 4.6 Fix the die in die stock
   - 4.7Cut external threads using a Die
   - 4.8 Check the fit for accuracy

5. .Assembling of two pieces, matching by filing

5.1 Cut the pieces to size using hack saw
5.2 File surface of flat for trueness
5.3 Mark the surfaces as per dimensions
5.4 Perform cutting with hack saw as per marked lines
5.5 Smooth the surfaces with file
5.6 Assemble the two pieces

6. Conversion of Round to Square
6.1 Identify the holding and striking tools
6.2 Heat the specimen to the appropriate temperature
6.3 Remove the specimen and hold it on the anvil
6.4 Hammer the specimen to the required shape

7 Conversion of Round to Hexagon
7.1 Identify the holding and striking tools
7.2 Heat the specimen to the appropriate temperature
7.3 Remove the specimen and hold it on the anvil
7.4 Hammer the specimen to the required shape

8. Preparation of a Chisel from round rod
8.1 Identify the holding and striking tools
8.2 Heat the specimen to the appropriate temperature
8.3 Remove the specimen and hold it on the anvil
8.4 Hammer the specimen to the required shape

9. Preparation of a ring and hook from M.S round
9.1 Identify the holding and striking tools
9.2 Heat the specimen to the appropriate temperature
9.3 Remove the specimen and hold it on the anvil
9.4 Hammer the specimen to the required shape

10. Preparation of a hexagonal bolt and nut
10.1 Identify the holding and striking tools
10.2 Heat the specimen to the appropriate temperature
10.3 Remove the specimen and hold it on the anvil
10.4 Hammer the specimen to the required shape

11. Cutting of wood with hand saw
11.1 Identify the orientation of grains
11.2 Select appropriate saw for cutting in each of the directions viz. across and along the grains
11.3 Select appropriate work holding device
11.4 Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge)
11.5 Mark dimensions on work using Marking gauge
11.6 Fix the work in the vice
11.7 Perform cutting along the grains using Rip saw
11.8 Perform cutting perpendicular to the grains using cross cut saw

12. Planning of wood
    12.1 Identify the direction for planning wood stock
    12.2 Select appropriate jack plane
    12.3 Prepare the jack plane for planning
    12.4 Load and unload the blade of a jack plane
    12.5 Select appropriate work holding device
    12.6 Perform marking on work using appropriate tool
    12.7 Fix the work in the vice
    12.8 Plane the surfaces on all four sides using jack plane

13. .Chiselling of wood
    13.1 Select appropriate chisels and saw
    13.2 Select appropriate work holding device
    13.3 Select appropriate measuring and marking tools
    13.4 Fix the work in the vice
    13.5 Mark the position of grooves on work using marking gauge
    13.6 Cut sides of grooves by hand saw
    13.7 Chip the material using firmer chisel by applying pressure with mallet
    13.8 Finish the grooves with rasp file

14. Preparation of a Dove-tail joint
    14.1 Select the appropriate cutting tools and work holding devices
    14.2 Plane the wooden pieces on all sides
    14.3 Mark at an angle of 150 with bevel square
    14.4 Trim the dovetail by chisel to exact size
    14.5 Cut the dovetail groove on second piece
    14.6 Finish the groove
    14.7 Assemble the two pieces to prepare dovetail halving joint by using mallet

15. Preparation of Mortise and Tenon joint
    15.1 Select the appropriate cutting tools and work holding devices
    15.2 Plane the two pieces to the required size using jack plane
    15.3 Mark the dimensions to make Tenon using mortise gauge
    15.4 Cut tenon with tenon saw along the marked lines
    15.5 Use firmer chisel to remove the excess material to set finished tenon
    15.6 Mark the dimension to make mortise on the second piece with mortise gauge
    15.7 Use mortise chisel to provide recess in the second piece to accommodate tenon
    15.8 Assemble the two pieces by fitting the tenon into mortise

16. Wood turning on lathe
    16.1 Select appropriate tools
    16.2 Plane the four corners of the work piece using jack plane
    16.3 Mark the centres of the work on either side
    16.4 Mount the work between head stock & tailstock centres
    16.5 Fix the tool in the tool post & Position it in appropriate height
    16.6 Start the lathe to make the work piece to revolve at desired speed
    16.7 Feed the bevel gauge against the rotating work to get the required size and shape
    16.8 Use outside callipers to check the diameter of the pin
    16.9 Use parting off tool to reduce the diameter on either ends of the pin
    16.10 Remove the rolling pin between centres and cut off excess material on either sides

17. Preparation of any household article (ex: stool)
    - 17.1 Prepare the drawings of a stool required for a particular drawing table
    - 17.2 State the specifications of the wood stock required
    - 17.3 Identify the type of joints to be made
    - 17.4 Identify the operations to be made and their sequence
    - 17.5 Perform operations to produce pieces of joint
    - 17.6 Assemble all joints as per the drawing

18. Practice on cutting of sheet
    - 18.1 Cut the required sheet from the stock using snip
    - 18.2 Mark the dimensions on the sheet using scriber & steel rule
    - 18.3 Draw the circular shapes using divider
    - 18.4 Perform rough cutting of the curved shapes using chisel and finish cutting using snips
    - 18.5 Cut the straight edges using straight snip

19. Formation of joints like grooved joint, locked groove joint
    - 19.1 Cut the sheet into two halves
    - 19.2 Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes
    - 19.3 Perform bending edges of sheets applying moderate pressure using mallet
    - 19.4 Interlock the bent edges and apply pressure with mallet to make required joint

20. Preparation of a rectangular open type tray
    - 20.1 Draw the development of the object to be made
    - 20.2 Place the pattern on the sheet
    - 20.3 Mark the dimensions using scriber
    - 20.4 Shear the required piece from the stock using straight snips
    - 20.5 Mark the lines on the sheet to form bends
    - 20.6 Strengthen the sides of sheet by single hem using hatchet stake
    - 20.7 Form the sheet into desired shape using stakes
    - 20.8 Seam the corners by inserting laps of the adjacent sides with single hem

21. Preparation of hollow cylinder
    - 21.1 Draw the development of the object to be made
    - 21.2 Place the pattern on the sheet
    - 21.3 Mark the dimensions using scriber
    - 21.4 Shear the required piece from the stock using straight snips
    - 21.5 Mark the lines on the sheet to form bends
    - 21.6 Strengthen the sides of sheet by single hem on top & bottom side using hatchet stake
    - 21.7 Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet
    - 21.8 Prepare single hem on to longitudinal sides in opposite directions
    - 21.9 Interlock the sides and apply pressure to make a strong joint

22. .Preparation of pipe elbow

22.1 Draw the development of a cylindrical pipe truncated at an angle of 450 on one side
22.2 Cut the sheet over the marked dimensions using curved snips
22.3 Form the sheet into cylindrical shape using stakes
22.4 Seam the sides of two pipes using mallet
22.5 Seam the two pipes
22.6 Solder the joint to make leak proof

23. Preparation of funnel

23.1 Draw the development of upper and bottom conical parts
23.2 Place the pattern on the sheet and cut to required size
23.3 Form the sheet into conical shape using appropriate stake and mallet
23.4 Seam the top conical part and bottom conical part to obtain required funnel

24. Preparation of utility articles such as dust pan, kerosene hand pump

24.1 Draw the development of given dust pan
24.2 Scribe the lines on the sheet and cut to required size
24.3 Hem all the four sides to strengthen the edges
24.3 Form the sheet into designed shape using suitable stakes and mallet
24.4 Solder the corner lap joints to make the required dust pan

24. Preparation of pipe joint with pipe fittings

24.1 Select the plumbing tools: pipe wrench, pipe vice, Hack Saw, Pipe Cutter, pipe Threading Dies
24.2 select pipe fittings: Coupling, union, nipple, Elbow, Tee, Reducer
24.3 Perform pipe fitting operations on the pipe

24. Thread cutting on Pipe

25.1 Select the plumbing tools: pipe wrench, pipe vice, Hack Saw, Pipe Cutter, pipe Threading Dies
25.2 Perform thread cutting on pipe

COURSE CONTENT

FITTING SHOP

1. Marking and chipping on Mild – steel flat 12 mm thick.
2. Cutting with hack saw, M.S. Flats of 6 mm thick.
3. Marking, cutting, drilling, Chamfering and tapping on a M.S. Flat 12 mm thick.
4. Assembling of two pieces, Matching by filing (6 mm thick M.S. Plate)

FORGING SHOP

1. Conversion of round to square.
2. Conversion of round to Hexagon.
3. Preparation of chisel from round rod.
4. Preparation of ring and hook from M.S. round.
5. Preparation of a hexagonal bolt and nut.

CARPENTRY SHOP

1. Cutting of wood with hand saw.
2. Planning of wood.
3. Planning and chiselling of wood.
4. Preparation of dovetail joint.
5. Mortise and tenon joint.
6. Wood turning on a lathe.
7. Preparation of one household article.

SHEET METAL WORK

1. Practice on cutting of sheet
2. Formation of joints like grooved joints, locked groove joint
3. Preparation of a rectangular open type tray
4. Preparation of hollow cylinder
5. Preparation of pipe elbow
6. Preparation of mug.
7. Preparation of funnel
8. Preparation of utility articles such as dustpan, kerosene hand pump.

Plumbing Practice

1 Familiarization of Plumbing Tools
2 Familiarization of Pipefitting
3. Familiarization of Plumbing Operations

REFERENCE BOOKS

1. Manufacturing Technology (VolI) by P N Rao (McGraw Hill)
2. Principles of Foundry Technology by P L Jain (McGraw Hill)
3. Workshop Practice Vol- I by HajraChoudhury Media Promoters and Publishers Pvt Ltd.

PHYSICS LAB PRACTICE
(C-20 CURRIUCULUM COMMON TO ALL BRANCHES)

Subject Code	Subject Title	Periods per week	Total periods per year
M-109 A	Physics Laboratory	03	45

TIMESCHEDULE

S.No	Name of the Experiment	No.of Periods
1.	Hands on practice on Vernier Calipers	03
2.	Hands on practice on Screw gauge	03
3.	Verification of Parallelogram law of forces and Triangle law of forces	03
4.	Simple pendulum	03
5.	Velocity of sound in air – (Resonance method)	03
6.	Focal length and Focal power of convex lens (Separate & Combination) (**Single**	03
7.	Refractive index of solid using traveling microscope	03
8.	Boyle's law verification	03
9.	Meter bridge	03
10.	Mapping of magnet lines of force and locate null points	03
	DEMONSTRATION EXPERIMENTS	
11.	Surface tension of liquid using traveling microscope	03
12.	Coefficient of viscosity by capillary method	03
	Revision	06
	Test	03
	Total	**45**

Objectives:

Upon completion of the course the student shall be able to

1.0 Practice with Vernier calipers to determine the volumes and areas of a cylinder and sphere and their comparison etc .

2.0 Practice with Screw gauge to determine thickness of a glass plate, cross sectional area of a wire and volumes of sphere and also their comparison etc

3.0 Verify the parallelogram law and Triangle law

4.0 Determine the value of acceleration due to gravity using Simple Pendulum

5.0 Determine the velocity of sound in air at room temperature and its value at zero degree centigrade.

6.0 Calculate the Focal length and focal power of convex lenses using distant object method , U-V method , U-V graph and 1 / U – 1 / V graph methods and their comparison.

7.0 Determine the refractive index of a solid using travelling microscope.

8.0 Verify the Boyle's law employing a Quill tube.

9.0 Determine the specific resistance of material of a wirel using Meter Bridge.

10.0 Drawing magnetic lines of force under N-S and N-N methods and locate null points.

11.0 Determine the surface tension of a liquid using travelling Microscope (**Demo)**

12.0 Determine the viscosity of a liquid using capillary method (**Demo)**

Competencies and Key competencies to be achieved by the student

Name of the Experiment	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate the physical quantities of given object	• Read the scales • Calculate the requisite physical quantities of given objects
2. Hands on practice on Screw gauge(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate thickness of glass place and cross section of wire and other quantities	• Read the scales • Calculate thickness of given glass plate • Calculate cross section of wire and other quantities
3. Verification of Parallelogram law of forces and Triangle law of forces(03)	• Fix suitable weights • Note the positions of threads on drawing sheet • Find the angle at equilibrium point • Construct parallelogram • Compare the measured diagonal • Construct triangle • Find the length of sides • Compare the ratios	• Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length
4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph

5. Velocity of sound in air –Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound at room temperature • Calculate velocity of sound at 0^0 C
6. Focal length and Focal power of convex lens (Separate & Combination) (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses • Draw u-v and 1/u – 1/v graphs	• Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graphs
7. Refractive index of solid using traveling microscope(03)	• Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab	• Read the scale • Calculate the refractive index of glass slab
8. Boyle's law verification (03)	• Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value P x l	• Find the length of air column • Find the pressure of enclosed air • Find the value P x l

9. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance
10. Mapping of magnet lines of force(03)	• Draw magnetic meridian • Placed the bar magnet in NN and NS directions • Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines	• Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines
11. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water

12.. Coefficient of viscosity by capillary method(03)	• Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method	• Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water

Scheme of Valuation for end Lab Practical Examination :

A. Writing Aim, Apparatus, Formula, Graph, Precautions carries 10 (Ten) Marks
B. For Drawing the table, taking Readings, Calculation work, Drawing the graph, finding result carries 15 (Fifteen) Marks
C. Viva Voice 05 (Five) Marks

Total **30 (Thirty) Marks**

➢ **Course outcomes**

Course Outcomes	CO1	Experiments with Vernier calipers, Screw gauge, Parallelogram law and Triangle law
	CO2	Experiments with Simple pendulum, Resonance apparatus (Velocity of sound in air)
	CO3	Experiments with Convex lens, Refractive index of solid by travelling microscope
	CO4	Experiments with quill tube (Boyles law verification), Meter bridge, Mapping of magnetic lines of force
	CO5	Experiments with Surface tension and Viscosity

➢ **COs-PO mapping strength (as per given table)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3			1	1	1	1
CO2	3	2	2		1		
CO3	3		2			1	2
CO4	3	2			2		
CO5	3		1	2		1	2

3 = strongly mapped 2= moderately mapped 1= slightly mapped

CHEMISTRY LAB PRACTICE
(C-20 curriculum common to all Branches)

Subject Code	Subject Title	Periods per week	Total periods per year
C -109B	Chemistry Lab PRACTICE	03	45

CO1	Operate and practice volumetric apparatus and preparation of standard solution
CO2	Evaluate and judge the neutralization point in acid base titration
CO3	Evaluate the end point of reduction and oxidation reaction
CO4	Judge the stable end point of complex formation, stable precipitation
CO5	Judge operate and demonstrate and perform precise operations with instrument for investigation of water pollution parameters

PO CO mapping

Course code C-109B	**Chemistry Laboratory No of Cos;5**				**No Of periods 45**
POs	**Mapped with CO No**	**CO periods addressing PO in Col 1 NO**	**%**	**Level 1,2,3**	**remarks**
PO1	CO1,CO2,CO3, CO4,CO5	12	26.66	2	>40% level 3 (highly addressed) 25% to 40% level2(moderately addressed 5% to 25% level1 (Low addressed < 5%(not addressed)
PO2	CO1,CO2,CO3, CO4,CO5	9	20	1	
PO3					
PO4	CO1,CO2,CO3, CO4,CO5	12	26.66	2	
PO5	CO2,CO3, CO4,CO5	12	26.66	2	
PO6					
PO7					

COs-POs mapping strength (as per given table)

2= moderately mapped

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3		1				1		
CO2	2	3		2	2			1		
CO3	2	3		2	2			1		
CO4	2	3		2	2			1		
CO5	2	3		2	2			1		

1= slightly mapped
3=strongly mapped

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
i) Seminars ii) Tutorials iii) Guest Lectures iv) Assignments v) Quiz competitions vi) Industrial visit vii) Tech Fest viii) Mini project ix) Group discussions x) Virtual classes xi) Library visit for e-books

TIMESCHEDULE

S.No	Name of the Experiment	No.of Periods	Mapped with COs
1.	a) Recognition of chemical substances and solutions used in the laboratory by senses. b) Familiarization of methods for Volumetric analysis	03	CO1
2.	Preparation of Std Na_2CO_3 and making solutions of different dilution	03	CO1
3.	Estimation of HCl solution using Std.Na_2CO_3 solution	03	CO2
4.	Estimation of NaOH using Std.HCl solution	03	CO2
5.	Estimation of H_2SO_4usingStd.NaOH solution	03	CO2
6.	Estimation of Mohr's Salt using Std.$KMnO_4$	03	CO3
7.	Determination of acidity of water sample	03	CO2
8.	Determination of alkalinity of water sample	03	CO2
9.	Determination of total hardness of water using Std. EDTA solution	03	CO4
10.	Estimation of Chlorides present in water sample	03	CO4
11.	Estimation of Dissolved Oxygen(D.O)in water sample	03	CO5
12.	Determination of pH using pH meter	03	CO5
13.	Determination of conductivity of water and adjusting ionic strength	03	CO5
14.	Determination of turbidity of water	03	CO5
15.	Estimation of total solids present in water sample	03	CO5
	Total:	**45**	

Objectives:

Upon completion of the course the student shall be able to

1.0 Practice volumetric measurements (using pipettes, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc. To identify the chemical compounds and solutions by senses.

2.0 Practice making standard solutions with pre weighed salts and to make solutions of desired dilutions using appropriate techniques.

3.0 Conduct titrations adopting standard procedures and using Std. Na_2CO_3solutionfor estimation of HCl

4.0 Conduct titrations adopting standard procedures and using Std. HCl solution for estimation of NaOH

5.0 Conduct titrations adopting standard procedures and using Std. NaOH solution for estimation of H_2SO_4

6.0 Conduct titrations adopting standard procedures and using Std.$KMnO_4$solution for estimation of Mohr's Salt

7.0 Conduct titrations adopting standard procedures to determine the acidity of given samples of water (One ground water and one surface / tap water, and rain water if available)

8.0 Conduct titrations adopting standard procedures to determine the alkalinity of given samples of water (One ground water and one surface / tap water)

9.0 Conduct titrations adopting standard procedures to determine the total hardness of given samples of water (One ground water and one surface / tap water) using Std. EDTA solution

10.0 Conduct titrations adopting standard procedures to determine the chlorides present in the given samples of water and wastewater (One ground water and one surface / tap water)

11.0 Conduct the test using titrometric / electrometric method to determine Dissolved Oxygen (D.O) in given water samples (One sample from closed container and one from open container / tap water)

12.0 Conduct the test on given samples of water / solutions (like soft drinks, sewage, etc.) to determine their pH using standard pH meter

13.0 Conduct the test on given samples of water / solutions

a) To determine conductivity

b) To adjust the ionic strength of the sample to the desired value

14.0 Conduct the test on given samples of solutions (coloured and non coloured) to determine their turbidity in NTU

15.0 To determine the total solids present in given samples of water (One ground water and one surface / tap water)

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
Familiarization of methods for Volumetric analysis. Recognition of chemical substances And solutions (03)	-	--
Preparation of Std Na_2CO_3 and making solutions of different dilution(03)	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions	▪ Weighing the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions
Estimation of HCl solution using Std. Na_2CO_3solution (03)	▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the flow of the titrant	▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations
Estimation of NaOH using Std.HCl solution (03)		
Estimation of H_2SO_4 using Std.NaOH solution (03)		
Estimation of Mohr's Salt using Std.$KMnO_4$ (03)		
Determination of acidity of water sample (03)		

Determination of alkalinity of water sample (03)	▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results	
Determination of total hardness of water using Std. EDTA solution (03)		
Estimation of Chlorides present in water sample (03)		
Estimation of Dissolved Oxygen(D.O) in water sample (By titration method) (03)		
Determination of pH using pH meter (03)	▪ Familiarize with instrument ▪ Choose appropriate 'Mode' / 'Unit' ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately ▪ Follow Safety precautions	▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately
Determination of conductivity of water and adjusting ionic strength to required level (03)		
Determination of turbidity of water (03)		
Estimation of total solids present in water sample (03)	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate ▪ Drying the crucible in an oven	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate

SCHEME OF VALUATION

A) Writing Chemicals, apparatus ,principle and procedure 5M

B) Demonstrated competencies 20M

Making standard solutions
Measuring accurately the standard solutions and titrants
Effectively controlling the flow of the titrant
Identifying the end point
Making accurate observations

C) Viva-voce 5M

Total 30M

Course code	Course Title	No. of Periods/Weeks	Total No. of periods	Marks for FA	Marks for SA
M-110 (common to all branches)	Computer Fundamentals Lab Practice	3	90	40	60

Time schedule:

S.No.	Chapter/Unit Title	No. of sessions each of 3 periods duration	No. of Periods
1.	Computer hardware Basics	2	6
2.	Windows Operating System	2	6
3.	MS Word	8	24
4.	MS Excel	7	21
5.	MS PowerPoint	5	15
6.	Adobe Photoshop	6	18
	Total periods	**30**	**90**

S.No.	Chapter/Unit Title	No. of Periods	CO's Mapped
1.	Computer hardware Basics	6	CO1
2.	Windows Operating System	6	CO1
3.	MS Word	24	CO2
4.	MS Excel	21	CO3
5.	MS PowerPoint	15	CO4
6	Adobe Photoshop	18	CO5
	Total periods	**90**	

Course Objectives	i)To know Hardware Basics ii)To familiarize operating systems iii)To use MS Office effectively to enable to students use these skills in future courses iv) To use Adobe Photoshop in image editing.

Course Outcomes	At the end of the course students will be able to		
	CO1	M-110.1	Identify hardware and software components
	CO2	M-110.2	Prepare documents with given specifications using word processing software
	CO3	M-110.3	Use Spread sheet software to make calculation and to draw various graphs / charts.
	CO4	M-110.4	Use Power point software to develop effective presentation for a given theme or topic.
	CO5	M-110.5	Edit digital or scanned images using Photoshop

CO-PO/PSO MATRIX

CO NO.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
C-110.1	3	3	3	3	3	3	3	3	2	3
C-110.2	3	3	3	3	3	3	3	3	2	3
C-110.3	3	3	3	3	3	3	3	3	2	3
C-110.4	3	3	3	3	3	3	3	3	2	3
C-110.5	3	3	3	3	3	3	3	3	2	3
Average	3	3	3	3	3	3	3	3	2	3

3=Strongly mapped , 2=moderately mapped, 1=slightly mapped

Learning Outcomes:

I. Computer Hardware Basics

1. a).To Familiarize with Computer system and hardware connections
   b).To Start and Shut down Computer correctly
   c).To check the software details of the computer
2. To check the hardware present in your computer

II. Windows's operating system

3. To Explore Windows Desktop
4. Working with Files and Folders
5. Windows Accessories: Calculator – Notepad – WordPad – MS Paint

III. Practice with MS-WORD

6. To familiarize with Ribbon layout of MS Word
   Home – Insert- Page layout – References – Review- View.
7. To practice Word Processing Basics
8. To practice Formatting techniques
9. To insert a table of required number of rows and columns
10. To insert Objects, Clipart and Hyperlinks
11. To use Mail Merge feature of MS Word
12. To use Equations and symbols features

IV.Practice with MS-EXCEL

13. To familiarize with MS-EXCEL layout
14. To access and enter data in the cells
15. To edit a spread sheet- Copy, Cut, Paste, and selecting Cells
16. To use built in functions and Formatting Data
17. To create Excel Functions, Filling Cells
18. To enter a Formula for automatic calculations
19. To sort and filter data in table.
20. To present data using Excel Graphs and Charts.
21. To develop lab reports of respective discipline.
22. To format a Worksheet in Excel, Page Setup and Print

V. Practice with MS-POWERPOINT

23. To familiarize with Ribbon layout features of PowerPoint 2007.
24. To create a simple PowerPoint Presentation
25. To set up a Master Slide in PowerPoint
26. To insert Text and Objects
27. To insert a Flow Charts
28. To insert a Table
29. To insert a Charts/Graphs
30. To insert video and audio
31. To practice Animating text and objects
32. To Review presentation

VI. Practice with Adobe Photoshop

33.To familiarize with standard toolbox
34. To edit a photograph.
35. To insert Borders around photograph.
36. To change Background of a Photograph.
37. To change colors of Photograph.
38. To prepare a cover page for the book in your subject area.
39. To adjust the brightness and contrast of the picture so that it gives an elegant look.
40. To type a word and apply the shadow emboss effects.

Key competencies:

Expt No	Name of Experiment	Competencies	Key competencies
1 (a).	To familiarize with Computer system and hardware connections	a. Identify the parts of a Computer system: i). CPU ii). Mother Board iii) Monitor iv) CD/DVD Drive v) Power Switch vi) Start Button vii) Reset Button b. Identify and connect various peripherals c. Identify and connect the cables used with computer system d. Identify various ports on CPU and connect Keyboard & Mouse	Connect cables to external hardware and operate the computer
1 (b).	To Start and Shut down Computer correctly	a. Log in using the password b. Start and shut down the computer c. Use Mouse and Key Board	a. Login and logout as per the standard procedure b. Operate mouse &Key Board
1 (c).	To Explore Windows Desktop	a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support	a. Access application programs using Start menu b. Use taskbar and Task manager

2.	To check the software details of the computer	a. Find the details of Operating System being used b. Find the details of Service Pack installed	Access the properties of computer and find the details
3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste move commands to organize files and folders	a. Create files and folders Rename , arrange and search for the required folder/file
	Working with Files and Folders Continued....	c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut to files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	a. Use windows accessories and select correct text editor based on the situation. b. Use MS pain to create /Edit pictures and save in the required format.

6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References-Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two Word documents simultaneously d. Choose correct Paper size and Printing options	a. Create a Document and name appropriately and save b. Set paper size and print options
7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS- word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use key board and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table – marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.

10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar-Title Bar- Ribbon-Worksheets-Formula Bar-Status Bar	a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet

16.	To use built in functions and Formatting Data	a. Perform Mathematical Calculations verify -AutoSum b. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations
18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To sort and filter data in table	a. Sort data in multiple columns b. Sort data in a row c. Sort data using Custom order d. Filter data in work sheet	a. Refine the data in a worksheet and keep it organized b. Narrow a worksheet by selecting specific choice
20.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce c. Excel Column Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
21.	To develop lab reports of respective discipline	Create Lab reports using MS Word and Excel	a. Insert Practical subject name in Header and page numbers in Footer
22.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percentage symbols c. Change height of a row and width of a column d. Change data alignment e. Insert Headers and Footers f. Set Print Options and Print	a. Format Excel sheet b. Insert headers &footers and print

23.	To familiarize with Ribbon layout &features of PowerPoint 2007.	Use various options in PowerPoint a. Home b. Insert c. Design d. Animation e. Slideshow f. View g. Review	Access required options in the tool bar
24.	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a PowerPoint slide	a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes b. Use bullets option
25.	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint g. Add Notes to a PowerPoint Presentation	a. Setup Master slide and format b. Add notes
26.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and word art f. Use 3d features g. Arrange objects	Insert Text and Objects Use 3d features
27.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art
28.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format

29.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart e. Format a Chart Background	Create charts and Bar graphs, Pie Charts and format.
30.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
31.	To Practice Animation effects	a. Apply transitions to slides b. To explore and practice special animation effects like Entrance, Emphasis, Motion Paths &Exit	Add animation effects
32.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Hand-out	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

33	To familiarize with standard toolbox	a. Open Adobe Photoshop b. Use various tools such as i. The Layer Tool ii. The Color & Swatches Tool iii. Custom Fonts & The Text Tool iv. Brush Tool v. The Select Tool vi. The Move Tool vii. The Zoom Tool viii. The Eraser ix. The Crop Tool x. The Fill Tool	Open a photograph and save it in Photoshop
34	To edit a photograph	a. Use the Crop tool b. Trim edges c. Change the shape and size of a photo d. Remove the part of photograph including graphics and text	a. Able to edit image by using corresponding tools.
35	To insert Borders around photograph	a. Start with a single background layer b. Bring the background forward c. Enlarge the canvas d. Create a border color e. Send the border color to the back f. Experiment with different colors	Able to create a border or frame around an image to add visual interest to a photo
36	To change Background of a Photograph	a. open the foreground and background image b. Use different selection tools to paint over the image c. Copy background image and paste it on the foreground. d. Resize and/or drag the background image to reposition. e. In the Layers panel, drag the background layer below the foreground image layer.	Able to swap background elements using the Select and Mask tool and layers.
37	To change colors of Photograph	a. Change colors using: i) Color Replacement tool ii) **Hue/Saturation adjustment layer tool**	Able to control color saturation

38	To prepare a cover page for the book in subject area	a. open a file with height 500 and width 400 for the cover page. b. apply two different colors to work area by dividing it into two parts using Rectangle tool. c. Copy any picture and place it on work area→ resize it using free transform tool. d. Type text and apply color and style e. Apply effects using blended options	Able to prepare cover page for the book
39	To adjust the brightness and contrast of picture to give an elegant look	a. open a file. b. Go to image→ adjustments→ Brightness/Contrast. c. adjust the brightness and contrast. d. Save the image.	Able to control brightness/contrast.
40	To type a word and apply the shadow emboss effects	a. open a file b. Select the text tool and type text. c. Select the typed text go to layer→ layer style→ blended option→ drop shadow, inner shadow, bevel and emboss→ contour→ satin→ gradient overlay d. Save the image.	Able to apply shadow emboss effects

Table specifying the scope of syllabus to be covered for unit tests

Unit Test	Learning outcomes to be covered
Unit test-1	From 1 to 8
Unit test-2	From 9 to 22
Unit test-3	From 23 to 40

I Year Internal Lab Examination
UNIT TEST - I
MODEL QUESTION PAPER
COMPUTER FUNDAMENTALS LAB

SCHEME: C-20 **SUBJ CODE: M-110**
MAX MARKS:40 **Time:90Min**

1. Identify the internal hardware components of a PC and assemble them.
2. Identify the external components or peripherals of a PC and connect them.
3. Identify the components on motherboard.
4. Perform the process of placing processor on CPU slot.
5. Perform the process of removing and placing the RAM in the corresponding slot.
6. Identify the CMOS battery and test whether it is working it or not.
7. Find details of following:
   a) Operating System being used.
   b) Processor name
   c) RAM
   d) Hard disk
8. Create a folder by your name, search a file or folder and find its path.
9. Draw the National Flag using MS Paint.
10. Create a word document that contains TEN names of your classmates (boys-5 & girls-5) and perform the following tasks:
    a) Save the document to your desktop.
    b) Sort the names in each list alphabetically.
    c) Set line spacing to 1.15.
    d) Use bullet points for the names in both lists separately.

I Year Internal Lab Examination
UNIT TEST - II
MODEL QUESTION PAPER
COMPUTER FUNDAMENTALS LAB

SCHEME: C-20 **SUBJ CODE: M-110**
MAX MARKS:40 **Time:90Min**

1. Write individually addressed letters to your friends about the Republic Day celebration using Mail Merge.

2. Create a Word document about your college and insert page numbers in footer and College Name in header.

3. Create your class time table using Tables in MS Word.

4. Create a 2-page document about your College& insert hyperlinks for courses offered in the college and insert Bookmarks next to College Name.

5. Write individually addressed letters to your friends (at least 5 members) to intimate the External Examination time table using Mail Merge.

6. Write an equation $\frac{(x+y)^2}{(x-y)^2} = \frac{x^2+2xy+y^2}{x^2-2xy+y^2}$ in MS word.

7. Create the organizational structure of your college in MS Word.

8. Create a spreadsheet by totaling marks of 3 or more subjects, then calculate percentage and hence find grade based on boundary conditions of FIVE students:
   Grades O >= 90%, A >=80%, B >=70%, C >=60%, D >=50%, E >=40%, F <40%

9. Create a Excel spreadsheet for the following data, making sure that the cell marked with Category (A1) is pasted in cell A1 in the spreadsheet and perform the questions below.

Category (A1)	**Product Name**	**Quantity**	**Inventory**	**Price per Unit**	**Total Price**
Office Supplies	Binder	2	20	12.99	25.98
Office Supplies	Pencil	20	20	0.99	
Electronics	Samsung 4K Smart TV	1	5	399.00	
Electronics	Bluetooth Speakers	4	5	44.49	
Computers	Lenovo X230 12in Laptop	2	2	279.90	

a). Change the format of the "Total Price" column to "Currency" format.

b) Calculate Total Price by writing formula.

c) Turn on filtering for the table.

d) Sort the table by column "Category" from A to Z.

10. Create a spreadsheet to calculate Cumulative monthly attendance for a period of Three months.

Year Internal Lab Examination
UNIT TEST - III
MODEL QUESTION PAPER
COMPUTER FUNDAMENTALS LAB

SCHEME: C-20 **SUBJ CODE: M-110**
MAX MARKS:40 **Time:90Min**

1. Create a PowerPoint Presentation about your College in 5 slides only.

2. Create a PowerPoint Presentation on Computer Hardware in minimum 5 slides.

3. Create a PowerPoint Presentation on Computer Fundamentals with *Entrance, Emphasis* effects in minimum 5 slides.

4. Create a PowerPoint Presentation on anyChapterwith special animation effects like *Entrance, Motion Paths &Exit.*

5. Resize the image using Photoshop.

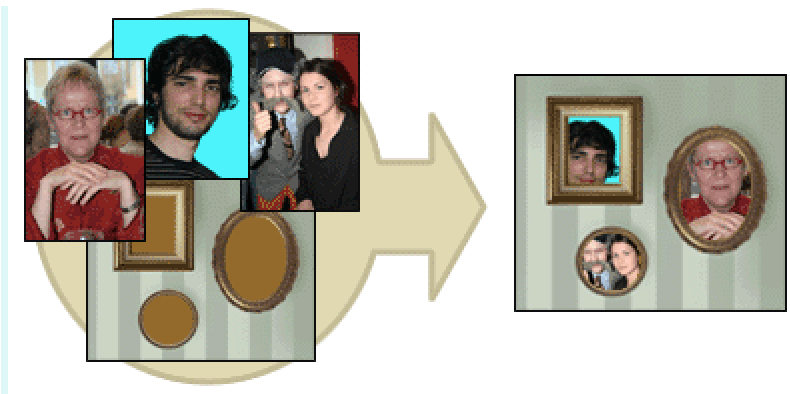
6. Change the background of a Photograph.

7. Edit an image by using
   a) Crop tool.
   b) Resize the image
   c) Save the new image with new name keeping original image as it is.

8. A Picture of two parrots (parrots.jpg) is given to you. Make anyone of one of the parrots in Black & White.

9. Convert a color image to monochrome and improve quality of photograph.

10. Copy three pictures and fit into the empty frames.



BOARD DIPLOMA EXAMINATIONS

DIPLOMA IN COMPUTER ENGINEERING

MODEL PRACTICAL QUESTION PAPER-YEAR END EXAM

COMPUTER FUNDAMENTALS LAB

SCHEME: C-20 **SUBJ CODE:M-110**

MAX MARKS:60 **TIME: 3HOURS**

1. Identify the internal hardware components of a PC and assemble them.
2. Identify the external components or peripherals of a PC and connect them.
3. Write the procedure to create the files and folders
4. Write the procedure to access Calculator, Paint and Notepad application
5. Write the procedure to perform the following in MS Word
   (a) Change the Font Size
   (b) Change the Font Style
   (c) Change the Text Size
6. Write the procedure to perform the following in MS Word
   (a) Change the Font Color.
   (b)Use Various Text Alignment Options.
   (c)Format text in Bold, Italic and Underline.
7. Create the hierarchy of your family in MS Word.
8. Write the procedure to perform the following in MS Word:
   (a) Insert a Table
   (b) Add a Row
   (c) Add a column
   (d) Delete a Row
   (e) Delete a column
9. Write the procedure to use Equation $\frac{(x+y)^2}{(x-y)^2} = \frac{x^2+2xy+y^2}{x^2-2xy+y^2}$ and Symbols.
10. Write the procedure to perform the following in MS Excel
    (a) To Modify Column Width
    (b) To Modify Row Height
    (c) Format text in Bold, Italic, and Underline.
11. Write the procedure to create charts and Graphs in MS Excel.
12. Write the procedure to create simple Power Point Presentation on your college in Three slides.
13. Write the procedure to perform Animation on Text and Objects in your presentation.
14. Take a photographic image. Give a title for the image. Put the border. Write your names. Write the Name of Institution and Place.
15. Prepare a cover page for the book in your subject area. Plan your own design.
16. You are given a picture of a flower and associated background (Extract.jpg).Extract the Flower only from that and organize it on a background. Select your own background for organization.
17. You are given a picture (BrightnessContrast.jpg). Adjust the brightness and contrast of the picture so that it gives an elegant look.
18. You are given a picture (position.jpg). Position the picture preferably on a plain background of a color of your choice - Positioning include rotation and scaling.
19. Remove the arrows and text from the given photographic image(Filename: photo.jpg).
20. Type a word; apply the following effects. Shadow Emboss.

III SEMESTER

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M- 301	Engineering Mathematics - II	4	-	60	3	20	80	100
M -302	Engineering Materials	4	-	60	3	20	80	100
M -303	Basic Electrical& Electronics Engineering	4	-	60	3	20	80	100
M-304	Basic Thermodynamics	4	-	60	3	20	80	100
M-305	Strength of Materials	4	-	60	3	20	80	100
M-306	Production Technology-I	4	-	60	3	20	80	100
PRACTICAL								
M-307	Machine Drawing	-	6	90	3	40	60	100
M-308	Material Testing and Metallography Lab Practice	-	3	45	3	40	60	100
M-309	Fuels Laboratory Practice		3	45	3	40	60	100
M-310	Electrical Engineering Lab Practice	-	3	45	3	40	60	100
M-311	Workshop Practice -I	-	3	45	3	40	60	100
TOTAL		**24**	**18**	**630**		**320**	**780**	**1100**

ENGINEERING MATHEMATICS-II

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
C-301	Engineering Mathematics-II	4	60	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Indefinite Integration	22	CO1
2	Definite Integration and its applications	24	CO2
3	Differential Equations of first order	14	CO3
	Total Periods	**60**	

Course Objectives	(i) To understand the concepts of indefinite integrals and definite integrals with applications to engineering problems. (ii) To understand the formation of differential equations and learn various methods of solving them.

Course Outcomes	CO1	Integrate various functions using different methods.
	CO2	Evaluate definite integrals with applications.
	CO3	Obtain differential equations and solve differential equations of first order and first degree.

ENGINEERING MATHEMATICS – II

Learning Outcomes

Unit-I

C.O. 1 Integrate various functions using different methods.

L.O.1.1. Explain the concept of Indefinite integral as an anti-derivative.

1.2. State the indefinite integral of standard functions and properties of Integrals $\int (u + v)\, dx$ and $\int ku\, dx$ where k is constant and u, v are functions of x.

1.3. Solve integration problems involving standard functions using the above rules.

1.4. Evaluate integrals involving simple functions of the following type by the method of substitution.

i) $\int f(ax + b)\, dx$ *where* $f(x)dx$ is in standard form.

ii) $\int [f(x)]^n f'(x)\, dx$

iii) $\int f'(x)/[f(x)]\, dx$

iv) $\int f\{g(x)\} g'(x)\, dx$

1.5. Find the integrals of $\tan x$, $\cot x$, $\sec x$ and $\operatorname{cosec} x$ using the above.

1.6. Evaluate the integrals of the form $\int \sin^m x \cos^n x\, dx$ where m and n are suitable positive integers.

1.7. Evaluate integrals of suitable powers of $\tan x$ and $\sec x$.

1.8. Evaluate the Standard integrals of the functions of the type

$$i)\ \frac{1}{a^2 + x^2}, \frac{1}{a^2 - x^2}, \frac{1}{x^2 - a^2}$$

$$ii)\ \frac{1}{\sqrt{a^2 + x^2}}, \frac{1}{\sqrt{a^2 - x^2}}, \frac{1}{\sqrt{x^2 - a^2}}$$

$$iii)\ \sqrt{x^2 - a^2}, \sqrt{x^2 + a^2}, \sqrt{a^2 - x^2}$$

1.9. Evaluate the integrals of the type

$$\int \frac{1}{a+bSin\theta}d\theta, \int \frac{1}{a+b\cos\theta}d\theta \text{ and } \int \frac{1}{a\cos\theta+b\sin\theta+c}d\theta .$$

1.10. Evaluate integrals using decomposition method.

1.11. Solve problems using integration by parts.

1.12 Use Bernoulli's rule for evaluating the integrals of the form $\int u.vdx$.

1.13. Evaluate the integrals of the form $\int e^x [f(x) + f'(x)]\, dx$.

Unit-II

C.O.2 Evaluate definite integrals with applications.

L.O.2.1. State the fundamental theorem of integral calculus

2.2. Explain the concept of definite integral.

2.3. Solve problems on definite integrals over an interval using the above concept.

2.4. State various properties of definite integrals.

2.5. Evaluate simple problems on definite integrals using the above properties.

Syllabus for Unit test-I completed

2.6. Explain definite integral as a limit of sum by considering an area.

2.7. Find the areas under plane curves and area enclosed between two curves using integration.

2.8. Obtain the mean value and root mean square value of the functions in any given interval.

2.9. Obtain the volumes of solids of revolution.

2.10. Solve some problems using Trapezoidal rule, Simpson's 1/3 rule for approximation of integrals.

Unit -III

C.O. 3 Form differential equations and solve differential equations of first order and first degree.

L.O. 3.1 Define a Differential equation, its order and degree

3.2 Find order and degree of a given differential equation.

3.3 Form a differential equation by eliminating arbitrary constants.

3.4 Solve the first order and first degree differential equations by variables separable method.

3.5 Solve Homogeneous differential equation of first order and first degree.

3.6 Solve exact differential equation of first order and first degree.

3.7 Solve linear differential equation of the form dy/dx + Py = Q, where P and Q are functions of x or constants.

3.8 Solve Bernoulli's differential equation reducible to linear form.

3.9 Solve simple problems arising in engineering applications.

Syllabus for Unit test-II completed

C-20
Engineering Mathematics – II
CO/PO – Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2				3	1	2
CO2	3	3	3	3				3	3	3
CO3	3	3	3	3				3	3	3
Avg	3	2.6	2.6	2.6				3	2.3	2.6

3 = Strongly mapped (High), **2 =** Moderately mapped (Medium), **1 =** Slightly mapped (Low)

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

PSO1: An ability to understand the concepts of basic mathematical techniques and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.
PSO2: An ability to solve the Engineering problems using latest software tools, along with analytical skills to arrive at faster and appropriate solutions.
PSO3: Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

Engineering Mathematics – II
PO- CO – Mapping strength

<table>
<tr><th rowspan="2">PO no</th><th rowspan="2">Mapped with CO no</th><th colspan="2">CO periods addressing PO in column I</th><th rowspan="2">Level
(1,2 or 3)</th><th rowspan="2">Remarks</th></tr>
<tr><th>Number</th><th>%</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3</td><td>60</td><td>100%</td><td>3</td><td rowspan="10">>40% Level 3 Highly addressed

25% to 40% Level 2 Moderately addressed

5% to 25% Level 1 Low addressed

<5% Not addressed</td></tr>
<tr><td>2</td><td>CO1, CO2, CO3</td><td>60</td><td>100%</td><td>3</td></tr>
<tr><td>3</td><td>CO1, CO2, CO3</td><td>60</td><td>100%</td><td>3</td></tr>
<tr><td>4</td><td>CO2, CO3</td><td>38</td><td>63.3%</td><td>3</td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PSO 1</td><td>CO1, CO2, CO3</td><td>60</td><td>100%</td><td>3</td></tr>
<tr><td>PSO 2</td><td>CO1, CO2, CO3</td><td>40</td><td>66.6%</td><td>3</td></tr>
<tr><td>PSO 3</td><td>CO1, CO2, CO3</td><td>48</td><td>75%</td><td>3</td></tr>
</table>

ENGINEERING MATHEMATICS – II

COURSE CONTENTS

Unit-I

Indefinite Integration.

1. Integration regarded as anti-derivative – Indefinite integrals of standard functions. Properties of indefinite integrals. Integration by substitution or change of variable. Integrals of tan x, cot x, sec x, cosec x. Integrals of the form $\int \sin^m x.\cos^n x\,dx,$ where at least one of m and n is odd positive integers. Integrals of suitable powers of tanx. secx and cosecx.cotx by substitution.

Evaluation of integrals which are reducible to the following forms:

$$i)\frac{1}{a^2+x^2},\frac{1}{a^2-x^2},\frac{1}{x^2-a^2}$$

$$ii)\frac{1}{\sqrt{a^2+x^2}},\frac{1}{\sqrt{a^2-x^2}},\frac{1}{\sqrt{x^2-a^2}}$$

$$iii)\sqrt{x^2-a^2},\sqrt{x^2+a^2},\sqrt{a^2-x^2}$$

Integration by decomposition of the integrand into simple rational, algebraic functions.

Integration by parts, Bernoulli's rule and integrals of the form $\int e^x [f(x) + f'(x)]\,dx$.

Unit-II

Definite Integral and its applications:

2. Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Definite integral as the limit of a sum. Area under plane curves – Area enclosed between two curves. Mean and RMS values of a function on a given interval Volumes of solids of revolution. Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a define integral.

Unit -III

Differential Equations:

3. Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solutions of differential equations of first order and first degree using methods, variables separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

Textbook:

Engineering Mathematics-II, a textbook for third semester diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Schaum's Outlines Differential Equations, Richard Bronson & Gabriel B. Costa
3. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

BLUE PRINT

S. No	Chapter/Unit title	No of Periods	Weight age allotted	Marks wise distribution of weight age				Question wise distribution of weight age				COs mapped
				R	U	Ap	An	R	U	Ap	An	
1	Unit – I: Indefinite Integration	22	28	11	11	06	0	2	2	2	0	CO1
2	Unit – II: Definite Integration and its applications	24	33	11	03	11	08	2	1	2	1	CO2
3	Unit – III: Differential Equations of first order	14	19	03	03	03	10	1	1	1	1	CO3
Total		60	80	25	17	20	18	5	4	5	2	

R: Remembering Type : 25 Marks
U: understanding Type : 17 Marks
Ap: Application Type : 20 Marks
An: Analysing Type : 18 Marks

Engineering Mathematics – II
Unit Test Syllabus

Unit Test	Syllabus
Unit Test-I	From L.O 1.1 to L.O 2.5
Unit Test-II	From L.O 2.6 to L.O 3.9

UNIT TEST MODEL PAPERS

Unit Test I

State Board of Technical Education and Training, A. P

First Year

Subject name: **Engineering Mathematics-II**

Sub Code: **M-301**

Time : 90 minutes Max.marks:40

Part-A **16Marks**

Instructions: (1) Answer **all** questions.

(2) First question carries **four** marks and the remaining questions carry **three** marks each.

1. Answer the following.

Evaluate $\int x^8 dx$ (CO1)

Evaluate $\int \frac{1}{\sqrt{4-x^2}} dx.$ (CO1)

$\int e^x \left(f(x) + f^{'}(x) \right) dx = e^x f(x) + c$ is true/false (CO1)

a. Evaluate $\int_0^{\frac{\pi}{2}} \cos x dx$ (CO2)

2. Evaluate $\int \left(3\cos ec^2 x - 2\tan x \sec x + \frac{1}{x} \right) dx.$ (CO1)

3. Evaluate $\int \frac{\sin(\log x)}{x} dx.$ (CO1)

4. Evaluate $\int e^x \sin 2x dx.$ (CO1)

5. Evaluate $\int_0^{\frac{\pi}{2}} \sin^2 x dx$ (CO2)

Part-B **3×8=2**

Instructions: (1) Answer **all** questions.

(2) Each question carries **eight** marks

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Evaluate $\int \frac{1}{5+4\cos x}dx.$ (or) (CO1)

   B) Evaluate $\int \sin^4 x \cos^3 x dx.$ (CO1)

7. A) Evaluate $\int \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)dx.$ (or) (CO1)

   B) Evaluate $\int x^4 e^{2x} dx.$ (CO1)

8. A) Evaluate $\int_0^{\frac{\pi}{2}} \cos 4x \cos x dx$ (or) (CO2)

   B) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin^{10} x}{\sin^{10} x+\cos^{10} x}dx$ (CO2)

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Unit Test II

State Board of Technical Education and Training, A. P

First Year

Subject name: **Engineering Mathematics-II**

Sub Code: **M-301**

Time : 90 minutes Max.marks:40

Part-A **16Marks**

Instructions: (1) Answer **all** questions.

(2) First question carries **four** marks and the remaining questions carry **three** marks each.

1. Answer the following.

   a. Volume of the curve $y = f(x)$ over the interval $[a, b]$ when rotated about X-axis is ____________ (CO2)

   b. Mean value of $f(x)$ over the interval $[a, b]$ is____________ (CO2)

   c. Order of differential equation $\frac{d^2y}{dx^2} + p^2y = 0$ is__________ (CO3)

   d. Integrating factor of $\frac{dy}{dx} + Py = Q$ is________________ (CO3)

2. Find the mean value of $x^2 + 2x + 1$ over the interval $[1, 2]$ (CO2)

3. Find the area enclosed by curve $x^2 = 4y$ between the lines $x = 2$ and $x = 4$ (CO2)

4. Form the differential equation by eliminating the arbitrary constants from $y = A\cos 2x + B\sin 2x.$ (CO3)

5. Solve $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}.$ (CO3)

Part-B **3×8=24**

Instructions: (1) Answer **all** questions.

(2) Each question carries **eight** marks

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Find the area bounded between the curve $y = x^2 - 5x$ and the line $y = 4 - 2x$ (CO2)

or

B) Find the R.M.S value of $\sqrt{\log x}$ between the lines $x = e$ to $x = e^2$ (CO2)

7. A) Find the volume of the solid obtained by revolving the ellipse $\frac{x^2}{16} + \frac{y^2}{25} = 1$ about x axis (CO2)

or

B) Calculate the approximate value of $\int_0^6 \frac{1}{1+x}\,dx$ by taking $n = 6$ using Trapezoidal rule (CO3)

8. A) Solve $\left(y^2 - 2xy\right)dx + \left(2xy + x^2\right)dy = 0.$ (CO3)

or

B) Solve $x\frac{dy}{dx} + \frac{y}{x} = x^3 y^6.$ (CO3)

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END EXAM MODEL PAPERS

STATE BOARD OF TECHNICAL EDUCATION, A.P

ENGINEERING MATHEMATICS C-301

TIME : 3 HOURS **MODEL PAPER- I** **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks. **10x3=30M**

1. Evaluate $\int\left(2\sin x-3e^{x}+\frac{4}{1+x^{2}}\right)dx.$ **CO1**
2. Evaluate $\int e^{x}\sin e^{x}dx.$ **CO1**
3. Evaluate $\int\sin 3x\cos 2x dx.$ **CO1**
4. Evaluate $\int xe^{x}dx.$ **CO1**
5. Evaluate $\int_{0}^{1}\frac{1}{1+x^{2}}dx.$ **CO2**
6. Find the mean value of $y=x^{2}$ from $x=0$ to $x=1$ **CO2**
7. Find the area of the region bounded by the curve $y=\sin x$ from $x=0$ to $x=\pi$ **CO2**
8. Find the order and degree of the differential equation $\left(\frac{d^{3}y}{dx^{3}}\right)^{2}-3\left(\frac{dy}{dx}\right)^{2}-x^{2}=1$ **CO3**
9. Solve $\frac{dy}{dx}=\frac{1+y^{2}}{1+x^{2}}$ **CO3**
10. Solve $\left(x^{2}+y\right)dx+\left(y^{2}+x\right)dy=0.$ **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks. 5x8=40M

11. A) Evaluate $\int \frac{3x+1}{(x-1)(x+3)}dx.$ **CO1**

Or

B) Evaluate $\int \frac{1}{5+4\cos x}dx.$ **CO1**

12. A) Evaluate $\int x\sin 3xcosxdx.$ **CO1**

Or

B) Evaluate $\int x^3 \cos xdx.$ **CO1**

13. A) Evaluate $\int_0^1 \frac{x^3}{1+x^8}dx.$ **CO2**

Or

B) Evaluate $\int_0^{\frac{\pi}{2}} \frac{1}{1+\tan^3 x}dx.$ **CO2**

14. A) Find the area of the region bounded by the curves $y^2 = 4x$ **and** $x^2 = 4y$. **CO2**

Or

B) Find the R.M.S values of $\sqrt{27-4x^2}$ from $x=0$ to $x=3$ **CO2**

15. A) Find the volume of the solid generated by revolution of the ellipse $\frac{x^2}{16}+\frac{y^2}{25}=1$ about X-axis **CO2**

Or

B) Calculate the approximate value of $\int_1^{11} x^3 dx$ by using Simpson's 1/3rd rule by dividing the range into 10 equal parts. **CO2**

PART-C

Answer the following question. Question carries TEN marks. 1x10=10M

16. Solve $2\sin x\frac{dy}{dx} - y\cos x = xy^3e^x$. **CO3**

STATE BOARD OF TECHNICAL EDUCATION, A.P

ENGINEERING MATHEMATICS C- 301

TIME : 3 HOURS **MODEL PAPER-II** **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks. 10x3=30M

1. Evaluate $\int\left(3e^{x}-2\cos x+\frac{3}{x}\right)dx.$ **CO 1**
2. Evaluate $\int\cos^{2}2xdx.$ **CO 1**
3. Evaluate $\int\frac{\tan^{-1}x}{1+x^{2}}dx.$ **CO 1**
4. Evaluate $\int x\cos xdx.$ **CO1**
5. Evaluate $\int_{0}^{2}\frac{1}{\sqrt{4-x^{2}}}dx.$ **CO2**
6. Find the mean value of $i=a\sin t$ over the complete wave. **CO2**
7. Find the volume generated by revolving the circle $x^{2}+y^{2}=9$ from $x=0$ to $x=2$ about x-axis **CO2**
8. Obtain the differential equation by eliminating the arbitrary constants A and B from the curve $y=Ae^{x}+Be^{-x}$ **CO3**
9. Solve $\frac{dy}{dx}=e^{2x+y}$ **CO3**
10. Solve $\frac{dy}{dx}+\frac{y}{x}=x$ **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks. 5x8=40M

11. A) Evaluate $\int \frac{1}{2x^2+3x+5}dx.$ **CO1**

Or

B) Evaluate $\int \sin^3 x\cos^5 xdx.$ **CO1**

12. A) Evaluate $\int e^x\left(\frac{2+\sin 2x}{1+\cos 2x}\right)dx.$ **CO1**

Or

B) Evaluate $\int e^{2x}x^4dx.$ **CO1**

13. A) Evaluate $\int_0^1 \frac{\sec^2 x}{(1+\tan x)^2}dx.$ **CO2**

Or

B) Evaluate $\int_0^{\frac{\pi}{2}} \log(1+\tan\theta)d\theta.$ **CO2**

14. A) Find the area bounded between the curves $y=x^2$ and the line $y=3x+4$. **CO3**

Or

B) Find the R.M.S value of $\sqrt{\log x}$ between the lines $x=e$ to $x=e^2$ **CO2**

15. A) Find the volume of right circular cone using integration. **CO2**

Or

B) Find the approximate value of π from $\int_0^1 \frac{1}{1+x^2}dx$ using Trapezoidal rule by dividing $[0,1]$ into 5 equal sub-intervals. **CO2**

PART-C

Answer the following question. Question carries TEN marks. 1x10=10M

16. Solve $xy^2dy-(x^3+y^3)dx=0$ **CO3**

Course Title	Course Code	Periods per week	Periods per Semester
Engineering Materials	M-302	04	60

TIME SCHEDULE

S. No	Chapter/Unit Title	No. of Periods	Weightage of Marks	Short answer Questions (3 M)	Essay Type Questions (8M)	Essay Type Question (10M
1	Introduction to Engineering materials	12	17	3	1	
2	Structure of Materials	08	11	1	1	
3	Production of Iron and Steel	10	11	1	1	1
4	Phase Diagrams and Heat treatment of Steel	20	17	3	1	
5	Ferrous, Non-Ferrous Metals and their alloys	10	14	2	1	
	Total	**60**	**70+10**	**10**	**5**	**1**

Note: 10 Marks higher order question may be given from the Chapter -3 or 4 or 5.

Course Objectives and Course Outcomes

Course Objectives	*Upon completion of the course the student shall be able to* Understand the mechanical properties and analyse the testing of materials, atomic structure of materials and phase transformation in iron carbon equilibrium, production of iron and steel and heat treatment methods.		
Course Outcomes	CO1	M-302.1	Explain the procedure to find the mechanical properties of the materials by destructive and non-destructive tests
	CO2	M-302.2	Explain the microstructure of materials.
	CO3	M-302.3	Describe iron and steel production processes
	CO4	M-302.4	Discuss the iron-iron carbide equilibrium diagram and heat treatment processes
	CO5	M-302.5	Explain the 1. classification, 2.composition and 3.properties of Ferrous, Non-Ferrous Metals and their alloys

PO-CO Mapping

Course Code : M-302	Course Title : Engineering Materials No of COs:5				No. Of periods: 60
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1 – CO5	40	66.67	3	**>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed**
PO2					
PO3	CO4	16	26.67	2	
PO4	CO1	04	06.67	1	
PO5					
PO6					
PO7					

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
M-302.1	03							02	03	01
M-302.2	03								03	
M-302.3	03							02	03	
M-302.4	03		02	01					03	
M-302.5	03								03	

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Suggestive activities for further strengthening of CO-PO mapping:

1. Industrial visits may be arranged to understand the operation of various furnaces used in extraction of various materials.
2. Students shall be asked to carry out mini project to identify the materials and methods to produce a particular quantity of steel.

Blue Print of Question Paper

S. No	Chapter Name	Periods Allocated	Weight age Allocated	Marks Wise Distribution of Weight age				Question Wise Distribution of Weight age				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction to Engineering materials	12	17	9	8			3		1		CO1
2	Structure of Materials	08	11	3	8			1		1		CO2
3	Production of Iron and Steel	10	11	3	8			1		1		CO3
4	Phase Diagrams and Heat treatment of Steel	20	27	9	8		10	3		1	1	CO4
5	Ferrous, Non-Ferrous Metals and their alloys	10	14	6	8			2		1		CO5
TOTAL		**60**	**80**	**30**	**40**		**10**	**10**		**5**	**1**	

Note: 10 Marks higher order question may be given from Chapter - 3 or 4 or 5 (Here It is taken from chapter – 4)

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Introduction of engineering materials

1.1 Classify the engineering materials as metals, non-metals, composites

1.2 List the Constituents in composites and types of reinforcements.

1.3 List the various engineering materials and their applications.

1.4 State the importance of various Engineering Materials used in Mechanical processes/industries.

1.5 Define the following Properties. i) Tensile, compressive and shear strength ii) Ductility iii) Hardness iv) Toughness v) Brittleness vi) Impact strength vii) Fatigue and viii) Creep Resistance.

1.6 Introduction to Testing of materials

1.7 Differentiate between destructive and non-destructive tests.

1.8 Describe the testing procedure for tensile strength, compression strength, shear strength, Impact strength, and hardness of metals.

1.9 Describe the procedure for Testing Materials by X-Ray, gamma–Ray, magnetic flux, Ultrasonic and penetrant test.

2.0 Structure of materials

2.1 State the meaning of space lattice.
2.2 Define unit cell.
2.3 Describe the three main types of space lattice.
2.4 Explain the formation of grains by dendrite growth.
2.5 Explain the effect of rate of cooling on grain formation.
2.6 Explain the effect of grain size on mechanical properties.
2.7 Identify two factors promoting grainsize.
2.8 Identify the three stages in the phenomenon of recrystallisation of cold worked components.

3.0 Production of Iron and Steel

3.1 Name the various raw materials required for production of iron.
3.2 Describe the method of producing Pig Iron in Blast furnace.
3.3 Describe the puddling furnace to produce wrought iron.
3.4 Explain the process of manufacturing cast iron in Cupola.
3.5 Describe the manufacturing of steel by Bessemer process, L.D. process, Open Hearth and Electric Process.

4.0 Phase Diagrams and Heat treatment of Steel

4.1 Explain the cooling curves of pure metal.
4.2 Mention the allotropic forms of pure iron with temperatures and their crystal structures.
4.3 Draw the iron carbon equilibrium diagram, identify various structures of the iron carbon system.
4.4 Locate Eutectic, Peritectic and Eutectoid points on the Iron Carbon equilibrium diagram.
4.5 Calculate the composition of phases in a steel/cast Iron from the iron carbon equilibrium diagram.
4.6 State the importance of heat treatment for steels.
4.7 Describe the main features of the various heat treatment operations.
4.8 Differentiate annealing and normalising.
4.9 Describe the effect of cooling rate in hardening.
4.10 State the importance of tempering.
4.11 Explain use of case hardening processes like; carburizing, nitriding and Cyaniding.

5.0 Ferrous, Non-Ferrous Metals and their alloys

5.1 Explain the composition, properties and applications of Cast Iron–Grey, White, Malleable, and Spheroidal.
5.2 State the basis of classification of plain carbon steels.
5.3 List out any five application of these steels.
5.4 Describe the need for alloying the steel with other elements.
5.5 State the composition, properties, and industrial applications of alloy steels.
5.6 Identify the need for non-ferrous metals and their alloys in engineering application.
5.7 Describe the properties and applications of –Copper, Aluminium, Tin, Zinc, Lead, Nickel, Magnesium and Chromium.
5.8 Write the composition, properties and industrial application of Copper and Aluminium alloys.
5.9 List the properties of bearing metals.

COURSE CONTENT

1.0 **Introduction to engineering materials**

Classification of engineering materials – Metals (ferrous, non-ferrous), non-metals (polymers, ceramics), Composites (Metal matrix composites, polymer matrix composites, ceramic matrix composites, Nano composites). Constituents in composites (matrix, reinforcement), Different types of reinforcements. A few Mechanical Engineering Materials, Importance of their study with applications. Various mechanical properties of engineering materials – Tensile strength, Compressive strength, Ductility, Malleability, Hardness, Toughness, Brittleness, Impact strength, Fatigue, Creep resistance

Introduction to Testing of materials - Differentiate between destructive and non-destructive tests. Destructive testing tests on UTM to determine tensile, shear strengths – Hardness Tests on Brinell & Rockwell testing machines – Impact test on Izod & Charpy testing machines. Non-destructive testing – Procedure for testing materials by X-ray, gamma ray, magnetic flux and ultrasonic testing and Penetrant test.

2.0 **Structure of Materials Crystals of metals**

Space lattices, Unit cell, three main types of metallic space lattices, namely Face Centered Cubic, Body Cantered Cubic, Hexagonal Close Packed. Crystallisation of metal, formation of grains by dendrite growth, grain boundary, grain size control, effect of grain size on properties–factors.

3.0 **Production of Iron and Steel**

Raw materials, iron ores, Lime stone, Coal-their availability in India, General Survey of Iron and steel making in India. Manufacturing of pig iron from blast furnace. Wrought iron by pudding furnace. Cast Iron from cupola. Production of steel by Bessemer, L.D. process; Open hearth and Electric processes.

4.0 Phase Diagrams and Heat treatment of Steel

Cooling curve for pure metal. Allotropic forms of pure Iron. Iron carbon equilibrium diagram. Importance of heat treatment. Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding.

5.0 Ferrous, Non-Ferrous metals and their alloys

Classification of Cast Iron – Grey, White, Malleable, Spheroidal – Composition, properties and applications. Plain Carbon Steels: Effect of carbon in steels, Soft, Mild, Medium and High carbon and also their properties and applications. Alloy Steels: Nickel Steels, Chromium steels, 18/8stainless steel, High Speed Steels, Manganese Steel. Properties and uses of Copper, Aluminium, Tin, Zinc, Lead, Nickel, Magnesium and Chromium, Copper and Aluminium alloys- Properties of bearing metals, Babbit metals.

REFERENCEBOOKS		
Material Science d Engineering	by	Raghavan (PHI)
Introduction to Physical Metallurgy	by	Sidne H Avner (Tata McGraw Hill)
Material science and metallurgy		O.P. Khanna (Dhanpat rai publishers

BOARD DIPLOMA EXAMINATION
MODEL QUESTION PAPER
DME - FOURTH SEMESTER EXAMINATION

ENGINEERING MATERIALS (M-302)

Time: **3** hours] [Total Marks: **80**

PART – A **3*10 = 30**

Instructions: (1) Answer **all** questions.

(2) Each question carries **Three** marks.

1. Define the following properties *(a)* Toughness *(b)* Creep Resistance.

2. What are Metal Composites? Give two applications of metal composites.

3. Differentiate between destructive and non-destructive tests.

4. What is the effect of grain size on mechanical properties?

5. What is the function of coke and limestone in the charge of blast furnace?

6. Define Phase. State Gibbs phase rule and abbreviate the terms involved in it.

7. List out six methods of heat treatment of steel.

8. Define case-hardening and list casehardening processes?

9. Appreciate the role of alloying elements in steel?

10. State composition, properties and uses of Bell metal.

PART – B **8*5 = 40**

Instructions: (1) Answer all **Five** questions either A or B from each question.
(2) Each question carries **Eight** marks.

11. (A) Explain the Rockwell hardness test with sketch and compare B-scale with C-scale.

(OR)

(B) Explain the Gamma Ray Radiography test with sketch and list out its advantages.

12. (A) Determine the effective number of atoms for the following structures with a sketch :
(i) FCC *(ii)* BCC *(iii)* HCP

(OR)

(B) Describe the solidification procedure of pure metal with sketch.

13. (A) Explain the procedure of manufacturing pig iron from blast furnace with sketch.

(OR)

(B) Explain how Wrought iron is produced from puddling furnace with sketch.

14. (A) Sketch the iron-carbon equilibrium diagram and mark the salient points.

(OR)

(B) Define solid solution. What are different types of solid solutions? Give Examples.

15. (A) Based on carbon content, how are the plain carbon steels classified? Discuss in detail the use of these steels.

(OR)

(B) State composition, properties and applications of
i) Nickel Steel

(ii) 18/8 Stainless Steel

(iii) HSS

PART – C **10*1 = 10**

Instructions: (1) Answer **the** question.
(2) Question carries **Ten** marks.

16. Analyse how Normalized steels are better than Annealed steels?

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-302 :: ENGINEERING MATERIALS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 4.1 to 5.9

Unit Test – 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Introduction to Engineering materials, Structure of Materials, Production of Iron and Steel	R,U	4	CO1,CO2, CO3
2	Introduction to Engineering materials	U	3	CO1
3	Introduction to Engineering materials	U	3	CO1
4	Structure of Materials	U	3	CO2
5	Production of Iron and Steel	U	3	CO3
Part - B (24 marks)				
6	Introduction to Engineering materials	Ap	8	CO1
7	Structure of Materials	Ap	8	CO2
8	Production of Iron and Steel	Ap	8	CO3

Unit Test – 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Phase diagrams and Heat treatment of Steel, Ferrous, Non-Ferrous Metals and their alloys	R,U	4	CO4, CO5
2	Phase diagrams and Heat treatment of Steel,	U	3	CO4
3	Phase diagrams and Heat treatment of Steel,	U	3	CO4
4	Phase diagrams and Heat treatment of Steel,	U	3	CO4
5	Ferrous, Non-Ferrous Metals and their alloys	U	3	CO5
Part - B (24 marks)				
6	Phase diagrams and Heat treatment of Steel,	Ap	8	CO4
7	Phase diagrams and Heat treatment of Steel,	Ap	8	CO4
8	Ferrous, Non-Ferrous Metals and their alloys	Ap	8	CO5

R-Remember; U-Understanding; Ap-Application ; An- Analylising

C20-M-302

BOARD DIPLOMA EXAMINATION,

Unit Test - 1

ENGINEERING MATERIALS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4 Questions carry 3 marks each*

1. (a) The maximum cycle stress at which the material will operate indefinitely without failure is known as ________________.

   (b) For ductile material the percentage elongation will be more than 5%. (True/False)

   (c) What is the effective number of atoms for body cantered cubic lattice?

   (d) Melting point for pure iron is

   (a) 11300^0C (b) 1400^0C (c) 1539^0C (d) 723^0C
2. Define the mechanical properties strength and hardness.
3. State the principle of radiography testing.
4. State the effect of grain size on mechanical properties.
5. State any three advantages of steel making in electrical process,

PART – B

Instructions: *Part B consists of* ***3*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain Rockwell hardness test and compare B-scale with C-scale.

   (OR)

   Explain with a neat sketch how single shear and double shear tests are conducted.
7. Describe the solidification of a pure metal with a neat sketch,

   (OR)

   How are space lattice mainly classified? Explain each with a neat sketch.
8. Explain the process of steel making in open hearth furnace. Draw the furnace and name the parts,

   (OR)

   Draw a neat sketch of a Puddling furnace and explain how the wrought iron is produced from it.

C20-M-302

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

ENGINEERING MATERIALS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) What is the melting point of pure iron?

   (b) The annealing temperature of mild steel is in the range of 840^0C to 870^0C. (True/False)

   (c) Iron carbon alloy having carbon more than 2% is known as

   (a) Cast iron (b) High carbon steel (c) Mild steel (d) None of the above

   (d) Brass is an alloy of _______ and _______.

2. State the Gibb's phase rule and abbreviate the terms involved.
3. List out any six heat treatment processes of steel.
4. State any three advantages of vacuum hardening.
5. State the influence of silicon and manganese on plain carbon steel.

PART – B

Instructions: *Part B consists of* ***3*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Sketch the iron= carbon diagram and mark the salient points.

   (OR)

   Define the solid solution. Distinguish between substitutional and interstitial solid solution.

7. Differentiate between annealing and normalizing.

   (OR)

   Explain the heat treatment processes (a) Carburising (b) Nitriding

8. Why is gray cast iron particularly suitable for lathe beds?

   (OR)

   What are the desired properties of bearing metals? Name any three types of bearing metals.

Course Code	Course Title	No. of periods / Week	Total No. of Periods	Marks for FA	Marks for SA
M303	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**4**	**60**	**20**	**80**

TIME SCHEDULE

S.No	Chapter/ Unit Title	Periods	Weightage Allocated	Short Answer Questions (3 M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Electrical Engineering Fundamentals	14	14	2	1	1
2	Electrical Machines	16	14	2	1	
3	Electrical Measuring Instruments	10	14	2	1	
4	Electrical Safety Procedures	10	14	2	1	
5	Electronic Devices	10	14	2	1	
	Total	**60**	**70+10**	**10**	**05**	**1**

Note: 10 Marks Higher Order question may be given from the chapter - 1, or 2 or 3 or 4 or 5.

COURSE OUTCOMES MAPPING

S.No	Chapter/Unit Title	No. of periods	CO's Mapped
1.	Electrical Engineering Fundamentals	14	CO1
2.	Electrical Machines	16	CO2
3.	Electrical Measuring Instruments	10	CO3
4	Electrical Safety Procedures	10	CO4
5.	Electronic Devices	10	CO5
	Total	60	

COURSE OBJECTIVES	To familiarize the basic concepts of electrical principles and machines.
	To understand the construction and working of different measuring instruments and electronic devices and safety of electrical systems.
	To gain the knowledge to operate different electrical equipment and electronic devices.

COURSE OUTCOMES	CO1	M303.1	Explain the basic concepts of electrical principles and their applications.
	CO2	M303.2	Describe the usage of various electrical machines for different applications.
	CO3	M303.3	Illustrate various electrical measuring instruments and analyse the working of various measuring instruments.
	CO4	M303.4	Select appropriate safety instruments and procedures to prevent electrical hazards and analyze various causes of hazards
	CO5	M303.5	Describe the working of basic electronic devices.

CO'S – PO'S – PSO'S MAPPING STRENGTH

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3							3		
CO2	3	2	1					3	2	
CO3	3							3	1	
CO4	3		2					3		
CO5	3			1				3	1	
Average	3	2	1.5	1				3	1.3	

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

BLUE PRINT for the Question Paper

<table>
<tr><th rowspan="2">S.No</th><th rowspan="2">Chapter/ Unit Title</th><th rowspan="2">No. of periods</th><th rowspan="2">Weightage Allocated</th><th colspan="4">Marks wise Distribution of Weightage</th><th colspan="4">Question wise Distribution of Weightage</th></tr>
<tr><th>R</th><th>U</th><th>Ap</th><th>An</th><th>R</th><th>U</th><th>Ap</th><th>An</th></tr>
<tr><td>1</td><td>Electrical Engineering Fundamentals</td><td>14</td><td>14</td><td>3</td><td>3</td><td>8</td><td rowspan="2">10</td><td>1</td><td>1</td><td>1</td><td rowspan="2">1</td></tr>
<tr><td>2</td><td>Electrical Machines</td><td>16</td><td>14</td><td>3</td><td>3</td><td>8</td><td>1</td><td>1</td><td>1</td></tr>
</table>

3	Electrical Measuring Instruments	10	14	3	3	8		1	1	1	
4	Electrical Safety Procedures	10	14	3	3	8		1	1	1	
5	Electronic Devices	10	14	3	3	8		1	1	1	
	Total	**60**	**70+10**	**15**	**15**	**40**	**10**	**5**	**5**	**5**	**1**

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks Higher Order question may be given from the chapter - 1, or 2 or 3 or 4 or 5.

LEARNING OUTCOMES

1.0 Electrical Engineering Fundamentals

1.1 Define Ohm‘s Law and state the laws of resistance.

1.2 State work, power and energy.

1.3 State and explain Kirchhoff’s laws.

1.4 Define the terms

(a) Flux (b) Permeability (c) Reluctance

(d) Inductance (e) Permittivity (f) Capacitance.

1.5 State

(a) Faradays laws of Electro Magnetic Induction
(b) Lenz’s law
(c) Fleming‘s right hand rule
(d) Fleming‘s left hand rule

1.6 State and explain dynamically induced EMF and statistically induced EMF.

1.7 State and explain Self inductance, Mutual inductance and Coefficient of coupling.

1.8 Define the terms

(a) Alternating Current (b) Instantaneous Value (c) Maximum Value
(d) Time Period (e) Frequency (f) Average Value
(g) R.M.S Value (h) Form Factor (i) Phase Difference
(j) Power (k) Power Factor

1.9 State power and power factor in

(a) Pure resistor (b) Pure inductor (c) Pure capacitor

1.10 Explain single phase A.C. series circuits consisting of

(a) R-L (b) R-C (c) R-L-C.

1.11 Explain three phase system with voltage, current and power equations.

1.12 State the advantages of three phase system over single phase system.

2.0 Electrical Machines

2.1 Explain the construction and working of D.C. Generator.

2.2 List the type of D.C. Generators and draw the schematic diagram of each type.

2.3 Write the currents and voltages equations for different types of D.C. Generators.

2.4 Explain the working of Welding Generator with circuit diagram.

2.5 Explain the construction and working of D.C. Motor.

2.6 List the type of D.C. Motors and draw the schematic diagram of each type.

2.7 Write the currents and voltages equations for different types of D.C. Motors.

2.8 State the methods of speed control of D.C. Motors.

2.9 Explain the construction and working of Transformer.

2.10 Explain the working of Welding Transformer with circuit diagram.

2.11 Explain the construction and working of Three Phase Induction Motor.

2.12 Explain the construction and working of Single Phase Induction Motor.

2.13 List the types of Single Phase Induction Motors.

2.14 List the application of the following electrical motor

(a) DC Motor

(b) Three Phase Induction motor

(c) Single Phase Induction Motor

3.0 Electrical Measuring Instruments

3.1 List the types of electrical measuring instruments.

3.2 Explain the construction and working of Moving Coil Measuring Instrument.

3.3 Explain construction and working of Attraction Type Moving Iron Measuring Instrument.

3.4 Explain construction and working of Repulsion Type Moving Iron Measuring Instrument.

3.5 Compare Moving Coil Measuring Instrument and Moving Iron Measuring Instrument.

3.6 Explain the construction and working of Dynamometer Type Measuring Instrument.

3.7 Explain the construction and working of Induction Type Single Phase Energy meter.

4.0 Electrical Safety Procedures.

4.1 Explain the effects of electrical shock and burn.

4.2 Explain the procedures to be adopted to avoid electric shock.

4.3 Explain the first aid methods to be followed after electrocuted.

4.4 State the need of earthing of electrical equipment and machinery.

4.5 State the types of earthing of electrical equipment and machinery.

4.6 Explain the procedure of pipe earthing with diagram.

4.7 Explain the procedure of plate earthing with diagram.

5.0 Electronic Devices

5.1 Classify materials as conductor, semiconductors and insulators.

5.2 Distinguish between intrinsic and extrinsic semiconductors.

5.3 Explain the formation of P- type and N- type materials.

5.4 Explain the formation of PN Junction diode.

5.5 Explain the working of PN junction diode with forward bias and reverse bias.

5.6 Explain the formation of PNP and NPN transistors

5.7 Draw the circuit diagrams, input characteristics and output characteristics of transistor in Common Base, Common Emitter and Common Collector configurations.

5.8 Explain the working of Zener diode.

5.9 Explain the working of Light Emitting Diode.

COURSE CONTENTS

1. Electrical Engineering Fundamentals

Ohm‘s Law - the laws of resistance - work, power and energy - Kirchhoff’s laws – Flux – Permeability –Reluctance – Inductance – Permittivity - Capacitance. - Faradays laws of Electro Magnetic Induction - Lenz’s law - Fleming‘s right hand rule - Fleming‘s left hand rule - dynamically induced EMF and statistically induced EMF - Self inductance, Mutual inductance and Coefficient of coupling - Alternating Current - Instantaneous Value - Maximum - Time Period - Frequency – Average Value - R.M.S Value - Form Factor - Phase Difference – Power - Power Factor - power and power factor in Pure resistor, Pure inductor and Pure capacitor -single phase A.C. series circuits - three phase system with voltage, current and power equations - advantages of three phase system over single phase system.

2. Electrical Machines

Construction and working of D.C. Generator - type of D.C. Generators and the schematic diagram of each type - currents and voltages equations for different types of D.C. Generators - working of Welding Generator with circuit diagram - construction and working of D.C. Motor - type of D.C. Motors and schematic diagram of each type - the currents and voltages equations for different types of D.C. Motors - methods of speed control of D.C. Motors - construction and working of Transformer - working of Welding Transformer with circuit diagram - construction and working of Three Phase Induction Motor - construction and working of Single Phase Induction Motor - types of Single Phase Induction Motors - application of the DC Motor, Three Phase Induction motor, Single Phase Induction Motor.

3. Electrical Measuring Instruments

Types of electrical measuring instruments - construction and working of Moving Coil Measuring Instrument - construction and working of Attraction Type Moving Iron Measuring Instrument - construction and working of Repulsion Type Moving Iron Measuring Instrument - Compare Moving Coil Measuring Instrument and Moving Iron Measuring Instrument - construction and working of Dynamometer Type Measuring Instrument - construction and working of Induction Type Single Phase Energymeter.

4. Electrical Safety Procedures.

Effects of electrical shock and burn - procedures to be adopted to avoid electric shock - first aid methods to be followed after electrocuted - need of earthing of electrical equipment and machinery - types of earthing of electrical equipment and machinery - procedure of pipe earthing with diagram - procedure of plate earthing with diagram.

5. Electronic Devices

Classify materials as conductor, semiconductors and insulators - Distinguish between intrinsic and extrinsic semiconductors - formation of P- type and N- type materials - formation of PN Junction diode - working of PN junction diode with forward bias and reverse bias - formation of PNP and NPN transistors - circuit diagrams, input characteristics and output characteristics of transistor inCommon Base, Common Emitter and Common Collector configurations - working of Zener diode - working of Light Emitting Diode.

REFERENCE BOOKS

1. A Text Book of Electrical Engineering and Electronics - BL Theraja
2. Principles of Electrical Engineering and Electronics - VK Mehta
3. Basic Electrical and Electronics Engineering - DP Kothari & IJ Nagrath
4. A Text Book of Electrical Engineering - JB Gupta
5. A Text Book of Electrical Engineering - BL Theraja & AK Theraja

C20 :: M303

D.M.E. – III SEMESTER EXAMINATION
MODEL PAPER-I

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Duration: 3 hours Maximum Marks: 80

Part-A

Note: Answer all ten questions.

Each question carries three marks. 10X3 = 30

1. Define Ohm's law and state the laws of resistance.
2. State Fleming's Right Hand Rule.
3. List the types of DC Generators.
4. List any six applications of Single Phase Induction Motors.
5. List any six electrical measuring instruments.
6. Compare moving coil measuring instrument with moving iron measuring instrument in any three aspects.
7. State any three effects of electric shock.
8. State the need of earthing of electrical equipment and machinery.
9. What is semiconductor?
10. Distinguish between Intrinsic Semiconductor and Extrinsic Semiconductor in any three aspects.

Part-B

Note: Answer all five questions.

Each question has its own choice and carries eight marks. 5X8 = 40

11. (A) State and Explain Kirchhoff's laws with circuit diagrams.

    (OR)

    (B) State and explain Self inductance, Mutual inductance and Coefficient of coupling.

12. (A) Explain the working of Welding Generator with circuit diagram.

    (OR)

    (B)Explain the construction and working of Three Phase Induction Motor.

13. (A)Explain construction and working of Repulsion Type Moving Iron Measuring Instrument.

    (OR)

    (B) Explain the construction and working of Dynamometer Type Measuring Instrument.

14. (A)Explain the first aid methods to be followed after electrocuted.

    (OR)

    (B)Explain the procedure of pipe earthing with diagram.

15. (A)Explain the working of PN junction diode with forward bias and reverse bias.

    (OR)

    (B)Explain the formation of PNP and NPN transistors.

Part-C

Note: Answer the following question.

This question has no choice and carries ten marks. 1X10 = 10

16. Analyze the construction and working of Induction Type Single Phase Energy meter with latest digital energy meter.

C20 :: M303

D.M.E. – III SEMESTER EXAMINATION
MODEL PAPER-II

BASIC ELECTRICAL ENGINEERING AND ELECTRONICS

Duration: 3 hours Maximum Marks: 80

Part-A

Note: Answer all ten questions.

Each question carries three marks. 10X3 = 30

1. Define inductance
2. State Fleming's left Hand Rule.
3. List the various parts of DC Generator.
4. State the methods of speed control of DC motors.
5. Classify the electrical measuring instruments.
6. State the working of dynamo meter type measuring instruments
7. State the procedure to be adopted to avoid electric shock.
8. State the need of earthing the electrical equipment
9. Differentiate P-Type and N-type materials in any three aspects.
10. Distinguish between Intrinsic Semiconductor and Extrinsic Semiconductor in any three aspects.

Part-B

Note: Answer all five questions.

Each question has its own choice and carries eight marks. 5X8 = 40

11. (A) State and Explain dynamically induced emf and statically induced emf

(OR)

(B) Explain single phase AC RL circuit.

12. (A) Explain the construction and working of DC Motor with circuit diagram.

(OR)

(B)Explain the construction and working of single phase Transformer.

13. (A)Compare MI instruments and MC Instruments.

(OR)

(B)Explain the working of induction type single phase energy meter.

14. (A)State the types of earthing of electrical equipment and machinery.

(OR)

(B)Explain the procedure of plate earthing with diagram.

15. (A)Explain the working of Zener diode

(OR)

(B)Explain the formation of PNP and NPN transistors.

Part-C

Note: Answer the following question.

This question has no choice and carries ten marks. 1X10 = 10

16. Analyse the construction and working of Repulsion Type Moving Iron Measuring instrument with Moving coil measuring instrument.

SYLLABUS TO BE COVERED FOR UNIT TEST-I AND UNIT TEST-II

M-303 :: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Unit Test	Learning Outcomes to be covered
Unit Test-I	From 1.1 to 2.14
Unit Test-II	From 3.1 to 5.9

MODEL PAPER – FORMATIVE ASSESSMENT - 1

C20 :: M-303

BOARD DIPLOMA EXAMINATION, (C-20)

DME – THIRD SEMESTER EXAMINATION

C20 :: M303 :: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Duration: 90 minutes Maximum Marks: 40

Part-A

Note: Answer all five questions. **4 + 4X3 = 16**

First question carries four marks and remaining each question carries three marks.

1. (a) Electrical unit for permittivity is ____________________________________ .

   (b) Formula for Form Factor = ____ .

   (c) Power factor of a pure inductor is unity : True / False

   (d) R.M.S. value stands for ____ .

2. State Fleming's Right Hand Rule.

3. List the types of DC Generators.

4. List any six applications of Single Phase Induction Motors.

5. State the methods of speed control of DC Motors.

Part-B

Note: Answer all three questions. 3X8 = 24

Each question has its own choice and carries eight marks.

6. State and Explain Kirchhoff's laws with circuit diagrams.

(OR)

State and explain Self inductance, Mutual inductance and Coefficient of coupling.

7. Explain the working of Welding Generator with circuit diagram.

(OR)

Explain the construction and working of Three Phase Induction Motor.

8. Explain the working of Welding Transformer with circuit diagram.

(OR)

Explain the construction and working of Single Phase Induction Motor.

MODEL PAPER – FORMATIVE ASSESSMENT - 2

C20 :: M-303

BOARD DIPLOMA EXAMINATION, (C-20)

DME – THIRD SEMESTER EXAMINATION

C20 :: M303 :: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Duration: 90 minutes | Maximum Marks: 40

Part-A

Note: Answer all five questions. **4 + 4X3 = 16**

First question carries four marks and remaining each question carries three marks.

1. (a) Pointer indicates a value when deflecting torque is ___________ controlling torque .

   (b) Moving Iron Measuring Instrument is used to measure _________ quantities .

   (c) Moving Coil Measuring Instrument has uniform scale. : True / False

   (d) Induction Type Energy meter is used to measure ______ energy .
2. State any three effects of electric shock.
3. State the need of earthing of electrical equipment and machinery.
4. Define semiconductor.
5. Distinguish between Intrinsic Semiconductor and Extrinsic Semiconductor in any three aspects.

Part-B

Note: Answer all three questions. **3X8 = 24**

Each question has its own choice and carries eight marks.

6. Explain construction and working of Repulsion Type Moving Iron Measuring Instrument.

   (OR)

   Explain the construction and working of Dynamometer Type Measuring Instrument.

7. Explain the first aid methods to be followed after electrocuted.

   (OR)

   Explain the procedure of pipe earthing with diagram.
8. Explain the working of PN junction diode with forward bias and reverse bias.

   (OR)

   Explain the formation of PNP and NPN transistors.

Course Title	Course Code	Periods/Week	Periods per Semester
Basic Thermodynamics	M-304	04	60

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M))
1	Fundamentals of Thermodynamics	12	14	02	1	
2	Laws of Perfect Gases	10	14	02	1	
3	Thermodynamic Processes on Gases	16	14	02	1	01
4	Air Standard Cycles	12	14	02	1	
5	Calorific Values of Fuels	10	14	02	1	
	Total	**60**	**70+10**	**10**	**05**	**01**

Note: 10 Marks higher order question may be given from Chapter- 3 or Chapter - 4.

Course Objectives and Course Outcomes

Course Objectives	Upon completion of the course the student shall be able to: Analyse the Thermodynamic Processes ,Air Standard Cycles and Fuels for Combustion		
Course contents		Upon completion of the course the student shall be able to:	
	CO1	M-304.1	Explain the basics and laws of thermodynamics and solve problems on thermodynamic laws
	CO2	M-304.2	Apply Gas Laws to solve problems in thermodynamics
	CO3	M-304.3	Solve the problems on Thermodynamic Processes.
	CO4	M-304.4	Discuss Air Standard Cycles in order to compare with the actual cycles used in various thermodynamic systems
	CO5	M-304.5	Explain different methods to determine the calorific values of fuels.

PO-CO Mapping

Course Code: 304		Course Title: Basic Thermodynamics No of COs:5			No of Periods: 60
PO No	Mapped with CO Number	CO Periods addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		
PO 1	CO1 TO CO5	34	56.67	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO 2	CO3, CO4	16	26.67	2	
PO 3					
PO 4	CO5	05	08.33	1	
PO 5					
PO 6					
PO 7	CO1, CO3, CO4	05	08.33	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3						1	1	1	
CO2	3							1	1	
CO3	3	02					1	1	1	1
CO4	3	02					1	1	1	1
CO5	3			01				1	1	

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of a Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	**Fundamentals of Thermodynamics**	12	14	03	03	08	-	01	01	01		CO1
2	Laws of Perfect	10	14	03	03	08		01	01	01		CO2

	Gases											
3	Thermodynamic Processes on Gases	16	24	03	03	08	10	01	01	01	01	CO3
4	Air Standard Cycles	12	14	03	03	08		01	01	01		CO4
5	Calorific Values of Fuels.	10	14	03	03	08		01	01	01		CO5
TOTAL		**60**	**80**	**15**	**15**	**40**	**10**	**05**	**05**	**05**	**01**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from the chapter-3 or Chapter - 4. (Here it is taken from the Chapter – 3)

Learning Outcomes

Upon on completion of the course the student shall be able to:

1.0 Fundamentals of Thermodynamics.

1.1 Define the system, boundary, universe and working fluid of a thermodynamic system.
1.2 Explain the three types of thermodynamic systems with examples.
1.3 List the types of thermodynamic properties of a system.
1.4 Explain Extensive properties and Intensive properties with examples.
1.5 Define the terms heat, work, quasi-static work and flow work.
1.6 Define thermodynamic state, path, process and cycle with graphical representations.
1.7 Differentiate reversible and irreversible processes with examples.
1.8 State the conditions for reversibility of a process and thermodynamic cycle.
1.9 Define the Zeroth law of thermodynamics and Thermal equilibrium.
1.10 State first law of thermodynamics for a cycle, its significance, limitations and applications.
1.11 Write non-flow energy equation (NFEE) stating the units of the terms involved and Solve simple problems on non flow energy equation applicable to closed systems.
1.12 Write steady flow energy equation (SFEE) stating the units of the terms involved and Solve simple problems on steady flow energy equation only.
1.13 State Clausius and Kelvin-Planck statements of Second law of thermodynamics – Significance – Applications.
1.14 State the Concept of Entropy.

2.0 **Laws of Perfect Gases.**

2.1 State 1. Boyle's Law 2. Charle's Law 3. Avogadro's Law 4. Regnault's Law and 5. Joule's Law with graphical representations and writes mathematical expressions.
2.2 Define Perfect gas and derive the characteristic gas equation.
2.3 Write universal gas equation.
2.4 State relationship between characteristic gas constant (R), universal gas constant (G) and molecular weight (M).
2.5 Define Specific heat, specific heat at constant pressure (C_p) and specific heat at constant volume (C_v).
2.6 State the reason for C_p is being more than C_v.
2.7 Derive the relationship connecting the two specific heats and characteristic gas constant (R).
2.8 Solve simple problems using gas laws and gas equations.

3.0 Thermodynamic Processes on gases.

3.1 List and define popular thermodynamic processes on gases.
3.2 Draw the Pressure- Volume diagrams for the isochoric, isobaric, isothermal, isentropic, and polytropic processes.
3.3 Draw Temperature - Entropy diagrams for the isochoric, isobaric, isothermal, isentropic, and polytropic processes.
3.4 Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for an Isochoric process.
3.5 Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for an Isobaric process.
3.6 Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for an Isothermal process.
3.7 Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for an isentropic process.
3.8 Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for a Polytropic process.
3.9 Solve simple problems on the isochoric, isobaric, isothermal, and isentropic and polytropic processes to calculate heat transfer, work transfer, change in internal energy, change in enthalpy and change in entropy.
3.10 Explain Hyperbolic process.
3.11 Explain Throttling process
3.12 Explain Free expansion of gases.

4.0 Air Standard Cycles

4.1 Define the term ‘Air Standard cycle’.
4.2 List important air standard cycles and their practical applications.
4.3 State the assumptions made in analysis of ‘Air Standard cycles’.
4.4 Define the term Air Standard efficiency.
4.5 Represent Carnot cycle on p-V and T-s diagrams.
4.6 State the assumptions made in the analysis of Carnot cycle.
4.7 Derive an expression for the air standard efficiency of a Carnot cycle with the help of p-V and T-s diagrams– Simple Problems.
4.8 Represent Otto Cycle on p-V and T-s diagrams.
4.9 State the assumptions made in analysis of Otto Cycle.
4.10 Derive an expression for the air standard efficiency of a Otto Cycle with the help of p-V and T-s diagrams – Simple Problems.
4.11 State the assumptions made in analysis of Diesel cycle.
4.12 Derive an expression for the air standard efficiency of a Diesel cycle with the help of p-V and T-s diagrams– Simple Problems.

5.0 Calorific Values of Fuels

5.1 Define the terms fuel and combustion.
5.2 Classify fuels with examples.
5.3 State the advantages, disadvantages and applications of commonly used solid fuels.
5.4 State the advantages, disadvantages and applications of commonly used liquid fuels.
5.5 State the advantages, disadvantages and applications of commonly used gaseous fuels.
5.6 Compare solid, liquid and gaseous fuels.
5.7 Define the term calorific value of a fuel and types of calorific values.
5.8 Define Higher Calorific and Lower Calorific Values of fuel with units.
5.9 Write the Dulong's formula for calculating the higher calorific value of a fuel and then lower calorific value of the fuel – simple problems.
5.10 Explain the need of proximate and ultimate analysis of fuels.
5.11 Describe the unit and summarize the procedure for the determination of calorific value of the Solid and Liquid fuels with Bomb calorimeter – Simple Problems
5.12 Describe the unit and summarize the procedure for the determination of calorific value of the gaseous fuel with Junker's gas calorimeter – Simple Problems

COURSE CONTENT

1.0 Fundamentals of Thermodynamics.

Definition for system, boundary, surroundings, Universe, Working fluid of a system;
Types of thermodynamic systems: closed, open and isolated systems with examples;
Properties of thermodynamic system: Intensive and Extensive properties with examples;
Definitions of various properties of system like Pressure, Volume, Specific volume, Density, Specific weight, Specific gravity, Temperature , Enthalpy, Internal energy and their units with mathematical expressions .
Definitions for thermodynamic state, path, process and cycle with graphical representations;
Reversible and irreversible processes – Examples – Conditions for reversibility of a process and cycle;
Definitions for heat, work, quasi-static work and flow work - Simple problems on quasi-static work (pdv work)
Statements of Zeroth, First and Second laws of thermodynamics - Significances- PMM1- PMM2- Limitations – State the Applications.
Non flow energy equation **(without proof)** - simple problems on NFEE.
Steady flow energy equation **(without proof)** - simple problems on SFEE only
Definitions of heat engine, heat pump and refrigerating machine. **(No Problems)**
Concept of Entropy – Write the Mathematical Expression for Entropy- Significance.

2.0 Laws of Perfect Gases.

Define Perfect gas - Brief explanation of various perfect Gas Laws - Boyle's law, Charle's Law, Avogadro's Joule's law and Regnault's law- Graphical representations – Mathematical expressions for all the above laws - Simple problems on gas laws.
Derive characteristic gas equation pV = mRT;
Write universal gas equation and state the relationship of Universal gas constant with gas constant and molecular weight of the gas;
Definition of Specific heat of a gas - Specific heat at constant pressure and Specific heat at constant volume for a gas – Change in internal energy – Change in enthalpy – Mathematical expressions for change in internal energy and change in enthalpy of a gas - simple problems.
Derive an expression showing the relationship between the two specific heats and characteristic gas constant;
Simple problems on Characteristic and Universal gas equations;

3.0 Thermodynamic Processes on Gases.

Introduction to popular thermodynamic processes on gases - Isochoric, Isobaric, Isothermal, Hyperbolic, Isentropic, Polytropic and Throttling processes ;

Representation of the thermodynamic processes on Pressure- volume and Temperature – entropy diagrams;

Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for Isochoric, Isobaric, Isothermal, Isentropic, and Polytropic processes. **(Without Proofs);**

Solve simple problems on the isochoric, isobaric, isothermal, and isentropic and polytropic processes to calculate heat transfer, work transfer, change in internal energy, change in enthalpy and change in entropy.

4.0 Air Standard Cycles.

Meaning of air standard cycle- Introduction to important air standard cycles;

Assumption made in the analysis of various air standard cycles– Air standard Efficiency;

Derivation of Carnot cycle efficiency with p-V and T-s diagrams -Problems on Carnot cycle; Derivation of Otto cycle Efficiency with p-V and T-s diagrams - Simple problems on Otto cycle; Derivation of Diesel cycle efficiency with p-V and T-s diagrams - Simple problems on Diesel cycle;

Reasons for the highest efficiency of Carnot cycle over other air standard cycles working between same temperature limits.

5.0 Calorific Values of Fuels.

Definition of fuel and combustion;

Characteristics of fuels;

Types of fuels - solid, liquid and gaseous fuels – Examples;

Advantages, disadvantages, applications of different types of fuels.

Calorific value (Higher and lower) of fuels, Dulong's formula for calculating calorific values - Simple problems;

Need of proximate and ultimate analysis of fuels.

Bomb calorimeter : Unit-description-procedure and write mathematical expression for calculating Calorific values of solid or liquid fuel using Bomb calorimeters – Simple Problems.

Junker's Gas calorimeter: Unit – description – Procedure and write mathematical expression for calculating calorific value of gaseous fuel using Junker's calorimeter– Simple problems;

REFERENCE BOOKS

1. P. K. Nag, Engineering Thermodynamics, 2017, McGraw Hill Education Publishers
2. C. P. Arora, Thermodynamics, 2004, McGraw Hill Education Publishers
3. Thermal Engineering - J.K.Guptha and R. S. Khurmi, 2015, S.Chand & Company

C20-M-304

BOARD DIPLOMA EXAMINATION
D.M.E. – III SEMESTER EXAMINATION
BASIC THERMODYNAMICS

Time : 3 Hours Total Marks: **80**

PART – A

10 X3 = 30

Instructions: *Part A consists of **10** questions. Answer **all** questions and each question carries **three** marks.*

1. State the Kelvin-Plank statement of the second law of thermodynamics and explain with a line diagram.
2. Pressure behind the piston remains constant at 700 kPa while the volume increases from $0.003m^3$ to $0.024m^3$. Determine the work transfer across the boundaries.
3. Define Charles's law and write the equation for Charles's law between two states.
4. State Avagadro's law and calculate the molar volume at NTP conditions.
5. 2 kg of gas occupying 0.7 m^3 had an initial temperature of 15^0C. It was then heated at constant volume until its temperature becomes 135^0C. How much heat was transferred to the gas?
6. Derive an expression for work done in a constant pressure process.
7. Write three assumptions made in the analysis of air standard cycles.
8. Plot the Carnot cycle on Pressure-Volume diagram, Temperature-Entropy diagram and name the thermodynamic processes.
9. Define (a) LCV (b) HCV related to fuels.
10. Write the advantages of liquid fuels over solid and gaseous fuels.

PART – B

5 X 8 = 40

Instructions: *Part B consists of **5 questions.** Each question carries 8 marks and may have sub questions.*

11. A) In a steady flow system, a fluid flows at the rate of 4kg/s. It enters at a velocity of 300m/s and has enthalpy of 2330 kJ/kg at inlet. It leaves the system at a velocity of 150m/s and its enthalpy at outlet is 1656 kJ/kg. During its passage through the system through the system fluid has a loss of heat transfer by 30 kJ/kg to the surroundings. Determine the power of the system in kW. Neglect any change in the potential energy.

(OR)

B) A quantity of gas is contained in a frictionless piston – cylinder system. The pressure is given by

$$P= (8 – 4V)$$

Where p is in bar and V is in m^3. The gas expands from initial volume of 0.06 m^3 to 0.3 m^3 and there is a heat transfer of 105 kJ to the gas. Calculate the change of internal energy.

12. A) An ideal gas is expanded from initial state of 900 kN/m^2 and 0·12 m^3 to final state of 100 kN/m^2 and 0·48 m^3. The temperature change during this process was observed as 160°C. The values of C_p and C_v are 1·025 kJ/kg K and 0·735 kJ/kg K respectively. Find (a) mass of the gas and *(b)* the change in internal energy of the gas.

(OR)

B) 2·5 kg of an idea gas is expanded from a pressure of 700 kPa and volume 1·5 m^3 to a pressure of 140 kPa and volume of 4·5 m^3. The change is internal energy is 500 kJ. Specific heat at constant volume for the gas is 0·719 kJ/kgK. Determine (a) gas constant and (b) initial and final temperatures.

13. A) A quantity of gas has an initial pressure, volume and temperature 140 KN/m^2, 0.4 m^3 and 25^{0}C respectively. It is compressed to a pressure of 1.4MN/m^2 according to the law $PV^{1.25}$ = constant. Determine: (a) Work transfer to the gas
(b) Heat transfer from the gas
(c) Change in entropy

Take C_p = 1.041 kJ/kg K and C_v = 0.743 kJ/kg K

(OR)

B) 2 kg of air at 10 bar and 327^0 C expands adiabatically to a pressure of 1 bar. Determine (a) Final volume (b) Final temperature (c) Work energy transferred during the process (d) Change in internal energy and (e) Change in enthalpy

For air C_p = 1.005 kJ/kg K and R = 0.287 kJ/kg K

14. A) In an ideal Otto cycle the air at the beginning of isentropic compression is 1 bar and 15^0 C. The ratio of compression is 8. The heat added is 1008 kJ/kg during constant volume process. Take γ = 1.4; C_v = 0.714 kJ/kg K
Determine (a) Maximum temperature in the cycle
(b) The air standard efficiency
(c) The work done per kg of air
(d) The heat rejected per kg of air

(OR)

B) Derive an expression for air standard efficiency of Diesel Cycle in terms of compression ratio and cut-off ratio.

15. A) Explain the working of Bomb calorimeter with a line diagram and write an expression to find the Higher Calorific Value.

(OR)

B) Explain the working of Junkers gas calorimeter with a line diagram and write an expression to find the Higher Calorific Value.

PART – C

1X 10 = 10

Instructions: Answer the One question in *Part C which carries 10 marks.*

16. One kg of air initially at 0.7 MPa, 20^0C changes to 0.35 MPa, 60^0C by three reversible non-flow processes as shown in the figure. Process 1-a-2 consists of a constant pressure expansion followed by a constant volume cooling process 1-b-2, an isothermal expansion followed by a constant pressure expansion and process 1-c-2 an adiabatic expansion followed by a constant volume heating.

    Analyse the changes of internal energy, enthalpy and entropy for each process, the work transfer and heat transfer for each process. Take C_p = 1.005 and C_v = 0.718 kJ/ kg K and assume the specific heats to be constant.

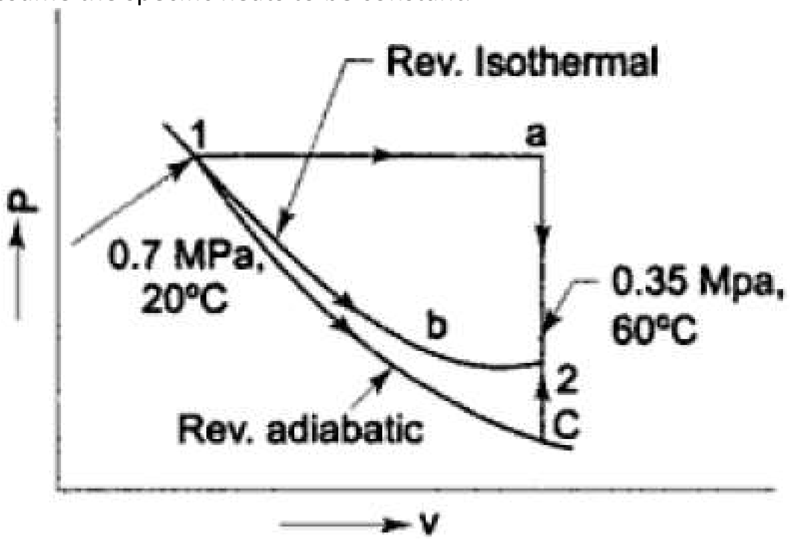


Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-304 :: BASIC THERMODYNAMICS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.8
Unit Test – II	From 3.9 to 5.12

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	**Fundamentals of Thermodynamics** , Laws of Perfect gases, Thermodynamic Processes on Gases	R,U	4	CO1 - CO3
2	**Fundamentals of Thermodynamics**	U	3	CO1
3	**Fundamentals of Thermodynamics**	U	3	CO1
4	Laws of Perfect Gases	U	3	CO2
5	Thermodynamic processes on gases	U	3	CO3
Part - B (24 marks)				
6	**Fundamentals of Thermodynamics**	Ap	8	CO1
7	Laws of Perfect Gases	Ap	8	CO2
8	Thermodynamic Processes on Gases	Ap	8	CO3

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Thermodynamic Processes in Gases, Air Standard Cycles, Calorific Values of Fuels	R,U	4	CO3-CO5
2	Thermodynamic Processes in Gases	U	3	CO3
3	Air Standard Cycles	U	3	CO4
4	Air Standard Cycles	U	3	CO4
5	Calorific Values of Fuels	U	3	CO5
Part - B (24 marks)				
6	Thermodynamic Processes in Gases	Ap	8	CO3
7	Air Standard Cycles	Ap	8	CO4
8	Calorific Values of Fuels	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-304

BOARD DIPLOMA EXAMINATION

D.M.E – Third Semester

Unit Test - 1

BASIC THERMODYNAMICS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Write the formulas for displacement work and flow work.
   (b) In the throttling process the entropy remains constant. (True/False)
   (c) The Universal gas constant value is _________ kJ/kg mole-K.
   (d) What is the characteristic of Isochoric process?
2. What are the intensive properties? Give two examples.
3. In a piston cylinder arrangement air expands from a volume of 0.003 m^3 to 0.024 m^3 at a constant pressure of 690 kN/m^2. The amount of heat rejected through cylinder walls is 6 kJ. Determine the change of internal energy.
4. 0.24 kg of gas at a pressure of 110 kPa and a temperature of 330 K occupies a volume 0.21 m^3. Calculate the value of gas constant and molecular weight of the gas.
5. Represent Isothermal process on p-V and T-s diagrams.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. In a steady flow system, afluid flows at the rate of 4 kg/s. It enters at a velocity of 300 m/s and has enthalpy of 2330 kJ/kg at inlet. It leaves the system at a velocity of 150 m/s and its enthalpy at outlet is 1656 kJ/kg. During its passage through the system fluid has a loss of heat transfer by 30 kJ/kg to the surroundings. Determine the power of the system in kW. Neglect any change in the potential energy.

   (OR)

   Apply the steady flow energy equation and find the heat transfer in the boiler and the exit velocity in the nozzle.
7. 2 kg of an ideal gas is heated from 25^0C to 105^0C. Assuming R = 0.265 kJ/ kg-K and γ = 1.18 for the gas, find (a) specific heats (b) change in internal energy and (c) change in enthalpy.

   (OR)

   An ideal gas is expanded from 400 kN/m^2 and 0.04 m^3 to 120 kN/m^2 and 0.1 m^3. The temperature fell down during the process was observed as 150^0C. If the values of C_P and C_V are 1.025 kJ/kg K and 0.726 kJ/kg K respectively. Find (a) the change in internal energy (b) the mass of the gas.

8. Represent isobaric process on p-V and T-s diagrams and Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for a isobaric process.

   (OR)

   Represent isentropic process on p-V and T-s diagrams and Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for an Isentropic process.

C20-M-304

BOARD DIPLOMA EXAMINATION
Unit Test – 2
D.M.E – Third Semester
BASIC THERMODYNAMICS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Write an expression for change entropy for constant pressure process.
   (b) Carnot cycle consists of two adiabatic and two isothermal processes. (True/False)
   (c) In the diesel cycle the heat is added at constant ____________ process.
   (d) Write the formulae for HCV of a fuel.
2. If 0.05 kg of gas is heated from 25^0 C to 150^0 C, what is the change of entropy, if the process is carried out at constant volume? Assume C_V = 0.9 kJ/ kg K.
3. A gas engine working on Otto cycle has a cylinder diameter if 180 mm and a stroke of 320 mm; the clearance volume is 0.0022 m^3. Find the air standard efficiency assuming γ = 1.4.
4. Show the Carnot cycle on p-V diagram and T-s diagram.
5. Write the advantages of liquid fuels over solid and gaseous fuels.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. One kg of air at a pressure of 10 bar and a temperature of 373 K undergoes a reversible process which may be represented by $pV^{1.1}$ = constant. The final pressure is 2 bar. Assume R =0.287 kJ/kg K and γ = 1.4, find (a) final volume (b) final temperature and (c) increase in entropy.

   (OR)

   Represent polytropic process on p-V and T-s diagrams and Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for a polytropic process.

7. Derive an expression for air standard efficiency of an Otto cycle. State the air standard assumptions.

   (OR)

   An engine operating on the ideal Otto cycle has a bore of 0.1 m a stroke of 0.127 m and compression ratio 7. At the beginning of compression stroke the cylinder contains air at 288.6 K and 100 kPa, if the maximum cycle temperature 1923 K. Determine (a) The pressure, volume and temperature at main points (b) The air standard efficiency and (c) Heat supplied and heat rejected per kg of air.
8. Explain the working of Bomb calorimeter with a line diagram and write an expression to find the Higher Calorific Value.

   (OR)

   Explain the working of Junkers gas calorimeter with a line diagram and write an expression to find the Higher Calorific Value.

Course Title	Course Code	Periods/Week	Periods per Semester
Strength of Materials	M-305	04	60

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Simple Stresses and Strains	20	17	3	1	*
2	Strain energy	09	09	3	-	
3	Shear Force and Bending Moment	15	19	1	2	
4	Theory of Simple Bending & Deflection of Beams	10	14	2	1	*
5	Torsion in Shafts	06	11	1	1	
	Total	**60**	**70+10**	**10**	**5**	**1**

Note: * 10 marks higher order question may be given from either from Chapter 1 or Chapter 4.

Course Objectives and Course Outcomes

Course Objectives			Upon the completion of course the student shall be able to understand the concepts of stress and strain and to find them in structural members viz., bars, beams, shafts for given conditions.
Course Outcomes	CO1	M-305.1	Explain the concept of stress and strain and various constituent relations
	CO2	M-305.2	Calculate the resilience in the bars
	C03	M-305.3	Calculate and draw the shear force and bending moment for the Cantilever, Simply Supported and Overhanging Beams subjected to point loads and UDL.
	CO4	**M-305.4**	Calculate the Flexural stresses in Cantilever and Simply Supported Beams of various cross-sections
	CO5	**M-305.5**	Derive the expression for Torsional Stresses in circular shafts and find them in solid and hallow circular shafts

PO-CO Mapping

Course Code : M-305	Course Title Strength of Materials	Number of Course Outcomes: 06			No. of Periods 60
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1 – CO5	30	50.00	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1 – CO5	20	33.33	2	
PO3					
PO4					
PO5					
PO6					
PO7	CO1 – CO5	10	16.67	1	

CO /PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2					1	1	2	
CO2	3	2					1	1	2	
CO3	3	2					1	1	2	
CO4	3	2					1	1	2	1
CO5	3	2					1	1	2	1
CO6	3	2					1	1	2	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Suggestive activities for further strengthening of CO-PO mapping:

1. The task of identifying the type stress developed in various machine elements through animated video may be carried in the class room.
2. Students shall be asked to substantiate the size of a particular machine element based the capacity of the machine.

Blue Print of the Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Simple Stresses and Strains	20	27	9		8	10	3		1	1	CO1
2	Strain energy	09	09	9	-	-	-	1	2	-	-	CO2
3	Shear Force and Bending moment	15	19	3		16	-	1		2	-	CO3
4	Theory of Simple bending & Deflection of Beams	10	14	3	03	8	-	1	1	1	-	CO1, CO4
5	Torsion in Shafts	06	11	-	03	8	-	-	1	1	-	CO1, CO5
TOTAL		**60**	**80**	**24**	**06**	**40**	**10**	**06**	**04**	**05**	**01**	

Note * 10 marks higher order question may be given from either Chapter 1 or Chapter 4.. (Here it is taken from chapter -1)

LEARNING OUTCOMES:

Upon the completion of course the student shall be able to

1.0 Simple Stresses and Strains

1.1 Classify the forces on different criteria

1.2 Differentiate the rigid body from the deformable body

1.3 Explain the concept of stress and strain

1.4 Draw the stress – strain diagrams for ductile and brittle materials subjected to tensile forces.

1.5 Define elastic constants and Poisons ratio.

1.6 Write expressions relating the elastic constants and Poisons ratio.

1.7 Calculate the stresses and strains in bars of uniform and varying cross – section subjected to end forces and intermediate forces.

1.8 Calculate the stresses and strains in composite bars .

1.9 Calculate the thermal stresses in uniform and composite Bars

1.10 Numerical problems related to the above cases.

2.0 Strain Energy

2.1 Understand the concept of strain energy and define the terms related to it

2.2 Derive the expressions for the stresses developed in bars subjected to Gradual, Sudden and Impact loads.

2.3 Calculate the stresses and strains in the bars using the strain energy concepts.

3.0 Shear Force and Bending Moment

3.1 State the concept of beams

3.2 Classify beams based on supports.

3.3 Define the shear force and bending moment in beams

3.4 Calculate the Shear Force and Bending Moment in Cantilever, Simply Supported subjected to Concentrated, UDL and combined loads. Draw their variation along the length of the beams.

3.5 Numerical problems related to the above cases.

4.0 Theory of Simple Bending and Deflection of Beams

4.1 Define a) Neutral layer, b) Neutral Axis, c) Radius of curvature d) Moment of Resistance, e) Bending stress f) Moment of Inertia g) Section Modulus f) Flexural Rigidity

4.2 Derive the expression for the Bending Moment (Flexural Formula) by stating the assumptions.

4.3 Calculate the bending stresses in beams of various cross-sections.

4.4 Define the slope and deflection of beam

4.5 Write the expressions for slope and deflection in cantilever and simply supported beams for standard cases.

4.3 Numerical problems related to the above cases.

5.0 Torsion in Shafts

5.1 Derive the expression for the Torsional equation by stating the assumptions.

5.2 Calculate the stresses developed in the solid and hallow circular shafts

5.3 Calculate the dimensions of the solid and hallow circular shafts subjected to torsion and also check them for rigidity.

5.4 Compare the strength and weight of the solid and hallow shafts for the given conditions.

5.5 Numerical problems related to the above cases.

COURSE CONTENTS:

1 Simple Stresses and Strains

Classification of Loads and their effects - Difference between rigid body and deformable body - Concept of stress and strain - Hooke's law - - Stress-strain diagrams for ductile and brittle materials - elastic constants – Poisons ratio - Factor of safety - Relation between elastic constants Stresses and strains in the bars - Stresses and strains in uniform bars and varying cross-section subjected to end point loads and intermediate loads - Stresses and strains in the composite bars - Thermal stresses in uniform and composite bars - Related numerical problems on the above cases.

2 Strain Energy

Strain energy or resilience, proof resilience and modulus of resilience - Strain energy in the bars of uniform cross-sections - Derivation of expression for the stress in the bars of uniform cross-section using strain energy concept for the following cases - i) Gradually applied load, ii) Suddenly applied load, iii) Impact/shock load - Related numerical problems on the above cases.

3 Shear Force & Bending Moment Diagrams

Classification of beams based on supports - Types of Loads – Concentrated load, UDL and UVL - Definition and explanation of shear force and bending moment - Calculation of shear force and bending moment at any point along the length of the beam and drawing the diagrams by the analytical method only for the following cases - a) Cantilever with concentrated and uniformly distributed loads, b) Simply supported beam with concentrated and uniformly distributed loads, - Finding the location of points of contraflexure.

4 Theory of Simple Bending and Deflection of Beams

Explanation of the terms - a) Neutral layer, b) Neutral Axis, c) Radius of curvature d) Moment of Resistance, e) Bending stress f) Moment of Inertia g) Section Modulus f) Flexural Rigidity - Assumptions in theory of simple bending-Derivation of Bending / Flexural Equation $M / I = \sigma / Y = E / R$ - Problems on calculating the bending stress, dimensions of the cross-section of beam, safe load and radius of curvature - Definition of slope and deflection of beams - Deflection formulae without proof for cantilever and simply supported beams with point load and uniformly distributed load only (Standard cases only)

5 Torsion in Shafts

Definition and functions of shaft - Calculation of polar moment of inertia and polar section modulus for solid and hollow shafts - Assumptions in simple torsion - Derivation of torsional formula $T / J = \tau / R = G\theta / L$ - Problems on design of shaft based on strength and rigidity - Numerical Problems related to comparison of strength and weight of solid and hollow shafts.

REFERENCE BOOKS:

1.	Strength of Materials	by	B.C.Punmia	
2.	Strength of Materials	by	R.S. Khurmi	S & Chand Company
3.	Mechanics of Materials	by	Gere	McGH

C-20 M-305

BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER
DME – III-SEMESTER
STRENGTH OF MATERIALS

PART – A

Instructions: Answer all the questions **3X10=30**
Each question carries THREE marks

1. Draw the stress-strain diagram for a ductile material and locate the salient points on it
2. Define the following terms (a) Factor of safety (b) Poisson's ratio
3. Define (a) Stress (b) Strain (c) Young's Modulus
4. Define Resilience, Proof Resilience and Modulus of Resilience
5. Derive an expression for the strain energy of a uniform bar subjected to tension
6. A bar of 20 mm diameter is subjected to an axial load of 100 kN applied gradually. Calculate the strain energy.
7. Define the terms Shear Force and Bending Moment
8. State any three assumptions made in the derivation of bending equation.
9. A simply supported beam of 1.5m is subjected to a central point load 10KN.Find the deflection of the beam, if Young's modulus is 200GN/M^2 and Moment of Inertia for the beam is $12X10^6mm^4$
10. A solid circular shaft running at 300rpm transmits 200KW.Corresponding shear stress produced is 100 N/mm^2. Calculate the suitable diameter of the shaft.

PART - B

Instructions: Answer all the questions **5X8=40**

Each question carries EIGHT marks

11(a) A test bar of certain material 40mm dia when subjected to an axial pull of 500KN recorded an extension of 0.34mm on a gauge length of 150mm and decrease of 0.022mm in diameter. Find the poissions ratio and three elastic constants.

OR

(b) A solid steel bar 500mm long and 70mm dia is placed inside an aluminium tube having 75mm inside dia and 100mm outside dia of equal length of steel. An axial load of 600KN is applied to the bar and the ends of cylinder are fixed rigidly. Find the stress developed in the steel bar and the aluminium tube. Take $E_s=210X10^3N/mm^2$and $E_{al}=70X10^3N/mm^2$.

12(a) A beam of length 2 m is fixed at one end and carries loads of 12 kN, 10 kN at a distance of 1 m and 2 m from the fixed end. Draw SFD and BMD.

OR

(b) A cantilever beam of length 5 m carried an UDL of 2 kN /m over 2 m from the fixed end and a point load of 5 kN at free end. Draw SFD and BMD.

13(a) A beam of length 1.2m is simply supported at its ends and carries two loads of 3.5KN and 4KN at a distance of 0.4m and 0.8 m from the left end support. Draw SFD and BMD

OR

(b) A beam of 10m length simply supported at its ends carries a load of 20 KN/M over the left hand half of the span and a point load of 30KN at the mid span. Draw Shear Force and Bending Moment diagrams.

14(a) A timber beam of rectangular section is to support a load of 20KN/M uniformly distributed over a span of 3.6m.If the depth of the section is to be twice the width and the stress in the timber is not to exceed 7N/mm^{2,} find the dimensions of the beam.

OR

(b) A timber beam 150X300 mm in section, supports a central point load on a span of 4m.If the max bending stress is 8 N/mm^2, what is the max deflection. Take E=0.1X10^{5}N/mm^2.

15(a) A solid shaft of 220mm dia is to be replaced by a hallow shaft. The ratio external dia to internal dia being 2:1.Find the size of hallow shaft, if the max shear stress is to be same as for the solid shaft. What percentage of economy in weight this change brings.

OR

(b) Derive the equation T/J=fs/R=Cθ/L

PART - C

Instructions: Answer the following One question which carries TEN marks. 1X10=10

16. A bar shown in the fig. is subjected to a tensile load of 100 kN. Find the diameter of the middle portion if the stress is limited to 150MPa in that portion. Also find the length of the middle portion if the total elongation of the bar limited to 0.2 mm. Take E = 200 GPa.

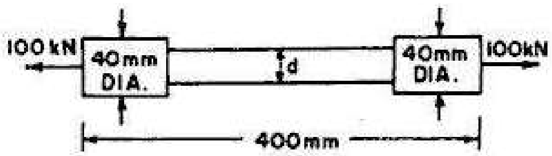


Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-305 :: STRENGTH OF MATERIALS

Unit Test	**Learning Outcomes to be covered**
Unit Test – I	From 1.1 to 2.3
Unit Test – II	From 3.1 to 5.5

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO1 – CO2
2	Simple stresses & strains	U/R	3	CO1
3	Simple stresses & strains	U	3	CO1
4	Simple stresses & strains	U	3	CO1
5	Strain Energy	U/R	3	CO2
Part - B (24 marks)				
6	Simple stresses & strains	U/Ap	8	CO1
7	Simple stresses & strains	U/Ap	8	CO1
8	Strain Energy	U/Ap	8	CO2

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO3 – CO5
2	Shear Force & Bending Moment in beams	U/R	3	CO3
3	Flexural Stresses in Beams	U/R	3	CO4
4	Deflection of Beams	U/R	3	CO4
5	Torsion in shafts	U/R	3	CO5
Part - B (24 marks)				
6	Shear Force & Bending Moment in beams	U/Ap	8	CO3
7	Flexural Stresses in Beams	U/Ap	8	CO4
8	Torsion in shafts	U/Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-305

BOARD DIPLOMA EXAMINATION,

UNIT TEST - 1

STRENGTH OF MATERIALS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4 Questions carry 3 marks each*

1. (a) State Hooke's Law

   (b) Define Poisson's Ratio

   (c) Define Bulk Modulus

   (d) Define Modulus of Resilience

2. Draw the stress-strain diagram for a typical ductile material and locate the salient points on it

3. A bar of 25 mm diameter is tested in tension. It is observed that when a load of 60 kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0045 mm. Find Poisson's ratio.

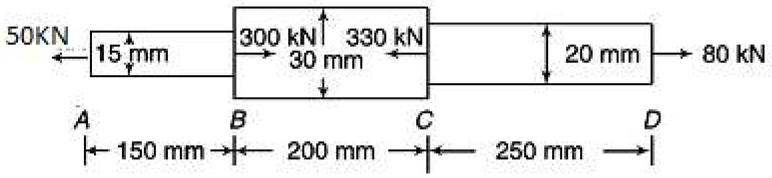
4. A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40 kN. The modulus of elasticity for steel may be taken as 200 kN/mm^2. Find the elongation and strain in the bar due to applied load.

5. Define (a) Resilience (b) Proof resilience

PART – B

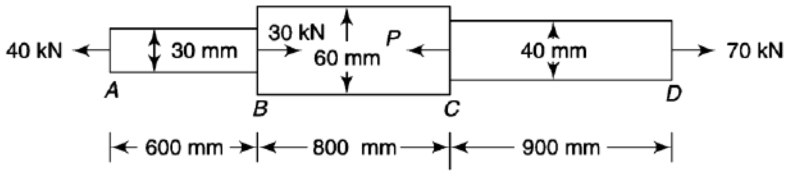
Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A steel circular bar has three segments as shown in the fig. Determine the total elongation of the bar. Take E = 210 GPa.



(OR)

A circular steel bar having three segments is subjected to various forces at different cross-sections as shown in the fig. Determine the necessary force to be applied at section C for the equilibrium of the bar. Also find the total elongation of the bar. Take E = 202 GPa.



7.

A concrete cylinder of diameter 150 mm and length 300 mm when subjected to an axial compressive load of 240 kN resulted in an increase of diameter by 0.127 mm and decrease in length by 0.28 mm. Find the Poisson's ratio and values of three Elastic Constants.

(OR)

A 15 mm diameter Steel rod passes centrally through a copper tube 30 mm external diameter and 20 mm internal diameter. The composite bar is rigidly joined at both the ends. If the temperature of the assembly is raised by 100°c, calculate the stresses developed in Steel and copper.

Take $E_s = 2\times10\, N/mm^2$ $E_c = 1.05\times10^5\, N/mm^2$

$\alpha_s = 12\times10^{-6}/^0c$, $\alpha_c = 17.5\times10^{-6}/^0c$.

8.

A Mild Steel bar of length 3 m and diameter of 50 mm hangs vertically and a load of 200 kN falls on a collar attached to the lower end. Find the maximum stress when

a) Height of fall is 150 mm

b) Load is applied suddenly with out impact

c) Load is applied gradually. Take E = 2 x 10^5 N/mm^2

(OR)

A bar 3.2 m length and 16 mm in diameter, hangs vertically and has a collar attached at its lower end. Determine the maximum instantaneous stress developed in the bar when a height of 80KN falls from a height of 32 mm on the collar. What will be the stress in the bar if the same load is applied suddenly and gradually on the collar? Take E = 205 GPa.

C20-M-305

BOARD DIPLOMA EXAMINATION,
D.M.E – Third Semester
UNIT TEST - 2
STRENGTH OF MATERIALS

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Define deflection of a beam
   (b) Define Section Modulus
   (c) Define Polar section modulus
   (d) Define bending moment in beams
2. Classify the beams based on the supports
3. List the assumptions made in the derivation of flexural equation
4. Find the maximum deflection of a cantilever beam of length 2m subjected to a UDL of 600N/m throughout its length. The cross-section of the beam is a rectangle of 40 mm x 20 mm. Take E = 200 GPa.
5. A shaft of diameter 30 mm transmits 10 kW power at 300 rpm. Find the stress developed in the shaft.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A cantilever beam of length 2m is subjected to a UDL of 500 N/m over a length of 1m from the fixed end and also a point load of 900 N at the free end. Draw the shear force and bending moment along the length of the beam.

(OR)

A simply supported beam of length 3m is subjected to a UDL of 600 N/m throughout its length and a mid-point load of 900N. Draw the shear force and bending moment along the length of the beam.

7. A Rectangular beam 300 mm deep is Simply Supported over a span of 4 meters. What uniformly distributed load per metre the beam may carry, if the Bending Stress is not to exceed 120 N/mm^2. Take $I = 8 \times 10^5\ mm^4$.

(OR)

A Cantilever beam of length 6 meters carries a uniform distributed load of 20 kN/m over the entire span. Calculate the dimensions of the beam, if the maximum Stress induced is not to exceed 80 N/mm^2. The ratio of depth to width is 2.

8. A power of 20 kW is to be transmitted at 360rpm. Find the diameter of the shaft if the allowable shear stress of the shaft material is 40 MPa and the permissible angle of twist per unit length of the shaft is 2^0.

(OR)

A solid shaft is transmitting 10 kW power at 420 rpm. If the same power is to be transmitted by a hallow shaft having external diameter as twice the internal diameter, find its dimensions. Also find the percentage of save in the cost when the solid shaft is replaced with the hollow shaft for the same material, length and power.

Course Title	Course Code	Periods per Week	Periods per Semester
Production Technology - I	M–306	04	60

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Lathe & Lathe Work	18	17	03	01	
2	Shaper, Slotter, Planner	14	17	03	01	01
3	Broaching Machine	06	08	-	01	
4	Cutting Fluids, Coolants and Lubricants	06	06	02	-	-
5	Welding	16	22	02	02	
	Total	**60**	**70+10**	**10**	**05**	**01**

Note: 10 Marks higher order question may be given from Chapter - 1 or Chapter - 2.

Course Objectives and Course Outcomes

<table>
<tr><td colspan="4">Upon completion of the course the student shall be able to</td></tr>
<tr><td rowspan="2">COURSE OBJECTIVES</td><td colspan="2">01</td><td>Describe the construction details and various operations on Lathe Machines, Shaper, Slotter, Planer</td></tr>
<tr><td colspan="2">02</td><td>Describe the construction details and various operations on Broaching machine
Describe the various welding operations</td></tr>
<tr><td rowspan="5">COURSE OUT COMES</td><td>CO1</td><td>M306-1</td><td>Describe various operations on 1.Lathe Machine, 2.Shaper, 3.Slotter and 4.Planer</td></tr>
<tr><td>C02</td><td>M306-2</td><td>Describe various operations on Broaching Machine</td></tr>
<tr><td>C03</td><td>M306-3</td><td>Discuss the appropriate cutting fluids, coolants and Lubricants depending upon the application.</td></tr>
<tr><td>C04</td><td>M306-4</td><td>Explain the working principle of various welding processes.</td></tr>
<tr><td>C05</td><td>M306-5</td><td>Describe the welding operations that are used in different welding processes.</td></tr>
</table>

PO-CO Mapping

Course Code: M-306	Course Title: Production Technology-I	No of Cos:5			No. Of periods:60
POs	Mapped with CO No	CO Periods Addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		>40% Level 3 (Highly Addressed)
PO1	CO1 – CO5	40	66.67	3	25% to 40% Level 2 (Moderately Addressed)
PO2					5% to 25% Level 1 (Low Addressed)
PO3					<5% Not Addressed
PO4	CO1 – CO5	10	16.67	1	
PO5					
PO6					
PO7	CO1 – CO5	10	16.67	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			1			1	03	1	1
CO2	3			1			1	03	1	1
CO3	3			1			1	03	1	1
CO4	3			1			1	03	1	1
CO5	3			1			1	03	1	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of Question Paper

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Lathe & Lathe Work	18	27	06	03	08	10	02	01	1	01	CO1
2	Shaper, Slotter, Planner	14	17	06	03	08		02	01	01		CO1
3	Broaching Machine	06	08			08				01		CO2
4	Cutting Fluids, Coolants and Lubricants.	06	06	03	03			01	01			CO3
5	Welding	16	22	03	03	16		01	01	02		CO4,C05
TOTAL		**60**	**80**	**18**	**12**	**40**	**10**	**06**	**04**	**05**	**01**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter - 1 or Chapter -2 (Here it is taken from the Chapter – 1).

Learning Objectives:
Upon completion of the course the student shall be able to

1.0 .Lathe and Lathe Work

1.1. State a)The working principle of lathe machine
b) The specifications of lathe machine
1.2. List a) The six types of lathe machines
b) List any three work holding devices
1.3. Describe the working of Lathe with legible sketch
1.4. Explain **a)** The procedure for Turning, Facing , taper turning, thread cutting, knurling, forming, drilling, boring, reaming, key way cutting operations on Lathe machine.
b) The methods of taper turning on lathe machine
1.5. Calculate included angle for taper turning
1.6. Describe the nomenclature of single point cutting tool with the help of legible sketch.
1.7. State the significance of various angles

2.0. Shaping, Slotting, and Planning

2.1. Describe a) The construction and working principle of shaper with legible sketch
b) The construction and working principle of slotter with legible sketch
c) The construction and working principle of planer with legible sketch
2.2. List the operations performed on shaper, slotter, and planer.
2.3. State a) the specifications of shaper.
b) The specifications of slotter.
C) The specifications of planer.
2.4. Explain a) The principle of quick-return mechanism as applied to shaper and Planer
b) Crank & slotted lever mechanism for obtaining the quick-return motion.
c) Whit worth mechanism for obtaining the quick-return motion.

3.0. Broaching Machines

3.1. Define Broaching

3.2. Mention horizontal type (single ram& duplex ram) vertical type, pull up, pull down, and push down Broaching machines

3.3. Explain a) The working principle of vertical type Broaching machine with the help of neat Sketch
b) The working principle pull up, pull down, and push down Broaching machines with the help of neat sketch

3.4. List Elements of broach tool

3.5. Explain nomenclature of broach teeth

3.6. List three types of broach teeth

3.7. Mention three different materials used for broach tool

3.8. State the advantages & limitations of broaching

4.0. Cutting Fluids, Coolants & Lubricants

4.1. State the properties of cutting fluids and coolants.
4.2. List any three types of cutting fluids
4.3. State the composition of cutting fluids and coolants
4.4. List three relative merits of the cutting fluids and coolants.
4.5. Select the proper cutting fluids and coolants for various machining operations.
4.6. List the solid, liquid and Gaseous lubricants
4.7. List any six properties of lubricants.
4.8. List any six applications of Lubricants.

5.0. Welding

5.1. State a) the necessity of welding
b) The advantages and limitations of welding.
c) The principle of flame cutting.
d) The relative advantages of flame cutting over other types of cutting.
5.2. List six welding processes.
5.3. Explain a) the principle of arc welding.
b) The principle of gas welding.
c) The principles of soldering & brazing.
d) Non-destructive testing of welds.
e) The principle of TIG and MIG welding.
f) Different welding procedures in arc and gas welding.
5.4. List a) The tools and equipment of arc welding.
b) The tools and equipment of oxy-acetylene welding.
5.5. Identify a) proper electrodes used for given metals
b) correct soldering materials for a given job
5.6. Define the terms soldering & brazing.
5.7. Differentiate soldering from brazing.
5.8. List a) The gas cutting equipment.
b) Six various defects in welds.
c) Three reasons for welding defects
d) Modern welding techniques Submerged, CO_2, Atomic – Hydrogen, ultrasonic welding

COURSE CONTENT

1.0 Lathe and Lathe Work

Working Principle of Lathe - types of Lathes - Engine lathe – construction details and specifications. Nomenclature of single point cutting tool, geometry, tool signature, functions of tool angles. General and special operations – (Turning, facing, taper turning thread cutting,
knurling, forming, drilling, boring, reaming, key way cutting.) Methods of taper turning – explanation. Lathe accessories viz., work holding devices and tool holding devices.

2.0 Shaping, Slotting, and Planning

Introduction to shaper, slotter, planer. Constructional details and specifications of shaper, slotter and planer. Operations on these machines. Tools and materials. Driving mechanisms -
quick return arrangement - crank & slotted lever mechanism, whit worth mechanism.

3.0 Broaching Machines

Introduction to broaching. Types of broaching machines – horizontal type (single ram & duplex ram) vertical type, pull up, pull down, and push down. Elements of broach tool, broach teeth details – nomenclature –types – tool material.

4.0 Cutting Fluids, Coolants & Lubricants

Introduction to coolants and lubricants. Types of cutting fluids. Properties and functions of fluids and coolants. Fluids and coolants required in turning, drilling, shaping, sawing & Broaching. Selection of cutting fluids, methods of application of cutting fluid. Classification of lubricants (solid, liquid, gaseous) Properties and applications of lubricants.

5.0 Welding

Introduction Classification of welding processes. Advantages and limitations of welding. Principles of arc welding. Arc welding equipment. Choice of electrodes for different metals. Principle of gas (oxy – acetylene) welding. Equipment of gas welding. Welding procedures (arc& gas) Soldering and Brazing techniques. Types and applications of solders & fluxes. Various flame cutting processes. Advantages and limitations of flame cutting. Defects in welding. Testing and inspection. Modern welding methods, (Submerged, CO_2, Atomic – Hydrogen, ultrasonic welding), Brief description of MIG & TIG Welding.

REFERENCE BOOKS

1.	Welding Technology	by Richard L Little (Tata McGraw Hill)
2.	Elements of Work Shop Technology vol. I & II	by Hazra Choudry (Media Promoters and Publishers Pvt. Ltd.)
3.	Engineering Metrology	by R K Jain (Khanna Publications)
4.	Welding Technology	by R S Parmar (Khanna Publications)
5.	Manufacturing Technology (volume-1)	by P N Rao (Tata McGraw Hill)

C20-M-306

BOARD DIPLOMA EXAMINATION

MODEL QUESTION PAPER

DME - THIRD SEMESTER EXAMINATION

PRODUCTION TECHNOLOGY- I

Time: 3 hours] [Total Marks : 80

PART-A **3x10=30**

Instructions: (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1. State the working principle of lathe.
2. List out any six lathe operations.
3. List out any six work holding devices used in lathe.
4. List out the different parts of a shaper.
5. State the main differences between planner and shaper.
6. How do you specify a shaper.
7. Mention three different materials used for broach tool
8. List three relative merits of the cutting fluids and coolants.
9. State the necessity of welding
10. Write any three differences between soldering and brazing.

PART-B **8x5=40**

Instructions: (1) Answer **all five** questions.

(2) Each question carries **eight** marks.

11. a)Describe the functions of lathe bed and lathe head stock with the help of sketch.

(OR)

b) Explain any two methods of taper turning carried out on lathe machine.

12. a)Explain the whit worth quick return mechanism of a slotter with line diagram.

(OR)

b)Explain the different operations performed by the shaper?

13. a)Draw internal pull broach and show various elements on it and explain them in brief.

(OR)

b)Draw a neat sketch of horizontal broaching machine and explain its working.

14. a)Describe with the help of sketches, the three types of Oxy-acetylene flames and their applications

(OR)

b)Explain the principle of operation gas welding with a neat sketch and write its advantages and applications?

15. a)Describe the procedure for submerged arc welding with a neat sketch. State its advantages.

(OR)

b) Explain the principle of ultrasonic welding with a neat sketch. State its advantages

PART-C **1x10=10**

Instructions: **1)** Answer the following One question which carries TEN marks.

16. Analyse the special operations to be performed on engine with additional attachments.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-306 :: PRODUCTION TECHNOLOGY - I

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.4
Unit Test – II	From 3.1 to 5.8

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Lathe and Lathe Work, Shaping, Slotting, and Planning	R,U	4	CO1, CO2
2	Lathe and Lathe Work	U	3	CO1
3	Shaping, Slotting, and Planning	U	3	CO1
4	Shaping, Slotting, and Planning	U	3	CO2
5	Lathe and Lathe Work	U	3	CO2
Part - B (24 marks)				
6	Lathe and Lathe Work	Ap	8	CO1
7	Shaping, Slotting, and Planning	Ap	8	CO2
8	Lathe and Lathe Work	Ap	8	CO2

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Broaching machines, Cutting Fluids, Coolants & Lubricants, Welding	R,U	4	CO3,CO4,C05
2	Cutting Fluids, Coolants & Lubricants	U	3	CO3
3	Broaching machines	U	3	CO4
4	Welding	U	3	CO5
5	Welding	U	3	CO5
Part - B (24 marks)				
6	Broaching machines	Ap	8	CO3
7	Welding	Ap	8	CO4
8	Welding	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-306

BOARD DIPLOMA EXAMINATION
D.M.E – Third Semester

Unit Test - 1
Production Technology – I

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Specification of lathe.

   (b) Lathe cutting tool is a single point cutting tool. (True/False)

   (c) Basic difference between shaper and slotter.

   (d) significance of clearance angle.
2. List out any six lathe operations.
3. List out the different parts of a shaper.
4. State the main differences between planner and shaper.
5. How do you specify a shaper.

PART – B

Instructions: *Part B consists of* ***3*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Describe the functions of lathe bed and lathe head stock with the help of sketch.

(OR)

Explain any two methods of taper turning carried out on lathe machine.

7. Explain the different operations performed by the shaper?

(OR)

Explain the whit worth quick return mechanism of a slotter with line diagram.

8. Draw the line diagram of turret lathe and describe the functions of main parts.

(OR)

With the help of a neat sketch describe the functions of main parts of the lathe.

C20-M-306

BOARD DIPLOMA EXAMINATION
D.M.E – Third Semester

Unit Test - 2
Production Technology – I

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Basic limitation of cutting fluid
   (b) Welding is a permanent joint. (True/False)
   (c) List out fluxes.
   (d) Define welding.
2. List three relative merits of the cutting fluids and coolants.
3. Define broaching
4. List three reasons for welding defects
5. Write any three differences between soldering and brazing.

PART – B

Instructions: *Part B consists of* ***2*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain properties and applications of cutting fluids and coolants.

(OR)

Explain various properties and applications of lubricants.

7. Describe with the help of sketches, the three types of Oxy-acetylene flames and their applications

(OR)

Explain the principle of operation gas welding with a neat sketch and write its advantages and applications?

8. Draw internal pull broach and show various elements on it and explain them in brief.

(OR)

Draw a neat sketch of horizontal broaching machine and explain its working**.**

Course Title	Course Code	Periods/ Week	Periods/Semester
Machine Drawing	M-307	06	90

TIME SCHEDULE

Sl.No	Chapter/Unit Title	Periods	Weightage of Marks	Short answer Questions	Essay type Questions
1	Introduction	06	-	-	-
2	Fastening Devices	24	10	02	-
3	Assembly Drawings	48	40	-	02
4	Piping Layouts and Joints	6	05	01	-
5	Welding Fabrication Drawings	6	05	01	-
	Total	**90**	**60**	**04**	**02**

Note:- In the end examination, candidate has to answer all questions in Part- A and one question out of two in Part-B

I.S/B.S latest specification should invariably be followed in all topics.

Course Objectives and Course Outcomes

<table>
<tr><td rowspan="2">COURSE OBJECTIVES</td><td colspan="3">On successful completion of the course, the students will be able to:</td></tr>
<tr><td colspan="3">1. Familiarize Conventional symbols of mechanical components, Conventional methods of representing threaded fasteners and Riveted joints.
2. Know clear visualization of objects and the proficiency in reading and interpreting assembly drawings
3. Use reinforcing and enhancing the knowledge and skill acquired in the assembly drawings.</td></tr>
<tr><td rowspan="6">COURSE OUTCOMES</td><td colspan="3">On successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td>M 307.1</td><td>Use Conventional symbols as per IS code SP46.</td></tr>
<tr><td>CO2</td><td>M 307.2</td><td>Use the Conventional methods of representing fasteners and joints</td></tr>
<tr><td>CO3</td><td>M 307.3</td><td>Prepare the construction piping layouts and joints</td></tr>
<tr><td>CO4</td><td>M 307.4</td><td>Draw the welded fabrication drawings</td></tr>
<tr><td>CO5</td><td>M 307.5</td><td>Draw the assembly drawing of a machine component for the given details</td></tr>
</table>

PO-CO Mapping

Course Code: M-307	Course Title: Machine Drawing No of Cos:5				No. Of periods:90
POs	Mapped with CO No	CO Periods Addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1 - CO5	60	66.67	3	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2	CO1 - CO5	25	27.77	2	
PO3					
PO4					
PO5					
PO6					
PO7	CO1,CO5	05	05.55	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2					1	3	2	
CO2	3	2					1	3	2	
CO3	3	2					1	3	2	
CO4	3	2					1	3	2	2
CO5	3	2					1	3	2	2

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of Question Paper

S.No	Chapter name	Periods allocated	Weightage allocated	Mark wise distribution of weightage			
				R	U	Ap	An
1	Introduction	06					-
2	Fastening Devices	24	10	5	5		-
3	Assembly Drawings	48	40			40	-
4	Piping Layouts and Joints	6	05	5			-
5	Welding Fabrication Drawings	6	05	5			
TOTAL		**15**	**60**	**15**	**5**	**40**	

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Understand the importance of machine drawing

1.1. Know the importance of Machine drawing.
1.2. Review of 1st angle and 3rd angle Projections
1.3. Review of Orthographic Projections and Sectional Views.

2.0 Know about fastening devices

2.1. Draw the standard thread profiles.
2.2. Draw bolted connections to standard proportions.
2.3. Draw different types of screws.
2.4. Draw different types of rivets and riveted connections.
2.5. Draw different types of keys and cotters.

3.0 Understand the assembly drawing practice and procedure

3.1. List the sequence of steps for preparing assembly drawing.
3.2. Practice the assembly drawing for the given components drawing.
3.3. Prepare the list of parts.

4.0 Understand the piping layouts and joints.

4.1. State the distinction between pipes and tubes.
4.2. Identify the common components of a piping layout.
4.3. Identify the conventional symbols used for the various components of piping layout.
4.4. Prepare single line and double line diagrams of piping layouts.
4.5. Explain the use of packing material in joint.

5.0 Appreciate the welded fabrication drawing.

5.1. Identify the different types of welds and their symbolic representation as per B.I.S., SP-46-2003
5.2. Identify the elements of welding symbol and their standard location on the symbol.
5.3. State welding process to be used, surface contour and finish of weld when given in symbolic form.
5.4. Practice the Preparation of working drawing of welded fabrications.

COURSE CONTENT

1.0 Introduction

1.1. Importance of Machine Drawing.
1.2. Brief revision of 1^{st} and 3^{rd} angle projections
1.3. Understand the concepts of Orthographic projections and Sectional views.

2.0 Fastening Devices

2.1. Temporary and Permanent fastenings and their areas of application-thread nomenclature, forms of screw thread profiles, Metric, B.A., Acme, Knuckle, etc.
2.2. Bolts and Nuts: Specification of bolts and nuts, Different types of bolted joints (like using through bolts, studs, screws etc.,) in different applications. Purpose of lock nuts and their Types.
2.3. Keys and cotters: Types of keys and cotters: Difference between key and cotter -uses.
2.4. Rivets and Riveted joints: Types, proportions and specification of rivets: Different types of riveted joints: Lap, Butt-single row, double row etc., chain and zigzag riveting – calculation of diameter of rivet: Pitch and arrangement of rivets in row – use of standard proportions.

Drawing Plate: 1

1. Exercise on Orthographic projections and Sectional views.
2. Thread Nomenclature and forms of screw thread profiles.
3. Exercises in drawing – bolted connections using standard proportions.
4. Drawing of various types of lock nuts & types of keys indicating their proportionate dimensions.
5. Exercise in drawing riveted joints using standard proportions: Single row, Double row (chain and zigzag) in lap and butt joints (single & double strap).

3.0 Assembly Drawings

3.1. Need and functions of assembly and detailed drawings.
3.2. Steps in preparing assembly drawings.
3.3. Bill of materials and parts list.
3.4. Exercises in preparing assembly drawings of commonly available engineering components.
3.5. **Drawing Plate: 2**

Draw the views / sectional views of

Socket and spigot joint	**Sleeve and cotter joint**	**Stuffing box**
Knuckle Joint assembly	**Bush Pin type flanged coupling**	**Muff coupling (solid & split)**
Universal coupling	**Foot step bearing**	**Plummer block**
Eccentric	**Lathe tool post**	**Lathe tail stock**
Cross Head	**Gib & Cotter Joint**	**Screw Jack**

4.0 Piping layouts

4.1. Classification of pipes and tubes.
4.2. Components of pipes lay-out.
4.3. Screw fitting bend, elbow, tee, lateral Cross-nipple, reducing socket and plug.
4.4. Unions: Screwed ground and flanged.
4.5. Valves: Gate valve: angle valve, check valve.
4.6. Various conventional symbol used for the above components.

Drawing Plate: 3

1. Single line diagram of pipe layout, two exercises.
2. Double line diagram of pipe layout, one exercise.

5.0 Welded fabrication drawings

5.1. Different types of weld and their basic symbols including sectional representation as per table of I.S. standards, fillet, square butt, single V-Butt, double V-Butt, single bevel butt, double bevel butt, stud, bead (edge or seal), spot, seam.

5.2. Elements of welding symbol and their standard location, the symbol as per IS standards reference Code, arrow head, weld symbol, supplementary symbol, dimensions of welds, method of welding process, special reference.

5.3. Significance of arrow & position of arrow head significance of reference line as per I.S. standards with reference to fillet, V-Butt and stud welds.

5.4. Supplementary symbols and special instructions: Surface of reference line; as per I.S. standards with reference to fillet, V-Butt and stud welds.

5.5. Dimensions of welds: length, location and spacing of welds as per IS: 813-1991 standards with showing dimensions required on a welding.

5.6. Need of special reference

Drawing Plate: 4

1. Drawing tables and figs. Referred in the contents above taking form I.S. standards.
2. Dimensioning a given welding drawings as per I.S., SP-46-2003.
3. Preparing working drawing of welding fabrication from given data.

REFERENCE BOOKS

1. Machine Drawing by **A.C. Parkinson**.
2. Machine Drawing by **Jones & Jones.**
3. Machine Drawing by **N.D. Bhat**.
4. Machine Drawing by **R.B. Gupta.**
5. Engineering drawing practice for schools & colleges: **SP-46-2003**.
6. Machine Drawing by **Bhattacharya** (Oxford Publishers).
7. Machine Drawing by **Ajeeth Singh** (MGH Publishers)
8. Machine Drawing by **N.Siddeswar, Kannaih, Sastri**. (MGH Publishers)

C-20-M-307

BOARD DIPLOMA EXAMINATION,
D.M.E. – III SEMESTER EXAMINATION
MACHINE DRAWING

Time : 3 Hours **Total Marks: 60**

Note: 1. Drawing should be neat and proportionate

2. Use first angle projection
3. Use Standard data
4. Assume missing data suitably if any

PART – A

Answer all the questions 4 X 5 = 20

1. Draw the two views of hexagonal headed bolt

2. Draw two views of double riveted zig –zag lap joint

3. Draw the single line symbols for the following pipe fittings

   (a) Cap (b) Tee (c) 90^0 elbow (d) Reducer (e) Gate valve

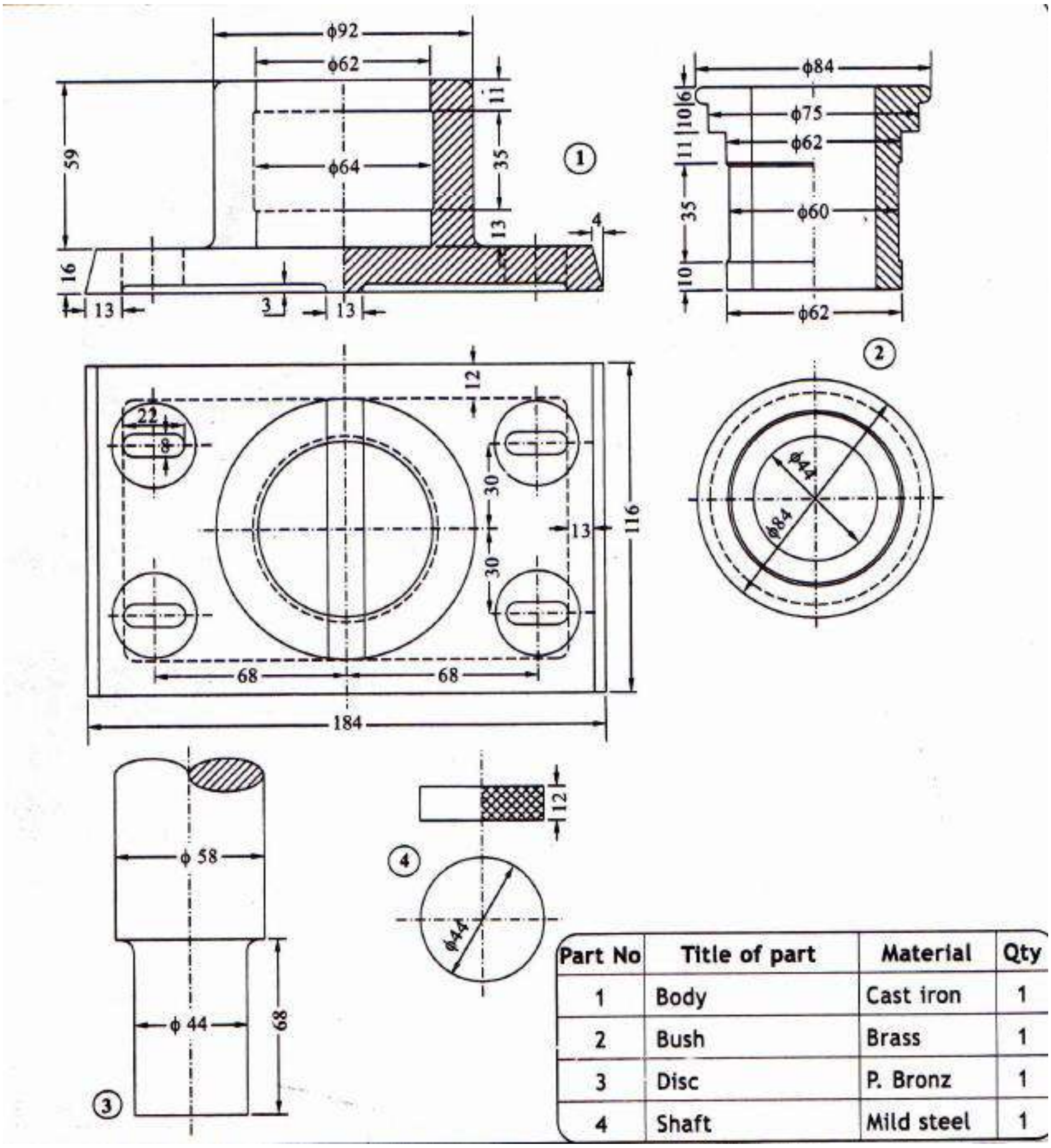
4. Show the welding symbols for the following types

   (i)Weld all round (ii) Grinding Finish (c) Chipping Finish (iv) Seam weld (V) Spot weld

Part B

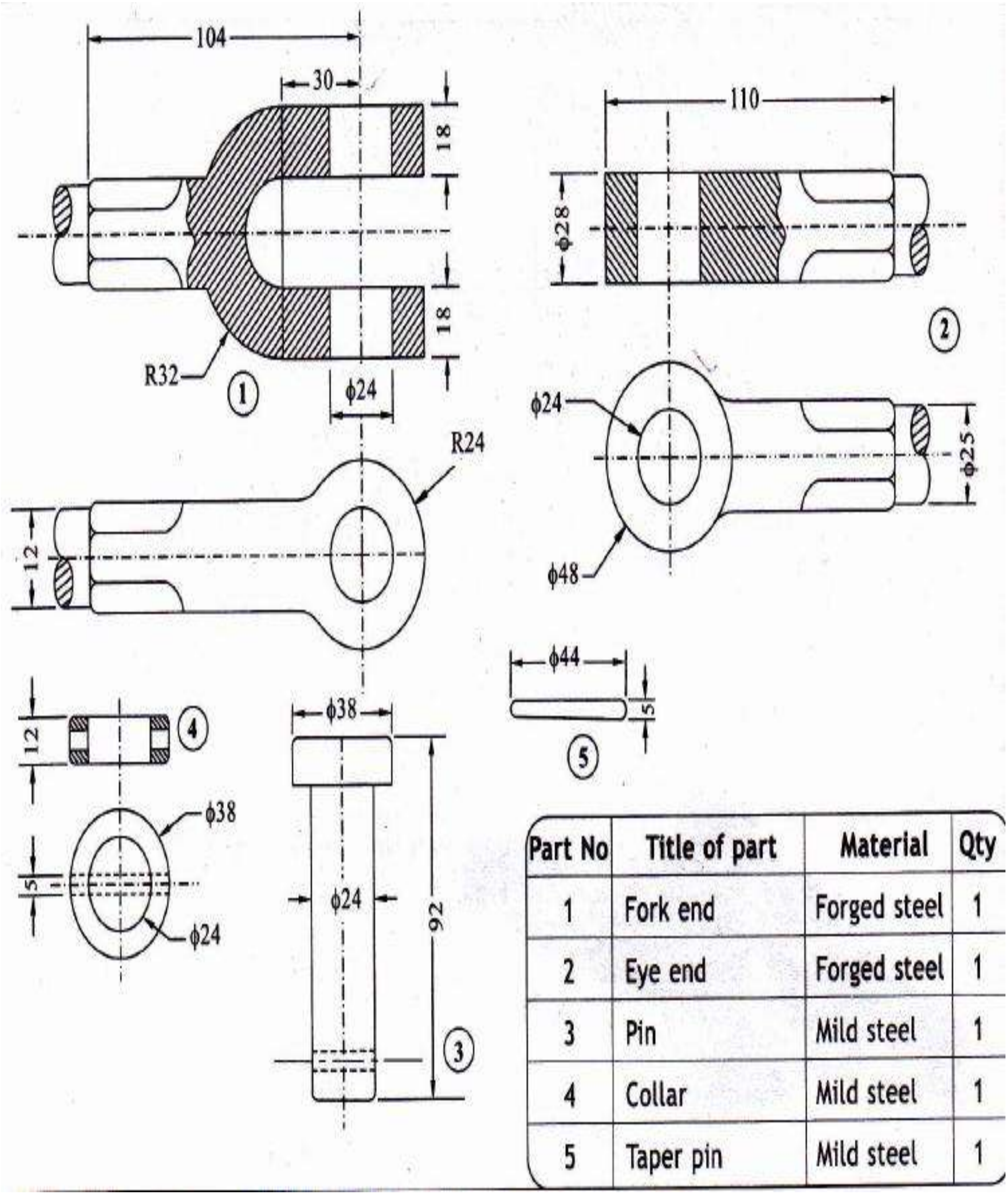
Answer any one question 1 X 40 = 40

5. Assemble together the parts of the **Foot step bearing** shown in the figure and draw its following views (i) sectional front view (ii) Top view (iii) Dimensioning



Part No	Title of part	Material	Qty
1	Body	Cast iron	1
2	Bush	Brass	1
3	Disc	P. Bronz	1
4	Shaft	Mild steel	1

6. Assemble together the parts of the **Knuckle joint** shown in the figure and draw its following views (i) sectional front view and (ii) Top view (iii) Dimensioning



Part No	Title of part	Material	Qty
1	Fork end	Forged steel	1
2	Eye end	Forged steel	1
3	Pin	Mild steel	1
4	Collar	Mild steel	1
5	Taper pin	Mild steel	1

Course Title	Course Code	Periods/Week	Periods/Semester
Material Testing & Metallographic Lab Practice	M-308	03	45

TIME SCHEDULE

S.NO	EXERCISE TITLE	NO.OF PERIODS
1	Simple Tension Test	**09**
2	Compression Test	**03**
3	Impact Test (Charpy & Izod)	**06**
5	Hardness Test (Brinell & Rockwell Tests)	**06**
6	Flexural Test on Simply Supported & Cantilever Beams	**06**
7	Compression Test on Helical Spring	**03**
8	Study of Micro Structure of Ferrous and Non-ferrous Metals	**12**
TOTAL		**45**

Course Objectives and Course Outcomes

COURSE OBJECTIVE	Upon the completion of the course the student shall be able to conduct tests on various equipments to find the mechanical properties of the metals and operate the metallurgical microscope to see and draw the microstructure of metals		
COURSE OUTCOMES	CO1	M-308.1	Operate the UTM to conduct various tests like i) Tension test ii) Compression Test iii) Shear test iv) Deflection Test on Spring to get basic mechanical properties of metals
	CO2	M-308.2	Conduct the Hardness tests and Impact tests to find Hardness and Impact Strength of given metals
	CO3	M-308.3	Perform Flexural Test on Simply Supported & Cantilever Beams to determine the Young's Modulus and Stiffness of the beam material
	CO4	M-308.4	Analyse the microstructure of a given metal
	CO5	M-308.5	Demonstrate ethics & etiquette while working in a group and display professionalism while communicating as a member and leader in a group

PO-CO Mapping

Course Code : M-308	Course Title: Material Testing & Metallographic lab Practice Number of Course Outcomes: 05				No. of Periods 45
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1 – CO4	08	17.78	1	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1 – CO4	04	08.89	1	
PO3					
PO4	CO1 – CO4	27	60.00	3	
PO5	CO5	03	06.67	1	
PO6					
PO7	CO1 – CO5	03	06.67	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1		3			1	3	1	1
CO2	1	1		3			1	3	1	1
CO3	1	1		3			1	3	1	1
CO4	1	1		3			1	3	1	1
CO5					1		1	1		

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes

Upon completion of the course the student shall be able to

1.0 Understand the various material testing methods.

1.1 Conduct the simple tension test to find the various mechanical properties of the given material such as: yield stress, ultimate stress, percentage of elongation, percentage of reduction in area and Young's Modulus.

1.2 Conduct experiments on concrete cube, cast iron, timber to test for its compressive strength.

1.3 Practice the method of determining the Young's modulus of materials by the principle of deflection.

1.4 Determine the modulus of rigidity by the method of deflection of helical springs.

1.5 Conduct the hardness test to find the hardness of given material.

1.6 Perform the impact tests to find the impact strength of given metal

1.7 Practice the method of preparing a specimen for the metallography.

1.8 Interpret the microstructure of specified ferrous and non ferrous materials.

1.9 Handle the metallurgical microscope to study the microstructures.

Key competencies to be achieved by the student

Exercise	Key competencies expected	Max. Marks	Marks awarded
Simple Tension Test	A. Fix the specimen in the jaws of the machine	02	
	B. Fix the strain gauge to the specimen	02	
	C. Apply the load gradually on the specimen	02	
	D. Record the load, elongation without error	01	
	E. Plot the graph stress vs strain	01	
	F. Locate the points - elastic limit, yield stress, ultimate stress on the graph	02	
	Total	**10**	
Compression test	A. Place the specimen in the machine properly	02	
	B. Apply the load on the specimen gradually	02	
	C. Record the ultimate load	01	
	Total	05	
Shear Test	A. Place the specimen in the correct set of bushes in the shear shackles	02	
	B. Apply the load on the specimen gradually	02	
	C. Record the ultimate load	01	
	Total	**05**	

Impact test	A. Prepare the specimen as per the specifications	05	
	B. Fix the specimen on the machine appropriately	02	
	C. Release the load to hit the specimen cautiously	02	
	D. Record the energy absorbed by the specimen and find the impact strength	01	
	Total	**10**	
Hardness test	A. Place the specimen on the anvil of the specimen and fix the indenter	01	
	B. Place the loads on the load pan corresponding to the material of the specimen and size of indenter	01	
	C. Make the indent on the specimen properly	02	
	D. Measure the diameter of indentation with Brinell microscope	03	
	E. Calculate hardness number	03	
	Total	**10**	
Flexural Test on Beams	A. Measure the cross-sectional dimensions of the beam with vernier	02	
	B. Place the weight pans/hangers at the required positions	01	
	C. Fix the dial indicator at the correct location	02	
	D. Apply the loads gradually (in ascending and descending order)	01	
	E. Note the dial indicator readings(deflections) without parallax error	02	
	F. Plot the graph between load and deflection	01	
	G. Find the Stiffness and Young's Modulus of the beam material	02	
	Total	**10**	
Torsion test of springs	A. Measure spring diameter and spring wire diameter with vernier callipers	04	
	B. Measure deflection applying load	02	
	C. Calculate modulus of rigidity of spring material	04	
	Total	**10**	
Study of micro structure of Metals and alloys	A. Prepare specimen	05	
	B. Handling microscope to observe C. microstructure	02	
	D. Draw the microstructure of given material	03	
	Total	**10**	

COURSE CONTENTS:

1. Determination of yield stress, ultimate stress, percentage of reduction in area, percentage of elongation, Young's modulus by conducting tension test on Universal testing machine.
2. Determination of crushing strength of concrete cube, cast iron, timber etc., using UTM/CTM
3. Determination of Young's Modulus by conducting flexural test on simply supported and cantilever beams of given material
4. Determination of Modulus of rigidity of spring steel by the deflection of springs.
5. Determination of impact strength of the material using Izod and Charpy's tests.
6. Determination of hardness of material using Brinell and Rockwell Testing methods.
7. Specimen preparation for the metallography.
8. Study of microstructures of Mild steel, Pure Iron, Grey Cast Iron, S.G. Iron, Eutectoid steel, Stainless steel, Aluminium, Brass, Bronze.

Course Title	Course Code	Total No. of Periods	Total Periods Per Semester
Fuels Laboratory Practice	M – 309	03	45

TIME SCHEDULE

S. No.	EXERCISE TITLE	Periods
1.	Flash & Fire point tests	12
2.	Viscosity measurement	12
3.	Calorific value tests	09
4.	Carbon residue test	09
5.	Calibration of Pressure Gauge	03

Course Objectives and Course Outcomes

Course Objectives	Upon completion of the course the student shall be able to: (i) To familiarise with the knowledge of materials and tools used in measurement of fuel properties, calibration of pressure gauge (ii) To reinforce the concepts of flash and fire points, viscosity, carbon residue, calorific value and calibration of pressure gauge by conducting corresponding experiments		
Course Outcomes		Upon completion of the course the student shall be able to:	
	CO1	M-309.1	Demonstrate to determine the flash and fire points, viscosity, calorific value and carbon residue of a given sample of fuel using given apparatus.
	CO2	M-309.2	Demonstrate to calibrate the pressure gauge using deadweight pressure gauge
	CO3	M-309.3	Perform precise operations with the flash and fire point devices, viscometers, dead weight pressure gauge tester.
	CO4	M-309.4	Analyse the experimental results to draw inferences, to make recommendations
	CO5	M-309.5	Demonstrate ethics and etiquette while working in a group and display professionalism while communicating as a member and a leader in a group.

PO-CO Mapping

Course Code: M-309		Course Title: Fuels Laboratory			No of Periods: 45
PO No	Mapped with CO no	CO Periods addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%ge		
PO1	CO1 – CO4	08	17.78	1	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1 – CO4	04	08.89	1	
PO3					
PO4	CO1 – CO4	27	60.00	3	
PO5	CO5	03	06.67	1	
PO6					
PO7	CO1 – CO5	03	06.67	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	**1**	**1**		**3**			**1**	**1**	**1**	**1**
CO2	**1**	**1**		**3**			**1**	**1**	**1**	**1**
CO3	**1**	**1**		**3**			**1**	**1**	**1**	**1**
CO4	**1**	**1**		**3**			**1**	**1**	**1**	**1**
CO5					**1**		**1**	**1**		

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes
Up on Completion of the course the student shall be able to:

1.0 Conduct an experiment to determine the flash and fire point of a given sample of fuel using given apparatus

1.1 Place the oil cup in the apparatus
1.2 Fill the water in water bath through funnel
1.3 Connect the equipment to the power supply
1.4 Fill the oil in the oil cup up to the gauge mark
1.5 Operate the shutter for opening and closing
1.6 Operate the shutter lid to observe vapours
1.7 Operate the stirrer
1.8 Apply the test flame
1.9 Identify the colour change of the flame
1.10 Record the two temperatures of flash and fire point

2.0 Conduct an experiment to determine viscosity of a given sample of oil using given apparatus

2.1 Move and place the collecting flask
2.2 Insert the thermometer and hydrometer in the device
2.3 Fill the oil in the oil cup up to the gauge mark
2.4 Operate the regulator to vary the temperature
2.5 Stir the water to get the uniform temperature
2.6 Record temperature using thermometer
2.7 Open and close the ball valve
2.8 Collect 50 ml of oil in the collecting flask
2.9 Record the time taken to collect 50 ml using stop watch
2.10 Document the readings systematically
2.11 Calculate the Viscosity
2.12 Sketch the related graphs

4.0 Conduct an experiment to determine the calorific value of a given sample of fuel using given apparatus

3.1 Set the thermometers, gas flow meter and regulator in position in the calorimeter
3.2 Move the measuring jar and stop watch in place for ready use
3.3 Operate the water tap for uniform flow of the water into the calorimeter
3.4 Operate the valve to get the uniform flow of gas into the calorimeter
3.5 Maintain constant pressure head in the gas meter by means of water column
3.6 Record the inlet and outlet temperature of water
3.7 Record time taken to consume volume of gas burnt and 1000 ml of water simultaneously
3.8 Record the barometer and manometer readings
3.9 Measure the weight of condensed steam

5.0 Conduct an experiment to determine the amount of carbon residue of a given sample of petroleum product

4.1 Place the wire mesh and asbestos block in their respective places
4.2 Cover all the crucibles with hood
4.3 Place the physical balance near the apparatus
4.4 Place inner crucible in outer crucible
4.5 Place sample oil in the porcelain crucible
4.6 Start the burner for heating the crucible
4.7 Stop the supply of fuel to the burner
4.8 Cool the crucible
4.9 Measure the weight of crucible before and after burning of oil

5.0 Conduct an experiment to calibrate the pressure gauge.

5.1 Place the open ended spanner and a needle puller for ready use
5.2 Place the can of gear near the apparatus
5.3 Insert and removal of dead weights on the plunger fat form
5.4 Set the levelling screws for exact levelling of the apparatus
5.5 Fill the oil reservoir without air bubbles by operating the cocks on either side of the oil reservoir
5.6 Operate the screw pump to generate and adjustment of system pressure
5.7 Observe and record the pressure due to mass load
5.8 Record the gauge pressure

Course Code	Course Title	No. of periods / Week	Total No. of Periods	Marks for FA	Marks for SA
M310	ELECTRICAL ENGINEERING LAB PRACTICE	3	45	40	60

COURSE OUTCOMES MAPPING

S.No	EXERCICSE TITLE	No. of periods	CO's Mapped
1.	Basic Electrical Wiring Circuits	12	CO1
2.	Identification and Testing the terminals of Starters, AC and DC Machines	12	CO2
3.	Speed Control of DC Shunt Motor	06	CO3
4	Testing of Three Phase & Single Phase AC Motors	09	CO4
5.	Earthing System & Safety	06	CO5
	Total	**45**	

COURSE OBJECTIVES	To familiarize the basic electrical Wiring Circuits
	To understand the how to test the Electrical Machines and starters.
	To gain the knowledge to operate different electrical equipment with safety.

COURSE OUTCOMES	CO1	M310.1	Connect various electrical wiring circuits.
	CO2	M310.2	Measure the resistance between the terminals of various Electrical Machines.
	CO3	M310.3	Draw the Speed Control Characteristics of DC Machines.
	CO4	M310.4	Draw the Performance Characteristics of AC Machines.
	CO5	M310.5	Install different Earthing Systems for electrical safety.

LEARNING OUTCOMES

1.0 Basic Electrical Wiring Circuits

1.1 Make a circuit with One lamp controlled by one switch with PVC surface conduit system

1.2 Make a circuit with One lamp controlled by one switch and provision of 2/3-pin socket.

1.3 Make a circuit for Stair case wiring and Go-down wiring

1.4 Make the electrical wiring for Fluorescent Lamp

2.0 Identification and Testing of terminals of Starters, DC Machines and AC Machines

2.1 Identifying the terminals and testing for its operation of Three Point and 4-Point starters.

2.2 Identifying the terminals and testing for its operation of DOL (Direct On Line) starter and Star – Delta Starter.

2.3 Identify of Terminals of the Following DC Machines with the Use of Test Lamp
(a) DC Shunt Motor (ii) DC Series Motor (iii) DC Compound Motor

2.4 Measuring the values of Insulation Resistance of the Following DC Machines with the Use of Megger.
(a) DC Shunt Motor (ii) DC Series Motor (iii) DC Compound Motor

2.5 Identify of Terminals of the Following AC Machines with the Use of Test Lamp
(a) 3-Phase Squirrel Cage Induction Motor (ii) 3- Phase Slip Ring Induction Motor.

2.6 Measuring the values of Insulation Resistance of the Following DC Machines with the Use of Megger.
(a) 3-Phase Squirrel Cage Induction Motor (ii) 3- Phase Slip Ring Induction Motor.

3.0 Speed Control of D.C Shunt Motor

3.1 Draw the Speed Control Characteristics of DC Shunt Motor By Armature Control method.

3.2 Draw the Speed Control Characteristics of Dc Shunt Motor By Field flux Control method.

4.0 Testing of Three Phase & Single Phase AC Motor.

4.1 Draw the Performance Characteristics (Speed, Efficiency) of Three Phase Squirrel cage Induction Motor by load test ..

4.2 Draw the Performance Characteristics of Single Phase AC Series Motor

4.3 Draw the Performance Characteristics of Ac Single Phase Induction Motor.

5.0 Earthing System & Safety

5.1 Measure the earth resistance at the Place of Pipe Earthing System or Plate Earthing system Using earth Megger .

5.2 Demonstrate the Procedure of First Aid on Electric Shock .

COURSE CONTENT

1.0 **Basic Electrical Wiring Circuits**

One lamp controlled by one switch- One lamp controlled by one switch and provision of 2/3-pin socket - Stair case wiring and Godown wiring-Practicing the wiring for Fluorescent Lamp

2.0 Identification and Testing of terminals of Starters, DC Machines and AC Machines

Identifying the terminals and testing for its operation of Three Point and 4-Point starters-Identifying the terminals and testing for its operation of DOL (Direct On Line) starter and Star – Delta Starter- Identify of Terminals and Measuring the Insulation Resistance of DC Shunt, Series & Compound Motors with the Use of Test Lamp and Megger - Identify of Terminals And measuring Insulation Resistance of the AC Squirrel Cage and Slip-Ring Induction Motors with the Use of Test Lamp and megger.

3.0 Speed Control Of DC Shunt Motor:

Speed Control Characteristics of DC Shunt Motor By Armature Control method and by Field flux Control method.

4.0 Testing of Three Phase & Single Phase AC Motor.

Draw the Performance Characteristics (Speed, Efficiency) of Three Phase Squirrel cage Induction Motor by load test-Draw the Performance Characteristics of Single Phase AC Series Motor -Draw the Performance Characteristics of Ac Single Phase Induction Motor.

5.0 Earthing System & Safety

Measure the earth resistance at the Place of Pipe Earthing System or Plate Earthing system Using earth Megger - Demonstrate the Procedure of First Aid on Electric Shock.

Course Title	Course Code	Periods/Week	Periods Per semester
Workshop Practice-I	M -311	03	45

TIMESCHEDULE

S.No	EXERCISE TITLE	No of Periods
1.	Foundry	18
2.	Machining	18
3.	Welding	9
	Total	45

Course Objectives and Course Outcomes

Course Objectives			**(i)** **To Familiarize tools used in Foundry, Machine shop and Welding** **(ii)** **To handle the tools appropriately and safely** **(iii)** **To reinforce theoretical concepts by practising relevant exercises of foundry, machine shop and welding** **(iv)** **Obtain skill in mould Preparation, casting, machining and arc welding**
Course Outcomes	**CO1**	**M-311.1**	**Prepare a casting for the given pattern**
	CO2	**M-311.2**	**Demonstrate the turning operations on Lathe**
	CO3	**M-311.3**	**Demonstrate the joining of metals by Arc Welding**
	C04	**M-311.4**	**Demonstrate ethics and etiquette while working in a group and display professionalism while communicating as a member and a leader in a group.**

PO-CO Mapping

Course Code : M-311	**Course Title Workshop Practice-II Number of Course Outcomes: 04**			**No. of Periods 45**	**Course Code : M-311**
POs	**Mapping with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1 – CO3	08	13.33	1	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed)
PO2					
PO3					

PO4	CO1 – CO3	34	77.8	3	5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO5	CO4	03	06.67	1	
PO6					
PO7					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			3				3	1	1
CO2	3			3				3	1	1
CO3	3			3				3	1	1
C04					1					

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes:

Perform mould preparation for Solid Bearing

1.1 Write the sand moulding procedures in foundry.
1.2 Prepare a mould sand mix.
1.3 Identify various tools used in foundry shop.
1.4 Select the moulding boxes
1.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
1.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Flange Coupling

2.1 Write the sand moulding procedures in foundry.
2.2 Prepare a mould sand mix.
2.3 Identify various tools used in foundry shop.
2.4 Select moulding boxes
2.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
2.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Split Bearing

3.1 Write the sand moulding procedures in foundry.
3.2 Prepare a mould sand mix.
3.3 Identify various tools used in foundry shop.
3.4 Select moulding boxes.
3.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
3.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Connecting Rod

4.1 Write the sand moulding procedures in foundry.
4.2 Prepare a mould sand mix.
4.3 Identify various tools used in foundry shop.
4.4 Select moulding boxes.
4.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
4.6 Locate the cope over the drag without any mismatch

Perform mould preparation for V-Pulley

5.1 Write the sand moulding procedures in foundry.
5.2 Prepare a mould sand mix.
5.3 Identify various tools used in foundry shop.
5.4 Select moulding boxes.
5.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
5.6 Locate the cope over the drag without any mismatch

Perform mould preparation for Gear Pulley

6.1 Write the sand moulding procedures in foundry.
6.2 Prepare a mould sand mix.
6.3 Identify various tools used in foundry shop.
6.4 Prepare mould in two boxes, three boxes.
6.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
6.6 Locate the cope over the drag without any mismatch

Perform Plain Turning Operations

7.1 Select proper tool to perform the job.
7.2 Centre the job by dial gauge
7.3 Select the suitable speed for different operations
7.4 Practice plain turning operation on a lathe machine
7.5 Use measuring instruments for taking dimensions.

Perform Step Turning Operations

8.1 Select proper tool to perform the job.
8.2 Centre the job by dial gauge
8.3 Select the suitable speed for different operations
8.4 Practice step turning operation on a lathe machine
8.5 Use measuring instruments for taking dimensions

Perform Taper Turning Operations

9.1 Select proper tool to perform the job
9.2 Calculate the taper angle.
9.3 Perform job setting on Lathe machine
9.4 Perform step turning operation on lathe.
9.5 Practice different taper turning methods on lathe
9.6 Perform taper turning for the required tapers by swivelling the compound rest.
9.7 Use measuring instruments for taking dimensions

Perform Collar Turning Operations

10.1 Select proper tool to perform the job.
10.2 Perform job setting on the lathe machine
10.3 Select the suitable speed for different operations
10.4 Practice step turning operation on a lathe machine for collars
10.5 Use measuring instruments for taking dimensions.

Perform Knurling Operations

11.1 Select proper tool to perform the job.
11.2 Perform job setting
11.3 Perform tool setting
11.4 Centre the job by dial gauge
11.5 Select the suitable speed for different operations
11.6 Practice knurling operation on a lathe machine
11.7 Use measuring instruments for taking dimensions

Perform Facing Operations

12.1 Select proper tool to perform the job.
12.2 Perform job setting
12.3 Perform tool setting
12.4 Centre the job by dial gauge
12.5 Select the suitable speed for different operations
12.6 Practice facing operation on a lathe machine
12.7 Use measuring instruments for taking dimensions

Welding beads layout

13.1 Perform Edge preparation
13.2 Attach clamps on work pieces and grounding
13.3 Select the correct rod and amperage range for the work you are attempting. ...
Rod Angle (lead angle) ...
13.4 Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
13.5 Perform Arc welding
13.6 Identify the weld bead shape

Perform Lap Joint

14.1 Perform Edge preparation
14.2 Arrange the work pieces for lap joint
14.3 Attach clamps on work pieces and grounding
14.4 Select the correct rod and amperage range for the work you are attempting. ...
Rod Angle (lead angle) ...
14.5 Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
14.6 Perform Arc welding
14.7 Identify the weld bead shape

Perform Butt Joint

15.1 Perform Edge preparation
15.2 Arrange the work pieces for butt joint
15.3 Attach clamps on work pieces and grounding
15.4 Select the correct rod and amperage range for the work you are attempting. ... Rod Angle (lead angle)
15.5 Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
15.6 Perform Arc welding
15.7 Identify the weld bead shape
15.8 Perform spot welding

Perform T- Joint

16.1 Perform Edge preparation
16.2 Arrange the work pieces for T-joint
16.3 Attach clamps on work pieces and grounding
16.4 Select the correct rod and amperage range for the work you are attempting. ... Rod Angle (lead angle)
16.5 Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc
16.6 Perform Arc welding
16.7 Identify the weld bead shape

COURSE CONTENT

1 Foundry

Moulding and casting of

1.1 Solid bearing
1.2 Flange coupling
1.3 Split bearing
1.4 Connecting rod
1.5 V – Pulley
1.6 Gear pulley

2 Machine Shop (Turning)

2.1 Plain Turning
2.2 Step Turning
2.3 Taper Turning
2.4 Turning Collars
2.5 Knurling
2.6 Facing

3. Welding

3.1 Layout of Beads
3.2 Lap joints
3.3 Butt joints.
3.4 T- joint
.

REFERENCE BOOKS

1. A text book of welding Technology –Khanna O.P. DhanpathRai Publications
2. Principles of Foundry Technology by P L Jain (McGraw Hill)
3. Workshop Practice Vol- II by HajraChoudhury Media Promoters and Publishers Pvt Ltd.

IV SEMESTER

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY								
M – 401	Engineering Mathematics - III	3	-	45	3	20	80	100
M – 402	Design of Machine Members	5	-	75	3	20	80	100
M – 403	Hydraulics & Fluid Power Systems	5	-	75	3	20	80	100
M – 404	Heat Power Engineering-I	5	-	75	3	20	80	100
M – 405	Energy Sources and power plant Engineering	4	-	60	3	20	80	100
M – 406	Production Technology -II	5	-	75	3	20	80	100
PRACTICAL								
M – 407	Production Drawing	-	3	45	3	40	60	100
M – 408	Communication Skills Lab Practice	-	3	45	3	40	60	100
M – 409	Thermal Engineering Lab Practice	-	3	45	3	40	60	100
M – 410	Hydraulics & Fluid Power Systems Lab Practice	-	3	45	3	40	60	100
M-411	Workshop Practice- II	-	3	45	3	40	60	100
TOTAL		**27**	**15**	**630**		**320**	**780**	**1100**

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ENGINEERING MATHEMATICS-III

Course Code	Course Title	No. of Periods/week	Total No. of periods	Marks for FA	Marks for SA
M-401	Engineering Mathematics-III	3	45	20	80

S.No.	Unit Title	No. of periods	COs mapped
1	Higher order Linear Differential equations with constant coefficients	15	CO1
2	Laplace Transforms	18	CO2
3	Fourier Series	12	CO3
	Total Periods	45	

Course Objectives	(i) To learn the principles of solving differential equations of second and higher order. (ii) To comprehend the concept of Laplace transformations and inverse Laplace transformations. (iii) To understand the concept of Fourier Series expansion of functions.

Course Outcomes	CO1	Solve homogeneous and non-homogeneous differential equations of second and higher order.
	CO2	Find Laplace and inverse Laplace transforms of various functions.
	CO3	Expand given functions as Fourier series and half- range Fourier Sine and Cosine series.

ENGINEERING MATHEMATICS – III

Learning Outcomes

Unit-I

Differential Equations of higher order

C.O. 1 Solve homogeneous and non-homogeneous differential equation of second and higher order.

L.O 1.1 Solve Differential equations of the type (aD^2 +bD + c) y = 0 where a, b, c are real numbers and provide examples.

1.2 Solve higher order homogeneous differential equations with constant coefficients and provide examples.

1.3 Define complementary function, particular Integral and general solution of a non-homogeneous differential equation.

1.4 Describe the methods of solving *f(D) y = X* where *f(D)* is a polynomial of n^{th} order and *X* is a function of the forms $k,\ e^{ax},\ \sin ax, \cos ax,\ x, x^n$ and their linear combinations where n is a positive integer, with examples.

Unit-II

Laplace Transforms

C.O. 2 Find Laplace and inverse Laplace transforms of various functions.

L.O. 2.1 Define Laplace Transform and explain the sufficient conditions of existence of Laplace Transform.

2.2. Obtain Laplace transforms of standard functions and solve simple problems.

2.3 Write the properties of Laplace Transform – Linearity property, First shifting theorem (without proof) and Change of Scale property and solve simple problems.

2.4. Write the Laplace Transform of unit step function and second shifting theorem (without proof) and solve simple problems.

2.5. Write formulae for Laplace transform of functions with multiplication by t^n and division by t, Laplace transform of derivatives, evaluation of some definite integrals using Laplace Transforms and solve simple problems.

Syllabus for Unit test-I completed

2.6 Define inverse Laplace Transform, obtain inverse Laplace Transforms of standard functions and solve simple problems.

2.7 Write linearity property, first and second shifting theorems (without proof), change of scale property of inverse Laplace transform and solve simple problems.

2.8 Write inverse Laplace transforms of derivatives and integrals and solve simple problems.

2.9 Write inverse Laplace transforms of functions with multiplication by s and division by s and solve simple problems.

2.10 Write inverse Laplace transforms of functions using partial fractions and solve some simple problems.

2.11 Define convolution of two functions, state convolution theorem (without proof) and solve simple problems.

Unit-III
Fourier series

C.O. 3 Expand given functions as Fourier series and half- range Fourier Sine and Cosine series

L.O. 3.1 Define the orthogonality of functions in an interval.

3.2 Define Fourier series of a function in the intervals $(c,\ c+2\pi)$ and $(c,\ c+2l)$ and write the Euler's formulae for determining the Fourier coefficients.

3.3 Write sufficient conditions for the existence of Fourier series expansion of a function.

3.4 Find Fourier series of simple functions in the range (0 , 2π) and (-π , π)

3.5 Write Fourier series for even and odd functions in the interval $(-\pi,\ \pi)$ and $(-l, l)$ expand simple functions.

3.6 Write Fourier series expansion of a function over the interval (0, 2l) and $(-l,\ l)$ and expand simple functions.

3.7 Write half-range Fourier sine and cosine series of a function over the interval (0, π) and $(0,\ l)$ and expand simple functions.

Syllabus for Unit test-II completed

Engineering Mathematics – III
CO/PO - Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1				2	3	2
CO2	3	3	3	3				3	3	3
CO3	3	3	3	3				3	3	3
Avg	3	2.66	2.33	2.33				2.66	3	2.66

3 = Strongly mapped (High), **2 =** Moderately mapped (Medium), **1 =** Slightly mapped (Low)

Note:

PO5: Appropriate quiz programme may be conducted at intervals and duration as decided by concerned teacher.

PO6: Seminars on applications of mathematics in various engineering disciplines are to be planned and conducted.

PO7: Such activities are to be planned that students visit library to refer standard books on Mathematics and latest updates in reputed national and international journals, attending seminars, learning mathematical software tools.

PSO1: An ability to understand the concepts of basic mathematical concepts and to apply them in various areas like computer programming, civil constructions, fluid dynamics, electrical and electronic systems and all concerned engineering disciplines.
PSO2: An ability to solve the Engineering problems using latest software tool, along with analytical skills to arrive at faster and appropriate solutions.
PSO3: Wisdom of social and environmental awareness along with ethical responsibility to have a successful career as an engineer and to sustain passion and zeal for real world technological applications.

C-20

Engineering Mathematics – III

PO- CO – Mapping strength

<table>
<tr><th rowspan="2">PO no</th><th rowspan="2">Mapped with CO no</th><th colspan="2">CO periods addressing PO in column I</th><th rowspan="2">Level (1,2 or 3)</th><th rowspan="2">Remarks</th></tr>
<tr><th>No</th><th>%</th></tr>
<tr><td>1</td><td>CO1, CO2, CO3</td><td>45</td><td>100%</td><td>3</td><td rowspan="10">>40% Level 3 Highly addressed

25% to 40% Level 2 Moderately addressed

5% to 25% Level 1 Low addressed

<5% Not addressed</td></tr>
<tr><td>2</td><td>CO1, CO2, CO3</td><td>37</td><td>82.2%</td><td>3</td></tr>
<tr><td>3</td><td>CO1, CO2, CO3</td><td>32</td><td>71.1%</td><td>3</td></tr>
<tr><td>4</td><td>CO1, CO2, CO3</td><td>32</td><td>71.1%</td><td>3</td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PSO 1</td><td>CO1, CO2, CO3</td><td>37</td><td>82.2%</td><td>3</td></tr>
<tr><td>PSO 2</td><td>CO1, CO2, CO3</td><td>45</td><td>100%</td><td>3</td></tr>
<tr><td>PSO 3</td><td>CO1, CO2, CO3</td><td>36</td><td>80%</td><td>3</td></tr>
</table>

ENGINEERING MATHEMATICS – III
(Common Course)
Course Content

Unit I: Differential Equations of higher order

1. Solve Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.
2. Solve Non-homogenous linear differential equations with constant coefficients of the form f(D)y = X where X is in the form k(constant), e^{ax}, sinax, cosax, x^n, where n is a positive integer, finding complimentary function, particular integral and general solution.

Unit II: Laplace Transforms

3. Definition, sufficient conditions for existence of LT, LT of elementary functions, linearity property, state first shifting theorem, change of scale property, multiplication by t^n, division by t, LT of derivatives and integrals, LT of unit step function, state second shifting theorem, inverse Laplace transforms- state shifting theorems and change of scale property, multiplication by s^n and division by s, derivatives, integrals, examples of inverse LT using partial fractions, state convolution theorem with simple examples.

Unit III: Fourier series

4. Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c\ ,\ c+2\pi)$ and $(c\ ,\ c+2l)$, Euler's formulae , sufficient conditions for existence of Fourier series expansion of a function, Fourier series expansion of basic functions limited to k(constant), $x, x^2, \sin ax, \cos ax, e^{ax}$ and their combinations over the intervals $(0,\ 2\pi), (-\pi, \pi), (0,\ 2l), (-l, l)$, Fourier series for even and odd functions over $(-\pi, \pi)$ and $(-l, l)$, Fourier half-range sine and cosine series over $(0,\ \pi)$ and $(0,\ l)$

Textbook:
Engineering Mathematics-I, a textbook for first year diploma courses, prepared & prescribed by SBTET, AP.

Reference Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers
2. M.R. Spiegel, Schaum's Outline of Laplace Transforms, Schaums' Series
3. M.Vygodsky, Mathematical Handbook: Higher Mathematics, Mir Publishers, Moscow.

Blue print

S. No	Chapter/ Unit title	No of Periods	Weightage allotted	Marks wise distribution of weightage				Question wise distribution of weightage				COs mapped
				R	U	Ap	An	R	U	Ap	An	
1	Unit – I Higher order Linear Differential equations with constant coefficients	15	28	11	11	3	3	2	2	1	1	CO1
2	Unit - II Laplace Transforms	18	33	11	11	11	0	2	2	2	0	CO2
3	Unit - III Fourier Series	12	19	3	3	3	10	1	1	1	1	CO3
	Total	**45**	**80**	**25**	**25**	**17**	**13**	**5**	**5**	**4**	**2**	

R: Remembering Type : 25 Marks
U: understanding Type : 25 Marks
Ap: Application Type : 17 Marks
An: Analysing Type : 13 Marks

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Engineering Mathematics – III
Unit Test Syllabus

Unit Test	Learning Outcomes to be Covered
Unit Test-I	From LO 1.1 to 2.5
Unit Test-II	From LO 2.6 to 3.7

Unit Test I

State Board of Technical Education and Training, A. P
First Year
Course name: **Engineering Mathematics-II**
Sub Code: **M-401**

Time : 90 minutes Max.marks:40

Part-A **16Marks**

Instructions: **(1) Answer all questions.**
(2) First question carries four marks and the remaining questions carry three marks each

1. Answer the following:
   a. Write the auxiliary equation for given differential equation $\left(D^2+4\right)y=0$ (CO1)
   b. For given differential equation $f(D)y=0$, if roots of auxiliary equation are 1,-1,then $y=$ _____________ (CO1)
   c. $L\left\{e^{3t}\right\}=$ ___________ (CO2)
   d. $L\{f(t)\}=\overline{f}(s)$ then $L\left\{e^{at}f(t)\right\}=\overline{f}(s+a)$: State TRUE/FALSE (CO2)
2. Solve $\left(D^2-2D+1\right)y=0.$ (CO1)
3. Find the particular integral of $\left(D^2+D+4\right)y=e^x$ (CO1)
4. Evaluate $L\left\{(t-1)^2\right\}$ (CO2)
5. Evaluate $L\left\{t^2+2\cos t+3\sin t\right\}$ (CO2)

Part-B **3×8=24**

Instructions: (1) Answer **all** questions.
(2) Each question carries **eight** marks
(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Solve $\left(D^4-5D^2+4\right)y=0.$ (CO1)

   or

   B) Solve $\left(D^2+D-6\right)y=1+e^{-3x}.$ (CO1)
7. A) Solve $\left(D^2+3D+2\right)y=x^2+\sin x.$ (CO1)

   or

   B) Solve $\left(D^2-D\right)y=2e^x+3\cos x.$ (CO1)
8. A) Evaluate $L\left\{e^{3t}\cos^2 t\right\}$ (CO2)

   or

   B) Evaluate $L\left\{e^t(t+1)^2\right\}$ (CO2)

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Unit Test II

State Board of Technical Education and Training, A. P

First Year

Course name: **Engineering Mathematics-II**

Sub Code: **M-401**

Time : 90 minutes | Max.marks:40

Part-A **16Marks**

Instructions: (1) Answer **all** questions.

(2) First question carries **four** marks and the remaining questions carry **three** marks each

1. Answer the following:

   a. $L\{f(t)\} = \overline{f}(s)$ then $L\{tf(t)\} = -\frac{d}{ds}\left(\overline{f}(s)\right)$: State TRUE/FALSE (CO2)

   b. $L^{-1}\left\{\frac{1}{s-3}\right\} = ?$

   (CO2)

   c. $L^{-1}\left\{\frac{1}{s^2+a^2}\right\} = ?$ (CO2)

   d. Write the Fourier series for the function $f(x)$ in the interval $c < x < c+2\pi$. (CO3)

2. Evaluate $L\{te^t\}$. (CO2)

3. Evaluate $\int_0^\infty e^{-3t}\sin 4t\,dt$. (CO2)

4. Evaluate $L^{-1}\left\{\frac{3}{s+4} + \frac{2}{s^2+16} - \frac{s}{s^2-4}\right\}$. (CO2)

5. Evaluate Fourier coefficient a_0 for $f(x)$ in the interval $(-\pi, \pi)$. (CO3)

Part-B **3×8=24**

Instructions: **(1) Answer all questions.**

(2) Each question carries eight marks

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

6. A) Evaluate $L\left\{te^{-t}\cos t\right\}$. (CO2)

or

B) Evaluate $L\left\{\frac{\cos at - \cos bt}{t}\right\}$. (CO2)

7. A) Evaluate $L^{-1}\left\{\frac{s}{(s+1)(s^2+1)}\right\}$. (CO2)

or

B) Evaluate $L^{-1}\left\{\frac{s}{(s-1)^4}\right\}$. (CO2)

8. A) Obtain the Fourier series for the function $f(x) = e^x$ in the interval $(0, 2\pi)$. (CO3)

or

B) Obtain the half range Fourier cosine series of $f(x) = x^2$ in $(0,1)$. (CO3)

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END EXAM MODEL PAPER

STATE BOARD OF TECHNICAL EDUCATION, A.P
ENGINEERING MATHEMATICS –C- 401

TIME : 3 HOURS **MODEL PAPER- I** **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks. **10x3=30M**

1. Solve $\left(D^2-3D+2\right)y=0.$ **CO1**
2. Solve $\left(D^2+D+1\right)y=0.$ **CO1**
3. Find the particular integral of differential equation $\left(D^2+4\right)y=\sin 2x.$ **CO1**
4. Find the particular integral of differential equation $\left(D^2+3D+2\right)y=e^{3x}.$ **CO1**
5. Find $L\left\{2e^{3t}+\sin 3t+\cosh t\right\}.$ **CO2**
6. Find $L\left\{e^{t}\cos 4t\right\}.$ **CO2**
7. Find $L^{-1}\left\{\frac{1}{s^2}+\frac{4}{s^2+4}+\frac{3s}{s^2-9}\right\}.$ **CO2**
8. Find the value of a_0 in the Fourier expansion of $f(x)=e^x$ in the interval $\left(0,2\pi\right).$ **CO3**
9. Find the Fourier coefficients of $f(x)$ in the interval $\left(-\pi,\pi\right).$ **CO3**
10. Find the value of a_1 in the half range cosine series of $f(x)=k$ in the interval $\left(0,\pi\right).$ **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks. 5x8=40M

11. A) Solve $\left(D^3-6D^2+11D-6\right)y=0.$ **CO1**

Or

B) Solve $\left(D^2-9\right)y=e^{3x}+e^{-3x}.$ **CO1**

12. A) Solve $\left(D^2-4D+4\right)y=\sin 3x.$ **CO1**

Or

B) Solve $\left(D^2+2D+2\right)y=x^2+x+1.$ **CO1**

13. A) Evaluate $L\left\{te^{t}\cos t\right\}$. **CO2**

Or

B) Evaluate $L\left\{t^{2}\cos 2t\right\}$. **CO2**

14. A) Evaluate $L\left\{\dfrac{\sin 5t\sin t}{t}\right\}$. **CO2**

Or

B) Evaluate $\int_{0}^{\infty}\dfrac{\sin t}{t}dt$. **CO2**

15. A) Find $L^{-1}\left\{\dfrac{1}{s(s+1)(s+2)}\right\}$. **CO2**

Or

B) Using convolution theorem find $L^{-1}\left\{\dfrac{s}{(s^{2}+1)(s^{2}+4)}\right\}$. **CO2**

PART-C

Answer the following question. Question carries TEN marks. 1x10=10M

16. Find the Fourier expansion of $f(x)=x+x^{2}$ in the interval $(-\pi,\pi)$ and hence deduce that $\dfrac{1}{1^{2}}-\dfrac{1}{2^{2}}+\dfrac{1}{3^{2}}-\dfrac{1}{4^{2}}+=\dfrac{\pi^{2}}{12}$. **CO3**

STATE BOARD OF TECHNICAL EDUCATION, A.P

ENGINEERING MATHEMATICS – C-401

TIME : 3 HOURS **MODEL PAPER- 2** **MAX.MARKS : 80M**

PART-A

Answer All questions. Each question carries THREE marks. 10x3=30M

1. Solve $\left(D^2+4D+4\right)y=0.$ **CO1**

2. Solve $\left(D^2+9\right)y=0.$ **CO1**

3. Find the particular integral of differential equation $\left(D^2-4D+3\right)y=e^{4x}.$ **CO1**

4. Find the particular integral of differential equation $\left(D^2-4D-5\right)y=\cos 2x.$ **CO1**

5. Find $L\left\{2-e^{-2t}+\sinh 6t\right\}.$ **CO2**

6. Find $L\left\{e^{-2t}t^2\right\}.$ **CO2**

7. Find $L^{-1}\left\{\frac{1}{s^2}+\frac{4}{s^2+4}+\frac{3s}{s^2-9}\right\}.$ **CO2**

8. Find the value of a_0 in the Fourier expansion of $f(x)=x+x^2$

   in the interval $\left(-1,1\right).$ **CO3**

9. Write Euler's formula of Fourier expansion of $f(x)$ in the interval $\left(c,c+2\pi\right).$ **CO3**

10. Find the value of a_1 in the half range cosine series of $f(x)=\pi$ in the interval

    $\left(0,\pi\right).$ **CO3**

PART-B

Answer All questions. Each question carries EIGHT marks. 5x8=40M

11\. A) Solve $\left(D^3+1\right)y=0.$ **CO1**

Or

B) Solve $\left(D^2+D-6\right)y=e^{3x}+e^{-3x}.$ **CO1**

12.A) Solve $\left(D^2-3D+2\right)y=\cos 3x.$ **CO1**

Or

B) Solve $\left(D^2+2D+1\right)y=2x+x^2.$ **CO1**

13.A) Evaluate $L\left\{e^{3t}\cos^2 t\right\}.$ **CO2**

Or

B) Evaluate $L\left\{t^2\cos 2t\right\}.$ **CO2**

14.A) Evaluate $L\left\{\dfrac{e^{-at}-e^{-bt}}{t}\right\}.$ **CO2**

Or

B) Using Laplace transforms evaluate $\int_0^\infty \cos 3t\,dt.$ **CO2**

15.A) Find $L^{-1}\left\{\log\left(\dfrac{s^2+1}{(s-1)^2}\right)\right\}.$ **CO2**

Or

B) Using convolution theorem find $L^{-1}\left\{\dfrac{1}{\left(s^2+1\right)\left(s+1\right)}\right\}.$ **CO2**

PART-C

Answer the following question. Question carries TEN marks. 1x10=10M

16\. Find the Fourier expansion of $f(x)=\left(\pi-x\right)^2$ in the interval $0\prec x\prec 2\pi$ and hence deduce that $\dfrac{1}{1^2}+\dfrac{1}{2^2}+\dfrac{1}{3^2}+---=\dfrac{\pi^2}{6}.$ **CO3**

Course Title	Course Code	Periods/Week	Periods/Semester
Design of Machine Members	M – 402	05	75

TIME SCHEDULE

S. No	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M))
1	Introduction to Machine Design	05	06	2	-	
2	Bolted Joints	12	14	2	1	
3	Riveted Joints and Welded Joints	18	14	2	1	**1**
4	Shafts, Keys and Couplings	18	14	2	1	
5	Bearings & Springs	22	22	2	2	
	Total	**75**	**70+10**	**10**	**5**	**1**

Note: 10 Marks higher order question may be given from the Chapter - 3 or 4 .

Course Objectives and Course Outcomes

<table>
<tr><td>Course Objectives</td><td colspan="3">Upon completion of the course the student shall be able to Understand the design philosophy and design the basic machine elements like shafts, keys, couplings, bearings, springs, bolted, riveted and welded joints</td></tr>
<tr><td rowspan="4">Course Outcomes</td><td>CO1</td><td>M-402.1</td><td>Explain the importance of principal stresses and theories of elastic failure in the design of machine members</td></tr>
<tr><td>CO2</td><td>M-402.2</td><td>Design the temporary and permanent joints used in mechanical engineering equipments</td></tr>
<tr><td>CO3</td><td>M-402.3</td><td>Calculate the stresses in the machine elements</td></tr>
<tr><td>CO4</td><td>M-402.4</td><td>Design the machine elements like 1.shafts, 2.Keys, 3.couplings, 4.bearings and 5.springs</td></tr>
</table>

PO-CO Mapping

Course Code : M-402	Course Title: Design of Machine Members Number of Course Outcomes: 04				No. of Periods 75
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1 – CO4	32	43	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1 – CO4	20	27	2	
PO3	CO1 – CO4	15	20	1	
PO4					
PO5					
PO6					
PO7	CO1 – CO4	08	11	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1				1	2	3	1
CO2	3	2	1				1	2	3	1
CO3	3	2	1				1	2	3	1
CO4	3	2	1				1	2	3	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of the Question Paper

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction to Machine Design	05	06	3	3	-	-	1	1	-	-	CO1
2	Bolted Joints	12	14	3	3	8	-	1	1	1	-	CO1, CO2, CO3
3	Riveted Joints and Welded Joints	18	14	3	3	8	-	1	1	1	-	CO2, CO3
4	Shafts, Keys and Couplings	18	14	3	3	8	10	1	1	1	1	CO1, CO3, CO4
5	Bearings & Springs	22	22	3	3	16	-	1	1	2	-	CO3, CO4
Total		**75**	**80**	**15**	**15**	**40**	**10**	**05**	**05**	**05**	**01**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter - 3 or 4 . (Here it is taken from the Chapter – 4).

LEARNING OUTCOMES

Upon completion of the course the student shall be able to

1.0 Introduction to Machine Design

1.1 Explain the basic procedure of machine design.

1.2 Explain the basic requirements of machine elements and the factors affecting their design

1.3 Explain the concept of principal stresses.

1.4 Write the expressions for principal stresses in two-dimensional cases. **(Problems are omitted)**

1.5 Explain the importance of theories of elastic failure in machine design.

1.6 Write the statements and equations for five theories of elastic failure. **(Problems are omitted)**

2.0 Bolted Joints

2.1 Classify the fasteners or Joints.

2.2 State the advantages, disadvantages and applications of screwed joints.

2.3 Explain screw thread nomenclature and specification of screw threads.

2.4 Classify different forms of threads and threaded fasteners with legible sketches.

2.5 Explain the stresses induced in the bolted joints.

2.6 Modes of failure of bolts.

2.7 Design of bolts subjected to tensile load only – simple problems.

2.8 Design the bolts for steam cylinder covers – simple problems.

2.7 Design the eye bolt used for lifting the given load.

2.8 Draw an eye bolt (not to scale) showing the proportions.

3.0 **Riveted and Welded Joints**

3.1 List the basic types of riveted joints.
3.2 Explain with legible sketch the terms used in riveted joints
3.3 Explain the modes of failures in riveted joints
3.4 Calculate the strength and efficiency of riveted joint
3.5 Design a riveted joint under the given conditions (problems on direct loading only)
3.6 Explain the concept of Diamond or Lozenge joint **(problems are omitted)**
3.7 List the types of welded joints and their symbols.
3.8 Explain the terms related to welded joints.
3.9 Write the advantages and disadvantages of welded joints.
3.10 Design the butt, parallel and transverse fillet welded joints Coursed to simple loading-Simple problems.

4.0 Shafts, Keys and Couplings

4.1 Define the terms i) shaft ii) axle
4.2 State the functions of i) shaft ii) axle
4.3 List the standard sizes of shafts as per I.S
4.4 Write the formula for power transmitted by the shaft
4.5 Design the shaft subjected to i) only torsion ii) only bending iii) combined loading using Rankine and Guest theories.
4.6 Design the shaft against the rigidity
4.7 Compare the strength and rigidity of solid and hollow shafts
4.8 Explain the function of keys and their classification
4.9 List the recommended materials used for keys and splines.
4.10 Write the specifications of i) parallel ii) Gib-head iii) taper sunk keys as per B.I.S.
4.11 Design the keys based on different modes of failure.
4.12 Design the keys based on empirical relations.
4.13 Explain the function of a coupling and their classification
4.14 Design the muff coupling, rigid flange coupling for a shaft of given size using empirical relations.

5.0 **Bearings & Springs**

5.1 State the functions of bearing,
5.2 Write the classification of bearings, their advantages, disadvantages and applications
5.3 Explain the construction and working principle of journal bearing
5.4 Terminology of journal bearing
5.5 Design the simple journal bearing using McKee's equation and calculate the heat generated and heat dissipated **(problems on Artificial cooling are omitted).**
5.6 List the types of thrust bearings
5.7 Write the expressions for the load and torque carried by foot step and collar bearings under uniform pressure conditions.
5.8 Write the expressions for the load and torque carried by foot step and collar bearings under uniform wear conditions.
5.9 Solve simple numerical problems related to the design of thrust bearings.
5.10 Rolling contact bearings – classification, advantages, disadvantages and applications.
5.11 Components of rolling contact bearings – Specification of rolling contact bearings.
5.12 Comparison between sliding and rolling contact bearings.
5.13 State the functions of springs and their classification
5.14 Explain the nomenclature of the helical spring
5.15 Write the expressions for the stresses and deflections of closely coiled helical springs
5.16 Design the helical spring – Simple problems.
5.17 Write the types of leaf springs and their applications.
5.18 Write the expressions for the stresses and deflections of semi-elliptical leaf springs.
5.19 Design the semi - elliptical leaf spring- Simple problems.

COURSE CONTENT

1. **Introduction**

Machine Design – Types of machine design - Factors governing the design of a machine element - General sequence of steps in designing a machine element – Need of standard data and data hand books;

Types of Stresses in design – Stress systems – Uni-axial, Bi-axial and Tri-axial- Graphical representation of the above three stresses - Principal stresses and their importance in machine design – Mathematical formulae for maximum principal stress, minimum principal stress and maximum shear stress acting on a bi-axial system. **(Theoretical concepts only - Problems omitted)**

Theories of elastic failure-Definition and their mathematical statements only. **(Theoretical concepts only - Problems omitted)**

2. **Bolted Joints**

Types of joints –advantages of bolted joints over riveted and welded joints - Nomenclature of thread - Different types of thread forms – specification of bolt;

Types of screw fasteners – lock nuts - Bolts of uniform strength;

Stresses in bolts due to initial tightening and external forces – Stresses due to combined forces – simple problems.

Design of bolts used in steam generating cylinder covers and boiler stays- Simple problems;

Design of eye bolt and sketching the eye bolt for a given load using empirical proportions – Simple problems;

3. **Riveted Joints and Welded Joints**

Types of Riveted joints – advantages of riveted joints over bolted and welded joints - Terms related to riveted joints - Modes of failure of riveted joints - Strength and Efficiency of joints - Simple problems on lap joints and butt joints Courseed to direct loading only.

Concept of Diamond or Lozenge joint **.(Problems are omitted)**

Types of Welded joints - Advantages and disadvantages over other joints - Terms related to weld –Standard location of Weld symbol –Strength of Butt-weld – Strength of Parallel Fillet weld – Strength of Transverse Fillet weld - Numerical problems on direct loading only. **(Problems on eccentric loading are omitted).**

4. **Shafts, Keys and Couplings**

Shafts : Function of shafts and materials used for shafts - Standard sizes of shafts as per I.S. - Types of shafts - Design of solid and hallow shafts based on strength and rigidity using Rankine and Guest theories of failure Courseed to both torsion and bending moments - Comparison of solid and hallow shafts for the weight, power and strength - Numerical problems.

Keys: Function of keys and splines – classification of keys - Materials of keys and splines – Modes of failure of keys – Stresses in the keys - Design of a rectangular sunk key considering its failure against shear and crushing –- Design of rectangular sunk key using empirical proportions for given diameter of the shaft and Check for strength – simple problems.

Couplings: Function of coupling – types of couplings - Requirements of a good coupling - Calculation of proportions of a muff coupling (solid) for a given shaft size using empirical formulae, sketching the same from
the computed dimensions – simple problems.

Rigid flange coupling: Calculation of dimensions for a C.I. flange coupling and coupling bolts for a given torque using empirical proportions for both protected and un-protected types – Simple Numerical problems.

5. **Bearings**

Functions and classification of bearings

Journal bearing – terminology – advantages, disadvantages and applications - McKee's Equation, Bearing Modulus -Power lost in friction – Design of journal bearing based on McKee's equation – Numerical problems.

Thrust bearing- Write the mathematical expressions for load carrying capacity, number of collars and power lost in flat pivot and flat collar bearings under the conditions of uniform pressure and uniform wear (**No derivations**) – Simple numerical problems.

Rolling contact bearings – Classification - applications - advantages and disadvantages - Components of rolling contact bearing - Specification of ball and roller bearings – comparison between sliding contact and rolling contact bearings.

Springs

Functions of springs- classification of springs –spring materials – Nomenclature of helical spring – Write mathematical formulae for stress and deflection of closely coiled helical spring (**No derivations**) – Design of helical spring – spring diameter, spring index, number of turns, stiffness- Simple problems.

Nomenclature of semi-elliptic leaf spring - Write mathematical formulae for stress and deflection of semi-elliptic leaf spring (**No derivations**) – Design of leaf spring – load carrying capacity, number of leaves, stiffness – Simple problems.

REFERENCES

1. Design of Machine Elements - Pandya and Shah.
2. Design of Machine Elements – V B Bhandari (MGH Publishers)
3. Machine Design - R.S.Khurmi.

C-20-M-402

MODEL QUESTION PAPER
DME – IV-SEMESTER
DESIGN OF MACHINE MEMBERS

PART – A

Instructions: **Answer all the questions** **3X10=30**
Each question carries THREE marks

01. List the factors to be considered in the design of a machine element.
02. State Rankine and Guest theories of elastic failure.
03. Find diameter of the hole to be drilled to make M40 bolt as bolt of uniform strength.
04. Draw Metric V Thread, American Standard Thread and Whitworth Thread.
05. Write any three advantages and disadvantages of welded joints over other joints
06. A flat key is used to connect a shaft of 60 mm diameter with a gear transmitting 20kW power at 420 rpm. Find the stresses developed in the key if the dimensions of the key are 90 mm X 15 mm X 10 mm.
07. List the important characteristics of a good coupling
08. Find the shear stress in the transverse fillet weld of length 100 mm and thickness 10 mm.
09. How a roller bearing is specified?
10. List the functions of springs

PART - B

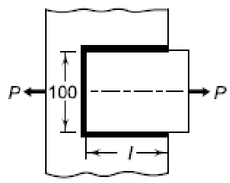
Instructions: **Answer all the questions** **5X8=40**
Each question carries EIGHT marks

11. (a) The cylinder head of a steam engine is connected to cylinder flange by means of 10 bolts. The effective cylinder diameter is 400 mm. The maximum pressure inside the cylinder is 10 bar. The material of bolts is plain carbon steel having yield strength in tension is 540 N/mm^2 and factor of safety is 6. Find the size of bolts by considering the effect of initial tightening and the stiffness factor as 0.6.

OR

(b)Design and draw an eye bolt used to lift a load of 95 kN. The tensile stress is not to exceed 100 N/mm^2.

12. (a) A steel plate, 100 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 70 and 50 N/mm^2 respectively. Find the length of each parallel fillet weld. Assume the tensile force acting on the plates as static.



OR

(b) A double-riveted double-strap butt joint is used to connect two plates; each of 12 mm thickness, by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made of steel. The permissible stresses in tension, shear and compression are 80, 60 and 120 N/mm^2 respectively. Determine the efficiency of the joint.

13. (a) Design a hallow shaft using Rankine and Guest theories of failure, to transmit 20 kW at 300 rpm. The outer diameter of the shaft is twice the inner diameter and the length of the shaft is 1m. The shaft is Courseed to a bending moment of 500N-m and the allowable tensile stress and shear stress of the shaft material are 90MPa and 50MPa respectively. The maximum torque is 1.25 times the rated torque.

OR

(b) It is required to transmit 10 kW power through a shaft at 300 rpm. The shaft is supported at its two ends in bearings which are at 1.5 m apart. A net load of 1200 N is acting at the midpoint of the shaft. Find the diameter of the shaft , if the permissible stresses for the shaft material in shear and tension are 40MPa and 75 MPa respectively.

14. (a) A shaft running at 900 rpm is supported by bearing having L/d ratio of 1.5. The bearing operates in still air at a room temperature of 30^0C. The oil used has absolute viscosity of 0.013 kg/m-s at the operating oil temperature of 130^0C. The diameter of the journal is 50 mm and the ratio d/c is 1000. Determine the permissible load for the bearing and power lost at the bearing. Assume the heat generated equals the heat dissipated.

OR

(b) In a thrust bearing, the external and internal diameters of the contacting surfaces are 320 mm and 200 mm respectively. The total axial load is 80 kN and the intensity of pressure is 350 kN/mm^2. The shaft rotates at 420 rpm. Taking the coefficient of friction as 0.06, calculate the power lost in overcoming friction. Also find the number of collars required for the bearing.

15. (a) It is required to design a helical compression spring Courseed to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1,090 and 81,370 N/mm^2 respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate:

(i) wire diameter; (ii) mean coil diameter; (iii) number of active coils;

OR

(b) A semi-elliptic leaf spring used for automobile suspension consists of three extra full-length leaves and 15 graduated-length leaves, including the master leaf. The centre-to-centre distance between two eyes of the spring is 1 m. The maximum force that can act on the spring is 75 kN. For each leaf, the ratio of width to thickness is 9:1. The modulus of elasticity of the leaf material is 207 000 N/mm^2. The leaves are pre-stressed in such a way that when the force is maximum, the stresses induced in all leaves are same and equal to 450 N/mm^2. Determine, the width and thickness of the leaves;

PART - C

Instructions: Answer the following One question which carries TEN marks. 1X10=10

16. Design a cast iron flange coupling to connect a motor shaft with a pump shaft. The motor is transmitting 20 kW power at 480 rpm. The shaft, key and bolts are made by same material having allowable shear, tensile and crushing stresses as 40 MPa, 80 MPa and 130 MPa respectively. The permissible shear stress of cast iron is 12 MPa.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-402 :: DESIGN OF MACHINE MEMBERS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.10
Unit Test – II	From 4.1 to 5.19

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO1, CO2
2	Principal stresses and Theories of failure	U/R	3	CO1
3	Bolted Joints	U/R	3	CO2
4	Riveted Joints	U/R	3	CO2
5	Welded Joints	U/R	3	CO2
Part - B (24 marks)				
6	Bolted Joints	U/Ap	8	CO2, CO3
7	Riveted Joints	U/Ap	8	CO2, CO3
8	Welded Joints	U/Ap	8	CO2, CO3

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO4
2	Shafts & Keys	U/R	3	CO4
3	Couplings	U/R	3	CO4
4	Bearings	U/R	3	CO4
5	Springs	U/R	3	CO4
Part - B (24 marks)				
6	Shafts & couplings	U/Ap	8	CO3, CO4
7	Bearings	U/Ap	8	CO3, CO4
8	Springs	U/Ap	8	CO3, CO4

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

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BOARD DIPLOMA EXAMINATION,

UNIT TEST - 1

DESIGN OF MACHINE MEMBERS

Time : 120 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Define Principal Stress

   (b) Define Pitch of a thread

   (c) Define Throat of a weld

   (d) Define transverse pitch of riveted joint
2. State Rankine theory of elastic failure and its mathematical statement
3. Draw (i) ACME, (ii)Buttress and (iii) Square threads forms
4. Draw the double riveted, double strap zigzag butt joint
5. Write any three advantages and disadvantages of welded joints over other joints

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. The cylinder head is connected to cylinder flange by means of 16 bolts. The bore of the cylinder is 400mm. The maximum pressure inside the cylinder is 1.25 N/mm^2. The material of bolts is plain carbon steel having yield strength in tension is 400 N/mm^2 and factor of safety is 5. Find the size of bolts by considering the effect of initial tightening and the stiffness factor as 0.6.

   (OR)

   Find the induced tensile stress in a boiler stay supporting an area 400 mm X 300 mm of the flat end surface. The nominal diameter of the stay is 60 mm and the pressure inside the boiler is 1.2 MPa. Consider the effect of initial tightening and the stiffness factor is 0.6.

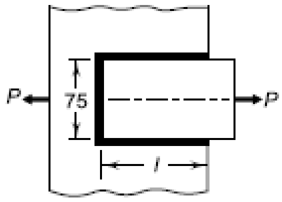
7. Explain different ways of the failures in riveted joints.

   (OR)

   Two tie-bar plates of a bridge structure, 250 mm wide and 20 mm thick, are to be connected by a double-strap butt joint. The rivets and the plates are made of steel. The permissible stresses in tension, shear and compression are 80, 60 and 120 N/mm^2 respectively.

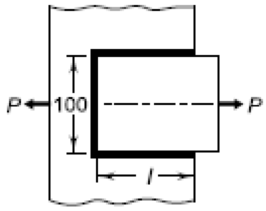
   (i) Determine the diameter of the rivet by using the following empirical relationship, $d = 6\sqrt{t}$ where t is the plate thickness and efficiency of the joint.

8. A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. The joint is Courseed to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 and 50 N/mm^2 respectively. Determine the required length of each parallel fillet weld.



(OR)

A steel plate, 100 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 70 and 50 N/mm2 respectively. Find the length of each parallel fillet weld. Assume the tensile force acting on the plates as static.



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BOARD DIPLOMA EXAMINATION,

UNIT TEST - 2

DESIGN OF MACHINE MEMBERS

Time : 120 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) State function of shaft

(b) State function of coupling

(c) List two advantages of roller bearings.

(d) Define stiffness of a spring

2. A flat key is used to connect a shaft of 60 mm diameter with a gear. Find the stresses developed in the key if the dimensions of the key are 90 mm X 15 mm X 10 mm.
3. List the characteristics of a good shaft coupling?
4. Compare the sliding contact bearings with rolling contact bearings
5. Write the mathematical formulae for stiffness of a leaf spring.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Design a hallow shaft using Rankine and Guest theories of failure, to transmit 20 kW at 300 rpm. The outer diameter of the shaft is twice the inner diameter and the length of the shaft is 1m. The shaft is Courseed to a bending moment of 500N-m and the allowable tensile stress and shear stress of the shaft material are 90MPa and 50MPa respectively. The maximum torque is 1.25 times the rated torque.

(OR)

A rigid flange coupling is used to connect a 45 kW, 1440 rpm electric motor to a centrifugal pump. The starting torque of the motor is 150% of the rated torque. Design flange coupling by taking allowable shear, tensile and crushing stresses as 40 MPa, 90 MPa and 130 MPa respectively for shaft, key and bolts. The permissible shear stress of cast iron is 15MPa.

7. A shaft 200 mm diameter has a speed of 2600 rpm and runs in a bearing which has a length 1.2 times the diameter. The bearing pressure is 0.8 MPa and the coefficient of friction at the bearing surface is 0.006. Calculate the frictional loss in kW units. The temperature of the bearing is controlled by the flow of oil through the bearing. If the difference between the outlet temperature and that at inlet is 20^0C, obtain the quantity of oil required if the specific heat is 1.92 kJ/kg ^{0}C.

(OR)

In a thrust bearing, the external and internal diameters of the contacting surfaces are 320 mm and 200 mm respectively. The total axial load is 80 kN and the intensity of pressure is 350 kN/mm^2. The shaft rotates at 420 rpm. Taking the coefficient of friction as 0.06, calculate the power lost in overcoming friction. Also find the number of collars required for the bearing.

8. It is required to design a helical compression spring Courseed to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1,090 and 81,370 N/mm^2 respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils;

(OR)

Design a laminated steel spring, simply supported at the ends, and centrally loaded with a span of 800 mm for the following data,

Proof load: 8.5 kN Max central deflection: 50 mm

Ratio of width to thickness: 10 Permissible bending stress: 370 MPa

E = 200 GPa

The plates are available in the multiple of 1 mm for thickness and in the multiple of 3 mm for width.

Course Title	Course Code	Periods/Week	Periods per Semester
Hydraulics & Fluid Power Systems	M-403	05	75

TIME SCHEDULE

S. No	Chapter/Unit Titles	Periods	Marks Allocated	Short Answer Questions (3M)	Essay type Questions (8M)	Higher Order Question (10M)
1	Basics of Fluid Mechanics and Fluid Statics	11	14	2	1	
2	Fluid kinematics and Dynamics	13	14	2	1	
3	Flow through pipes	11	11	1	1	1
4	Hydraulic Machines	32	20	4	1	
5	Introduction to Fluid Power Engineering	08	11	1	1	
Total		**75**	**70+10**	**10**	**05**	**01**

Note: Higher order question (10 Marks) may be given from Chapter- 3 or 4.

Course Objectives and Course Outcomes

COURSE OBJECTIVES	Upon completion of the course the student shall be able to		
	01		Understand the basic knowledge on properties of fluids, fluid statics, dynamics and various losses in flow through pipes
	02		Understand the calculation of force exerted by jets in different cases.
	03		Understand construction Details and working of Hydraulic Machines.
	04		Understand the basic components of Fluid Power control systems.
COURSE OUTCOMES	CO1	M-403.1	Explain the basics of fluid Statics and Dynamics
	C02	M-403.2	Calculate Various Losses in flow through pipes
	C03	M-403.3	Describe the working of Hydraulic Turbines and Pumps
	C04	M-403.4	Solve the problems on impact of jet on vanes, Hydraulic turbines and flow through pipes
	CO5	M-403.5	Explain the layout and Functions of each component of Fluid power control systems

PO-CO Mapping

<table>
<tr><td>Course Code:M-403</td><td colspan="4">Course Title: FM& HM
No of Cos: 5</td><td>No. Of periods:75</td></tr>
<tr><td rowspan="2">POs</td><td rowspan="2">Mapped with CO No</td><td colspan="2">CO Periods Addressing PO in Col 1</td><td>Level (1,2,3)</td><td rowspan="2">Remarks</td></tr>
<tr><td>No</td><td>%</td><td></td></tr>
<tr><td>PO1</td><td>CO1 – CO5</td><td>40</td><td>53.33</td><td>3</td><td rowspan="7">>40% Level 3 (Highly Addressed)
25% to 40% Level 2 (Moderately Addressed)
5% to 25% Level 1
(Low Addressed)
<5% Not Addressed</td></tr>
<tr><td>PO2</td><td>CO2, C04</td><td>25</td><td>33.33</td><td>2</td></tr>
<tr><td>PO3</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO5</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO7</td><td>CO1 – CO5</td><td>10</td><td>13.33</td><td>1</td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3						1	2	3	1
CO2	3	2					1	2	3	1
CO3	3						1	2	3	1
CO4	3	2					1	2	3	1
CO5	3						1	2	3	1

3: High, 2: Moderate, 1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Suggestive activities for further strengthening of CO-PO mapping:

1. Assignment may be given to suggest the capacity of an electrical motor / hydraulic pump to lift the water to a particular building in the college.
2. Guest lecture by an industrial expert may be arranged to understand the industrial applications of fluid power systems.

Blue Print of Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Basics of Fluid Mechanics and Fluid Statics	11	14	3	3	8		1	1	1	-	CO1
2	Fluid kinematics and Dynamics	13	14	3	3	8		1	1	1	-	CO1
3	Flow through pipes	11	11		3	8			1	1	-	CO2
4	Hydraulic Machines	32	30		12	8	10		4	1	1	CO3, CO4
5	Introduction to Fluid Power Engineering	08	11		3	8			1	1	-	CO5
Total		**75**	**80**	**6**	**24**	**40**	**10**	**2**	**8**	**5**	**1**	

R-Remember; U-Understanding; Ap- Application ; An- Analylising

Note: Higher order question (10 Marks) may be given from Chapter- 3 or 4. (Here it is taken from Chapter – 4)

Learning Outcomes:

Upon the completion of the course the student shall be able to

1.0 Understand the basics of fluid mechanics &Fluid Statics

1.1 Define a fluid
1.2 Classify fluids
1.3 Define fluid mechanics
1.4 Classify fluid mechanics
1.5 Define statics, kinematics and dynamics
1.6 Define 1. Density 2. specific volume 3. Specific weight 4. Specific gravity 5. surface tension 6. Capillarity 7. Compressibility 8.bulk modulus and state formulae with units.
1.7 Define viscosity
1.8 State Newton's law of Viscosity
1.9 Define dynamic viscosity, kinematics viscosity and state their units
1.10 Differentiate between ideal fluid and real fluid
1.11 Differentiate between Newtonian and Non-Newtonian fluids with examples
1.12 Define fluid pressure and its units
1.13 Explain the difference between absolute pressure, atmospheric pressure, gauge pressure and vacuum pressure
1.14 Explain pressure head of a liquid
1.15 State Pascal's law
1.16 Classify pressure measuring instruments
1.17 Explain simple and differential U-Tube manometers with sketches and Solve Simple problems
1.18 Explain the construction and working principle of Bourdon tube

2.0 Fluid kinematics and Fluid Dynamics

2.1 State types of fluid flow

2.2 Define steady flow and unsteady flow Define uniform flow and non- uniform flow one, two and three dimensional flow rotational and irrotational flow, laminar and turbulent flow compressible and incompressible flows

2.3 Flow pattern: path line, stream line and streak lines

2.4 Define rate of flow or discharge

2.5 State law of continuity and explain continuity equation and Solve simple problems on discharge and law of continuity.

2.6 Mention and explain types of head of liquid in motion

2.7 Explain potential energy, kinetic energy, pressure energy and total head

2.8 State Bernoulli's theorem

2.9 Explain Bernoulli's equation (without proof)

2.10 State the assumptions made in Bernoulli's theorem

2.11 Mention the practical applications of Bernoulli's theorem

2.12 Explain horizontal venturimeter, orifice meter and pitot's tube with expressions for discharge

2.13 Simple Problems on Bernoulli's theorem, Venturimeter.

3.0 Flow through pipes

3.1 Define loss of head in pipes

3.2 Mention major energy losses and minor energy losses

3.3 Define loss of head in pipes due to friction (major energy losses)

3.4 State the Darcy- Weisbach's formula (without proof)

3.5 Pipes in series, parallel and Equivalent pipes

3.6 State the condition for maximum transmission of power (without proof)

3.7 Explain the maximum efficiency of transmission of power

3.8 Solve simple problems on Power Transmission

4.0 Hydraulic Machines

4.1 Derive an expression for the force of jet exerted on a fixed flat plate held normal to the jet

4.2 Derive an expression for the force of jet exerted on a fixed flat plate held inclined to the jet

4.3 Derive an expression for the force of jet exerted on a fixed curved plate

4.4 Derive an expression for the force of jet exerted on a moving flat plate held normal to the jet

4.5 Derive an expression for the force of jet exerted on a moving flat plate held inclined to the jet

4.6 Derive an expression for the force of jet exerted on flat plates fixed on the rim of wheel

4.7 Explain power and efficiency of jet for all the above with formulae

4.8 Solve simple problems on the above

4.9 Explain the schematic layout of Hydraulic Power plant

4.10 Define gross head and net or effective head and state its formula

4.11 List the efficiencies of Hydraulic Turbines. Define hydraulic, mechanical, volumetric and overall efficiencies with formulae

4.12 Define and Classify hydraulic turbines

4.13 Describe Pelton wheel, Francis turbine, Kaplan turbine with a legible sketch.

4.14 Solve Simple problems on Work done and efficiency of Pelton Wheel Turbine only.

4.15 Explain the functions of penstock, surge tank and draft tube.

4.16 Define Unit power, unit speed and unit discharge- Specific speed

4.17 Compare impulse and reaction turbines

4.18 Define and Classify pumps.

4.19 Explain the Principle of operation and constructional details of a centrifugal pump

4.20 Define Work done by a centrifugal pump and state the formula (without proof)

4.21 State the various Heads of centrifugal pumps
4.23 Define and state the formula of Specific speed
4.24 Explain Priming of centrifugal pump.
4.25 Explain cavitation and its effects in centrifugal pump
4.26 Define and Classify Reciprocating pumps and state its applications.
4.27 Explain the Principle of operation, Constructional details and working reciprocating pumps
4.28 Expression for discharge, work done and Power required to drive a reciprocating pump (with-out derivation)
4.29 Explain Slip, Negative slip and co-efficient of discharge in reciprocating pump.
4.30 Differentiate centrifugal and reciprocating pumps

(Numerical Problems are omitted in Pumps)

5.0 Introduction to Fluid Power Engineering

5.1 Explain the meaning of fluid power.
5.2 List out the Advantages and applications of fluid power
5.3 Differentiate between Hydraulics and Pneumatics
5.4 Explain hydraulic system with a schematic diagram
5.5 Explain Pneumatic system with a schematic diagram
5.6 Distinguish between open loop and closed loop systems
5.7 State the functions of Valves and Actuators.
5.8 Classify Valves and Actuators.

Course Contents

1.0 Basics of fluid mechanics & Fluid Statics

Basics of Fluid Mechanics: Define a Fluid, properties of fluids: Definitions, units and formulae - Mass Density, Specific Volume, Specific Weight, Specific Gravity, Viscosity, Newton's law of viscosity, Kinematic Viscosity, variation of viscosity with temperature, cohesion and adhesion, Surface Tension, Capillarity, vapour pressure Compressibility and Bulk Modulus and their units, classifications of fluids, ideal and real fluids, Newtonian and non- Newtonian fluids, simple problems.

Fluid Statics: Definition of pressure and units of pressure , Relation between vacuum, absolute and atmospheric pressure , Pressure head of a liquid Pascal's law, Pressure measurement, pressure measuring instruments: Piezometer, Manometers –Simple U-tube and Differential U-tube, Mechanical gauge: Construction and working of Bourdon tube, Simple problems on U-tube manometers.

2.0. Fluid Kinematics and Fluid Dynamics

Fluid Kinematics : Types of fluid flow , Steady and unsteady flow, Uniform and non-uniform flow One, two and three dimensional flow, , laminar and turbulent flows, Rotational and Irrotational flow , Compressible and in-compressible flow , Flow pattern: path line, stream line and streak lines , Rate of flow or discharge , Continuity equation , Simple problems .

Fluid Dynamics: Various forms of energy present in fluid flow, Pressure energy, Potential energy, Kinetic energy, total energy, Bernoulli's equation, assumptions made in deriving Bernoulli's equation, Flow measurements: coefficient of discharge of Venturi meter, Pitot's tube, Simple problems .

3.0 Flow through pipes

Losses in pipe lines, minor losses in pipe lines: Loss due to sudden enlargement and sudden contraction, Major losses Loss of head in pipes due to friction, Darcy-Weisbach's formula (without proof), coefficient of friction and friction factor, pipes in series , pipes in parallel, concept of equivalent pipe, maximum power transmission, Hydraulic Gradient Line and Total Energy lines, power transmitted through the pipe, Condition for maximum power transmission, Simple problems.

4.0 Hydraulic Machines:

Impact of jet on Vanes

Impulse-momentum principle, Force exerted by a jet striking normally on a fixed plate, inclined fixed plate, on fixed curved vane strikes at centre. Force of jet on moving flat plate held normal to the jet, work done and efficiency. Simple Problems on impact of jets.

Hydraulic turbines

Schematics Layout of Hydraulic Power Plant, Types of heads ,Gross head , Net or effective head-definition and formula, Efficiencies with formula, Hydraulic Efficiency, Mechanical Efficiency, volumetric Efficiency, and Overall Efficiency.

Definition of a Turbine, Classification of hydraulic turbine

Impulse turbines: Constructional details and working of a Pelton wheel (Impulse turbine), Work done and efficiency of Pelton wheel (Definition and formulae only) Hydraulic Efficiency, Mechanical Efficiency, volumetric Efficiency, and Overall Efficiency- related numerical problems.

Reaction turbines -Constructional details and working of Kaplan and Francis turbine, Work done and efficiency of Francis turbine, Use of penstock, surge tank and draft tube, Unit power, unit speed and unit discharge- Specific speed and their significance. Comparison between impulse and reaction turbines

Hydraulic pumps

a) Centrifugal Pumps

Definition-pumps, Classification of pumps, differentiate positive and non-positive displacement of pumps, Construction and operation of a centrifugal pump, Types of casing. Work done by a centrifugal pump, Heads of centrifugal pumps, Efficiency, Discharge and Power required in a centrifugal pump, Specific speed- definition and formula, Priming of centrifugal pump, Cavitations

b) Reciprocating pumps

Definition of Reciprocating pumps and its applications Types of reciprocating pumps Principle of operation, Constructional details and working Power required to drive a reciprocating pump single acting, double acting pump. Slip, Negative slip and co-efficient of discharge in reciprocating pump. Comparison between centrifugal and reciprocating pumps

5.0. Introduction to Fluid Power Engineering

Definition of fluid power, advantages and applications of fluid power, Differentiate between Hydraulics and Pneumatics, components of hydraulic system with a schematic diagram, components of Pneumatic system with a schematic diagram, open loop and closed loop systems. Functions and Classifications of Control Valves and Actuators.

REFERENCE BOOKS

1	Fluid Mechanics	Dr. A. K. Jain	Khanna Publishers, Delhi
2	Fluid Mechanics and Machinery	B C S Rao	Tata McGraw Hill Publishers
3	Fluid Mechanics and Hydraulic Machines	R.K.Bansal	Laxmi Publications(P)Ltd New Delhi
4	Fluid Mechanics and Hydraulic Machines	Dr.D.S.Kumar	S.K KATARIA &SONS. New Delhi

C20-M-403

BOARD DIPLOMA EXAMINATION,
MODEL QUESTION PAPER
DME - FOURTH SEMESTER EXAMINATION

HYDRAULICS & FLUID POWER SYTEMS

Time: **3** hours] [Total Marks: **80**

PART – A **3*10 = 30**

Instructions: (1) Answer **all** questions.

(2) Each question carries **Three** marks.

1. Define the following fluid properties *(a)* Viscosity *(b)* Surface tension

2. Calculate the specific gravity of a liquid whose specific weight is 7·5 k N/m^3?

3. State any three limitations of Bernoulli's theorem

4. State continuity equation and mention units of each term.

5. Water flows through a pipe 250 mm in diameter and 60 m long with a velocity of 3 m/s. Find the loss of head due to friction by using Darcy's formula when f = 0·005.

6. Derive an expression for the force exerted by a jet of water on fixed vertical plate in the direction of the jet.

7. A jet of water of 50mm diameter with a velocity of 25m/sec is impinging normally on a plate. Find the force exerted by the jet. When plate is moving with a velocity of 10m/sec in the direction of jet

8. Write any three differences between Impulse turbine and Reaction turbine.

9. What is priming, why it is necessary.

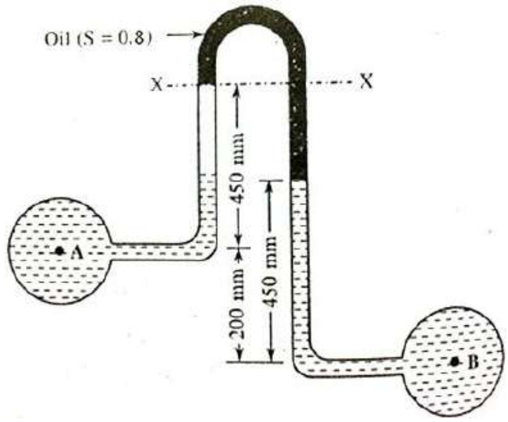
10. List out any six applications of fluid power systems.

PART – B **8*5 = 40**

Instructions: (1) Answer all **Five** questions either A or B from each question.

(2) Each question carries **Eight** marks.

11. (A) An inverted differential manometer is connected to two pipes A and B carrying water as shown in the figure. The fluid in the manometer is oil of specific gravity 0.8. Determine the pressure difference between A and B.



(OR)

(B) Explain the construction and working principle of Bourdon tube with a legible sketch.

12. (A) A pipe 300m long has a slope of 1 in 100 taper from 1.5 m diameter at the higher end to 0.75 m diameter at the lower end. The discharge of water through the pipe is 5500 litre/min. If the pressure at the higher end is 100 kPa, then find the pressure at the other end.

(OR)

(B) A horizontal venturi meter, 30 cm × 15 cm, discharges 80 liter/sec. If the difference of the pressure head between inlet and throat is 1·5 m of water, find the coefficient of discharge of venturi meter.

13. (A) Find the maximum power transmitted through a pipe of 100 mm diameter and 2 km long. The supply head is 4·9 kPa. [Take f = 0.01]

(OR)

(B) Two reservoirs are connected by a straight pipe 1·6 km long for the first half of its length it has 160 mm diameter and then suddenly reduced to 80 mm. The water level in the two reservoirs differ by 30 m. Determine the rate of flow in litre/min. [Take f = 0.01] Neglect minor losses.

14. (A) A jet of water of diameter 10cm strikes a flat plate normally with a velocity of 15m / s. The plate is moving with a velocity of 6m / s in the direction of the jet on the plate. Find (i) Work done by the jet on the plate / sec. (ii) Efficiency of the jet.

(OR)

(B) explain the working of centrifugal pump.

15. (A) Explain Pneumatic system with a schematic diagram.

(OR)

(B) Explain hydraulic system with a schematic diagram.

PART – C **10*1 = 10**

Instructions: (1) Answer **One** question.

(2) Question carries **Ten** marks.

16. A Pelton wheel receives water from the reservoir under a gross head of 510 m. one-third of gross head is lost due to friction in a penstock. The discharge of water is 2 m^3/ sec jet deflected angle is 165^0 neglect the effect of the shock the velocity coefficient is 0.98 and speed ratio is 0.46. Calculate power developed by the Pelton wheel and hydraulic efficiency.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-403 :: HYDRAULICS & FLUID POWER SYTEMS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1 to 3
Unit Test – II	From 4 to 5

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Basics of fluid mechanics &Fluid Statics, Fluid kinematics and Fluid Dynamics, Fluid flow through pipes	R,U	4	CO1, CO2,
2	Basics of fluid mechanics &Fluid Statics	U	3	CO1
3	Fluid kinematics and Fluid Dynamics	U	3	CO1
4	Fluid kinematics and Fluid Dynamics	U	3	CO1
5	Fluid flow through pipes	U	3	CO2,CO4
Part - B (24 marks)				
6	Basics of fluid mechanics &Fluid Statics	Ap	8	CO1
7	Fluid kinematics and Fluid Dynamics	Ap	8	CO1
8	Fluid flow through pipes	Ap	8	CO2,CO4

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Impact of jet on vanes, Hydraulic Machines, Introduction to Fluid Power Engineering	R,U	4	CO3,CO5
2	Hydraulic Machines	U	3	CO3,CO4
3	Hydraulic Machines	U	3	CO3,CO4
4	Hydraulic Machines	U	3	CO3,CO4
5	Introduction to Fluid Power Engineering	U	3	CO5
Part - B (24 marks)				
6	Hydraulic Machines	Ap	8	CO3,CO4
7	Hydraulic Machines	Ap	8	CO3,CO4
8	Introduction to Fluid Power Engineering	U	8	CO5

R-Remember; U-Understanding; Ap-Application ; An- Analylising

C20-M-403

BOARD DIPLOMA EXAMINATION,
Unit Test - 1

HYDRAULICS & FLUID POWER SYTEMS (M-403)

Time : 90 Minutes   Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) One litre of a certain fluid weighs 8N. specific volume of the same fluid is----------

   (b) ----------------------------is the formula for determining the size of equivalent pipe for two pipes of lengths L1, L2 and diameters d1, d2 respectively? Where, L = L1 + L2

   (c) In a steady, ideal flow of an incompressible fluid, total energy at any point of the fluid is always constant. This theorem is known as-------------

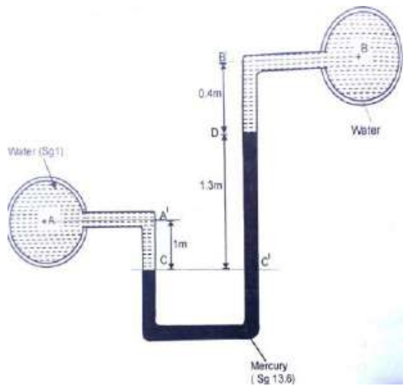
   (d) The imaginary line drawn in the fluid in such a way that the tangent to any point gives the direction of motion at the point, is called as----------

2. State any two differences between compressible and incompressible fluids?
3. State the condition for maximum power transmitted through a pipe. What is the corresponding maximum efficiency?
4. State any three assumptions made in Bernoulli's theorem.

PART – B

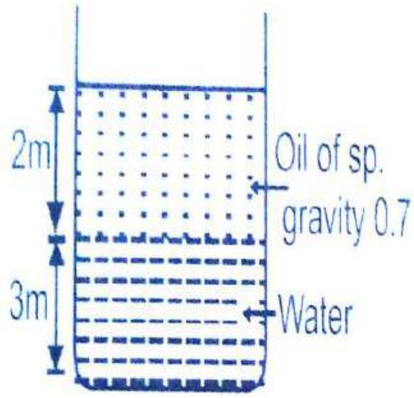
Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

5. A U-tube differential manometer, containing mercury is connected to two pipes as shown in figure. The pipes are carrying water. Find the pressure difference between two pipes.



(OR)

A cylinder vessel having the cross- sectional area of 2m^2 contains oil of Specific gravity 0.7 up to a depth of 2m and the remaining depth of 3m contains water as shown in fig. Determine. (A) The pressure and (B) Force acting on the bottom of the cylinder.



6. A vertical pipe of 15 m high and 6 m in diameter is filled with water. The distance between datum to the pipe bottom is 3 m. How much potential energy is stored in the water? Also express potential energy in terms of energy head.

(OR)

A 50 cm diameter pipe, carrying water, branches into two pipes of diameters 30 cm and 15 cm respectively. The mean velocity in the 50 cm diameter pipe is 3 m/sec and in the 30 cm diameter pipe is 2 m/sec. Determine.

(a) Discharge in 50 cm pipe.

(b) Velocity in 15 cm pipe.

7. Water is supplied from a reservoir through a 300 mm diameter pipe and 600 m long to a turbine which is situated 108m below the free surface. Discharge through the pipe is 81 lit/sec. Find the head lost and the power transmitted by the pipe? Darcy's friction factor, f =0.01.

(OR)

Find the maximum power that can be transmitted to a power station through a hydraulic pipe 3 km long and 20 cm diameters, when the pressure at the power station is 600 kN/m^2. Take f = 0.0075.

C20-M-403

BOARD DIPLOMA EXAMINATION,
Unit Test - 2

HYDRAULICS & FLUID POWER SYTEMS (M-403)

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Pelton turbine the energy available at inlet of runner that is at outlet of nozzle is known as----------------------

   (b) Francis Turbine is a Reaction turbine. (True/False)

   (c) Centrifugal pumps transport fluids by converting _________ energy to_________ energy

   (d) The speed of the reciprocating pump is generally measured in ______

2. Derive an expression for normal force due to impact of jet on an inclined fixed plate.
3. State any three differences between peloton wheel and Francis turbine.
4. Classify water turbines according to the direction of flow?
5. Define static and manometric heads of a centrifugal pump?

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A 20cm diameter jet of water strikes a curved vane with a velocity of 30m/s. The inlet angle is zero and the outlet angle is 25^0. Find the resultant force on the vane.
   a) When vane is fixed
   b) When the vane is moving with a velocity of 15m/s in the direction of jet

   (OR)

   A jet of water moving at 15 m/sec impinges on a symmetrical curved vane shaped to deflect the jet through 120^0 when stationary. If the vane is moving at 6 m/sec, find the angle of jet so that there is no shock at inlet. What is the absolute velocity of jet at outlet and the work done per kg of water?

7. A Pelton wheel is to be designed for the following specifications: Power = 12000kW, Head= 360m , Speed= 700 rpm, overall efficiency = 86% and the jet diameter is not to exceed one-sixth of the wheel diameter, determine
   a) The wheel diameter
   b) The no of jets required
   c) Diameter of jet

   Take Cv= 0.985 and speed ratio = 0.45

   (OR)

   Explain the working of reciprocating pump.

8. Explain Pneumatic system with a schematic diagram

   (OR)

   Explain hydraulic system with a schematic diagram.

C20-M-403

BOARD DIPLOMA EXAMINATION,
MODEL QUESTION PAPER
DME - FOURTH SEMESTER EXAMINATION

HYDRAULICS & FLUID POWER SYTEMS

Time: **3** hours] [Total Marks: **80**

PART – A **3*10 = 30**

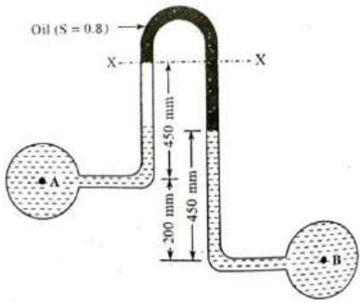
Instructions: (1) Answer **all** questions.
(2) Each question carries **Three** marks.

1. Define the following fluid properties *(a)* Viscosity *(b)* Surface tension
2. Calculate the specific gravity of a liquid whose specific weight is 7·5 k N/m^3?
3. State any three limitations of Bernoulli's theorem
4. State continuity equation and mention units of each term.
5. Water flows through a pipe 250 mm in diameter and 60 m long with a velocity of 3 m/s. Find the loss of head due to friction by using Darcy's formula when f = 0·005.
6. Derive an expression for the force exerted by a jet of water on fixed vertical plate in the direction of the jet.
7. A jet of water of 50mm diameter with a velocity of 25m/sec is impinging normally on a plate. Find the force exerted by the jet. When plate is moving with a velocity of 10m/sec in the direction of jet
8. Write any three differences between Impulse turbine and Reaction turbine.
9. What is priming, why it is necessary.
10. List out any six applications of fluid power systems.

PART – B **8*5 = 40**

Instructions: (1) Answer all **Five** questions either A or B from each question.
(2) Each question carries **Eight** marks.

11. (A) An inverted differential manometer is connected to two pipes A and B carrying water as shown in the figure. The fluid in the manometer is oil of specific gravity 0.8. Determine the pressure difference between A and B.



(OR)

(B) Explain the construction and working principle of Bourdon tube with a legible sketch.

12. (A) A pipe 300m long has a slope of 1 in 100 taper from 1.5 m diameter at the higher end to 0.75 m diameter at the lower end. The discharge of water through the pipe is 5500 litre/min. If the pressure at the higher end is 100 kPa, then find the pressure at the other end.

(OR)

(B) A horizontal venturi meter, 30 cm × 15 cm, discharges 80 liter/sec. If the difference of the pressure head between inlet and throat is 1·5 m of water, find the coefficient of discharge of venturi meter

13. (A) Find the maximum power transmitted through a pipe of 100 mm diameter and 2 km long. The supply head is 4·9 kPa. [Take f = 0.01]

(OR)

(B) Two reservoirs are connected by a straight pipe 1·6 km long for the first half of its length it has 160 mm diameter and then suddenly reduced to 80 mm. The water level in the two reservoirs differ by 30 m. Determine the rate of flow in litre/min. [Take f = 0.01] Neglect minor losses.

14. (A) A jet of water of diameter 10cm strikes a flat plate normally with a velocity of 15m / s. The plate is moving with a velocity of 6m / s in the direction of the jet on the plate. Find (i) Work done by the jet on the plate / sec. (ii) Efficiency of the jet

(OR)

(B) A jet of water 20 mm in diameter, moving with a velocity of 10 m/s, strikes on a series of vanes moving with a velocity of 3 m/s. Find (i) force exerted by jet (ii) work done per second (iii) efficiency of the jet.

15. (A) Explain Pneumatic system with a schematic diagram

(OR)

(B) Explain hydraulic system with a schematic diagram

PART – C **10*1 = 10**

Instructions: (1) Answer **One** question.
(2) Question carries **Ten** marks.

16. Suggest the power rating of a double-acting single cylinder reciprocating pump for a house hold application, to fill the water tank of capacity of 15000 Litres in 5 min. The pump has to lift the water from the sump 10m below the ground to the water tank at a height of 20m from the ground. The piston diameter 250 mm, piston rod diameter 50 mm and stroke 400mm operates at 80 rpm assume the efficiency of the pump as 80%. Calculate the percentage slip, coefficient of discharge.

Course Title	Course Code	Periods/Week	Periods per Semester
Heat Power Engineering-I	M-404	05	75

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Combustion of Fuels	12	14	02	01	
2	Internal Combustion Engines	20	14	02	01	01
3	Performance of IC Engines.	14	14	02	01	
4	Air Compressors.	15	14	02	01	
5	Gas Turbines & Jet Propulsion.	14	14	02	01	
	Total	**75**	**70+10**	**10**	**05**	**01**

Note: 10 Marks higher order question may be given from the Chapter - 2 or Chapter - 3 or Chapter - 4.

Course Objectives and Course Outcomes

Course Objectives		Upon completion of the course the student shall be able to: Apply the principle and concepts of Heat Power Engineering to solve the contemporary real time applications	
Course Outcomes	CO1	M-402.1	Explain the combustion process of fuels
	CO2	M-402.2	Describe the working of I.C. Engines and various systems of I.C. Engines.
	CO3	M-402.3	Solve numerical problems related to performance of I.C. Engines.
	CO4	M-402.4	Describe the working of Air compressors and solve numerical problems.
	CO5	M-402.5	Describe the working of Gas turbines and Jet propulsion

PO-CO Mapping

Course Code: M-404		Course Title: Heat Power Engineering – I Number of Cos Addressed: 05			No of Periods:75
PO No	**Mapped with CO No.**	**CO Periods addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%ge**		
PO1	CO1 – CO5	40	53.33	3	**>40% Level 3 Highly addressed** **25% to 40% Level 2 Moderately addressed** **5 to 25% Level 1 Low addressed** **<5% Not addressed**
PO 2	CO1, CO3, CO4	15	20.00	2	
PO 3	CO3	10	13.33	2	
PO 4					
PO 5					
PO 6					
PO 7	CO1 – CO5	10	13.33	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2					1	1	3	
CO2	3						1	1	2	1
CO3	3	2	2				1	2	3	
CO4	3	2					1	2	3	
CO5	3						1	1	2	

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Suggestive activities for further strengthening of CO-PO mapping:

1. Seminars may be arranged on the subject of emerging bio fuels, compatibility with conventional fuels and their effect on pollution.
2. Students shall be advised to go through the videos on jet propulsion

Blue Print of a Question Paper

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Combustion of Fuels	12	14	03	03	08		01	01	01		CO1
2	Internal Combustion Engines	20	24	03	03	08		01	01	01	01	CO2
3	Performance of I.C Engines	14	14	03	03	08		01	01	01		CO3
4	Air Compressors	15	14	03	03	08	10	01	01	01		CO4
5	Gas Turbines & Jet Propulsion.	14	14	03	03	08		01	01	01		CO5
TOTAL		**75**	**80**	**15**	**15**	**40**	**10**	**05**	**05**	**05**	**01**	

R-Remember; U-Understanding; Ap-Application ; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter - 2 or Chapter - 3 or Chapter - 4 (Here it is taken from the chapter –2).

Learning Outcomes

Upon on completion of the course the student shall be able to:

1.0 Combustion of Fuels.

1.1 Define Combustion, Products of Combustion
1.2 Balance of chemical Equations for the composition of unit mass/Unit Volume of the given fuel
1.3 Estimate the minimum air required for complete combustion of unit mass / unit volume of a fuel of given composition.
1.4 Estimate the percentage composition of dry products of flue gases by mass only during combustion.
1.5 Describe the working of Orsat's apparatus with a line diagram and summarize the procedure in conducting flue gas analysis by using Orsat's apparatus.

2.0 Internal Combustion Engines

2.1 Define "Heat Engine" and classify heat engines based on the location of furnace.
2.2 Give examples for the external combustion engines and internal combustion engines.
2.3 State the advantages of internal combustion engines over external combustion engines.
2.4 Classify Internal Combustion Engines based on number of strokes per cycle, type of fuel used, thermodynamic cycle, method of ignition, number of cylinders and arrangement of cylinders.
2.5 Draw the legible sketch of an I.C. engines and name the various parts.
2.6 Describe with line diagrams, the working of a four-stroke diesel engine.
2.7 Describe with line diagrams the working of a four-stroke petrol engine.
2.8 Describe with line diagrams the working of a two-stroke petrol engine.

2.9 Compare two stroke engines with four stroke engines
2.10 Draw the port time diagrams for two-stroke petrol engine and also draw valve time diagrams for four-stroke petrol and four-stroke diesel engines.
2.11 Describe the working of fuel system of diesel engine with a legible sketch.
2.12 Describe the working of fuel system of petrol engine with a legible sketch.
2.13 Describe the working of simple carburettor with a neat sketch.
2.14 Describe the working of Zenith carburettor with a neat sketch.
2.15 Explain different methods of cooling systems of I.C engines.
2.16 Explain different methods of Ignition systems of IC engine.
2.17 Explain different methods of lubricating systems in I.C. engines.
2.18 Explain different methods of governing of I.C. engines.
2.19 Concept of super charging in I.C. engines.

3.0 Performance of Internal Combustion Engines

3.1 State the objectives of testing an IC engine
3.2 List performance parameters of an IC engine.
3.3 Write the mathematical formula for performance parameters of an IC engine **(no proofs) - simple problems on performance parameters**
3.4 Describe the Morse test on multi-cylinder engine - simple problems
3.5 Parameters of Heat balance sheet.- simple problems.

4.0 Air compressors

4.1 List the functions of air compressors and the uses of compressed air.
4.2 Categorize the different types of compressors based on number of stages, principal of operation, pressure ratio, number of cylinders, method of cooling, .
4.3 Describe with a line diagram, the working of a single stage reciprocating air compressor.
4.4 State the formula for work done and power required by a single stage compressor. **(No derivation).**
4.5 Solve simple problems on single acting single stage reciprocating air compressors **(neglecting clearance volume).**
4.6 Summarize the advantages of multi- stage compressor over single stage compressor.
4.7 Explain the use of inter cooler.
4.8 Explain the condition for minimum work done in two stage compression.
4.9 State the formula for work required, minimum work required and power required in two stage compressor**.(no derivation)**
4.10 Solve simple problems on work required, minimum work required and power required in a two stage air compressor with or without perfect intercooling. **(neglecting clearance volume).**
4.11 List the types of rotary compressors- Distinguish reciprocating air compressors with rotary air compressors.
4.12 Describe the working of a centrifugal compressor, an axial flow type compressor and a vane type compressor with a line diagram.

5.0 Gas turbines & Jet Propulsion.

5.1 Classify the gas turbines based on cycle of operation, thermodynamic cycle, fuel used and process of heat addition.
5.2 Differentiate the gas turbines with the I.C. engines.
5.3 State the advantages and limitations of gas turbine.
5.4 Describe with a line diagram, the working of an open cycle constant pressure type gas turbine.
5.5 Describe the working of a closed cycle type gas turbine with line diagram.
5.6 Draw the cycle of operation for the above type gas turbines on p-V and T-s diagrams.
5.7 Explain the concept of jet propulsion.
5.8 Describe the principle of operation of Ramjet engine with a line diagram.
5.9 Describe the principle of operation of Turbo- jet engine with a line diagram.
5.10 State the applications of jet engine.
5.11 Describe the working of a rocket engine with a line sketch.
5.12 List the fuels used in jet propulsion.

COURSE CONTENT

1.0 Combustion of Fuels .

Introduction to combustion of fuel- Write Combustion chemical equations for the combustion of carbon, Hydrogen, sulphur, Methane, Ethane etc.

Mathematical expressions for calculation of minimum air required on mass basis and volume basis. **(No derivations)**

Calculation of minimum air required for the complete combustion of unit mass/unit volume of fuel having a given composition – Simple problems.

Calculation of Actual air required for the complete combustion of unit mass/unit volume of fuel having a given composition when excess air is supplied – Simple problems.

Procedure for Conversion of volumetric analysis to gravimetric analysis, and vice-versa - simple problems.

Products of combustion - Calculation of percentage composition of dry flue gases by mass and volume (**neglecting wet products) -** simple problems.

Brief description of Orsat's apparatus, procedure for determination of flue gas analysis, chemicals used for absorption of different gases in flue gases.

2.0 Internal Combustion Engines

Heat engines – Internal combustion engines and external combustion engines - advantages of I.C. engines over external combustion engines- classification of I.C. engines - neat sketch of I.C. engine indicating important parts - Function of each part and materials used for the parts – Brief explanation on the working of four-stroke diesel engine, working of four stroke and two stroke petrol engines with line diagrams - Comparison of two stroke engines and four stroke engines - Comparison of diesel engine and petrol engine - Valve timing/port diesel and petrol engines.

Description with sketches of a diesel fuel system - fuel tanks, fuel filter, fuel pump and fuel injector - Description of petrol engine fuel system - functions of tank, fuel filter, fuel pump and carburettor - Working of a Zenith Carburettor (Line sketch) –

Cooling system of I.C. engines : air cooling, water cooling system with thermo siphon method of circulation and water cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water cooling system.

Ignition systems: Description and working Battery coil ignition and magneto ignition systems with line diagrams - Comparison of both systems.

Lubricating systems used in I.C. engines: Splash and Pressure systems with line diagrams. Governing of I.C. engines: – Explanation of quantitative method and qualitative methods of governing (No sketches)

Super charging in I.C. Engines (Concepts only)- advantages.

3.0 Performance of Internal Combustion Engines.

Objectives – Mathematical Expressions for I.P, B.P, F.P, Mechanical efficiency, indicated thermal efficiency, Brake thermal efficiency, Air standard efficiency, Relative efficiency and Specific fuel consumption- Simple problems on the above parameters.
Procedure to conduct Morse test on multi cylinder petrol engine – Simple problems.
Calculation of parameters of Heat balance sheet – Simple problems.

4.0 Air Compressors.

Functions of air compressor – uses of compressed air – types of air compressors.-Single stage reciprocating air compressor its construction and working (with line-diagram) using p-V diagram.
Formulae for work required and power required **(No proof)** - simple problems on calculation of work done and power required for single acting single stage air compressors. **(neglecting clearance volume).**
Multi stage compressors – advantages over single stage compressors. Use of inter cooler – Formulae for work done and power required in two stage compressors - conditions for minimum work in two stage compressor **(without proof).**
Solve simple problems on work required, minimum work required and power required in a two stage air compressor with or without perfect intercooling. **(neglecting clearance volume).**
Rotary compressors –-types – descriptive treatment of Centrifugal compressor, axial flow type compressor -and vane type compressors- differences between reciprocating and rotary air compressors.

5.0 Gas Turbines & Jet Propulsion

Gas turbines – Classification – open cycle gas turbines and closed cycle gas turbines – comparison of gas turbines with reciprocating I.C. engines. Applications and limitations of gas turbines. Open cycle constant pressure gas turbine – general layout, P.V. and T.S diagrams and working - Closed cycle gas turbine – P.V. and T.S diagrams – working. Principle of operation of Ram jet engine and Turbojet engines – application of jet engines. Rocket engine – its principle of working & application. Fuels used in jet propulsion.

REFERENCE BOOKS

1. R.S.Khurmi & J K Guptha, Thermal Engineering, 2006, S CHAND publishers
2. Mahesh M Rathore, Thermal Engineering, 2010, MGH Publishers
2. Mathur & Mehtha, Thermal Engineering, 2009, Jain Brothers
3. Heywood, Internal Combustion Engines Fundamentals, 2017, MGH Publishers
4. P.L.Ballaney, Thermal Engineering, 1966, Khanna Publishers

C-20-M-404

BOARD DIPLOMA EXAMINATION
D.M.E. – IV SEMESTER EXAMINATION
HEAT POWER ENGINEERING -I

Time : 3 Hours Total Marks: **80**

PART – A

10 X3 = 30

Instructions: *Part A consists of **10** questions. Answer **all** questions and each question carries **three** marks.*

1. Write the expression for minimum air required for combustion of fuel
2. Write the chemicals used in Orsat apparatus to absorbs various combustion products.
3. Write any three differences between battery ignition system and magnetic ignition system.
4. Write the objectives of supercharging.
5. List important performance parameters of I.C engines.
6. A single cylinder, 4-stroke diesel engine has a bore of 110 mm, stroke 120 mm. The indicated mean effective pressure is 375 kN/mm^2.
7. Write any three applications of compressed air in the engineering applications.
8. Write three differences between centrifugal compressors and axial flow compressors.
9. Write the applications of the gas turbines.
10. List the fuels used in Jet engines.

PART – B

5 X 8 = 40

Instructions: *Part B consists of **5** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

11. A) Describe the working of Orsat apparatus with a line sketch

(OR)

B) The following is the percentage composition a sample of coal on mass basis:

C -82; H_2 – 6; O_2 – 9; and ash – 3. Find

i) The minimum mass of air required for complete combustion of coal; and

ii) The volumetric analysis of the products of combustion, if 10% excess air is supplied.

Assume air contains 23% of oxygen on mass basis.

12. A) Explain the working of 4- stroke C.I. engine with a neat sketch.

(OR)

B) Draw Valve time diagram of four stroke engine and label the important events.

13. A) A six-cylinder, four-stroke engine gasoline engine having a bore of 90 mm and stroke of 100 mm has a compression ratio 8. The relative efficiency is 60%. When the indicated specific fuel consumption is 3009 g/kWh. Estimate (i) The calorific value of the fuel and (ii) Corresponding fuel consumption given that imep is 8.5 bar and speed is 2500 rpm.

(OR)

B) The following results were obtained from a test on a petrol engine. I.P = 30 kW; B.P = 26 Calorific Value of the fuel = 44100 kJ/kg; Fuel consumption = 8.2 kg/hr. Find (a) Indicated thermal efficiency (b) Brake thermal efficiency (c) Mechanical efficiency.

14) A) The following data relates to a double acting single cylinder 7.5 kW air compressor.

Suction pressure		= 0.9 bar
Delivery pressure		= 6 bar
Average piston speed		= 120 m/min
Law of compression	$PV^{1.25}$	= constant

Determine the cylinder dimensions if stroke to diameter ratio is 1.25. Neglect the clearance volume.

(OR)

B) A single acting single stage compressor has a cylinder of 200 mm diameter and 300 mm stroke. It runs at a speed of 500 rpm. The air is taken in at standard atmospheric pressure and temperature. The compression pressure is 6 bar abs. The clearance volume is 5% of the stroke volume. The index of compression and expansion is 1.3. Determine (a) The volumetric efficiency, and (b) The brake power required to drive the compressor, if the mechanical efficiency is 75%.

15) A) Explain the closed cycle gas turbine with a line diagram and show the thermodynamic cycle on P-V diagram and T-S diagram.

(OR)

B) Explain the Turbo-jet engine with a line diagram and compare with the Turbo-prop engine.

PART – C

1X 10 = 10

Instructions: *Part C consists of* ***1*** *question which carries 10 marks.*

16) Discuss the superiority of Zenith Carburettor with a neat sketch relative to simple carburettor.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-404 :: Heat Power Engineering- I

Unit Test	**Learning Outcomes to be covered**
Unit Test – I	From 1.1 to 2.15
Unit Test – II	From 2.16 to 5.12

Unit Test – 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Combustion of fuels, **Internal Combustion Engines**	R,U	4	CO1, CO2
2	Combustion of fuels	U	3	CO1
3	Combustion of fuels	U	3	CO1
4	Internal Combustion Engines	U	3	CO2
5	**Internal Combustion Engines**	U	3	CO2
Part - B (24 marks)				
6	Combustion of fuels	Ap	8	CO1
7	**Internal Combustion Engines**	Ap	8	CO2
8	**Internal Combustion Engines**	Ap	8	CO2

Unit Test – 2

Q.No	Question from the topic	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	IC Engines, Performance of IC Engines, Air Compressors, Gas Turbines & Jet Propulsion	R,U	4	CO2, CO3, CO4, CO5
2	**Internal Combustion Engines**	U	3	CO2
3	Performance of IC Engines	U	3	CO3
4	Air Compressors	U	3	CO4
5	Gas Turbines & Jet Propulsion	U	3	CO5
Part - B (24 marks)				
6	Performance of IC Engines	Ap	8	CO3
7	Air Compressors	Ap	8	CO4
8	Gas Turbines & Jet Propulsion	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-404

BOARD DIPLOMA EXAMINATION,

Unit Test - 1

Heat Power Engineering- I

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) The Orsat apparatus is used to find the calorific value of gaseous fuels. (True/False)

   (b) Expand the terms TDC and BDC.

   (c) What is the material used to manufacture cylinder, cylinder head and cylinder block?

   (d) What is the location of secondary filter in the S.I. Engines?
2. Write the expression for minimum air required for combustion of fuel
3. Distinguish proximate and ultimate analysis of fuel combustion.
4. Draw the typical indicator diagram for 4-stroke petrol engine.
5. Write any three reasons for necessity of cooling in the I.C. Engines.

PART – B

Instructions: *Part B consists of* ***3*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain the working of Orsat apparatus with a neat sketch.

   (OR)

   The volumetric analysis of a producer gas is as follows: Hydrogen – 20.2%, Methane – 2.8%, Carbon monoxide – 22.2%, carbon dioxide – 7.7% and Nitrogen – 47.1%. Estimate the volume of air required.
7. Explain the working of four stroke diesel engine with neat diagrams.

   (OR)

   Differentiate S.I engines and C.I engines based on any eight criteria.

8. Explain the Zenith Carburettor with neat sketch.

   (OR)

   Explain the battery ignition system in the S.I engines with a neat sketch.

C20-M-404

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

Heat Power Engineering - I

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) What is Morse test in I.C. Engines?
   (b) To calculate the volumetric efficiency in air compressors actual volume of air drawn is calculated at NTP conditions. (True/False)
   (c) In the axial flow compressor the pressure ratio per stage is _________.
   (d) What is the air standard cycle for gas turbine?
2. What is super charging and what are the objectives of super charging?
3. Write down the classification of reciprocating compressors based on any three criteria.
4. Find the amount of work required to compress and discharge 1 m^3 of air at 15^0C and 1 bar to 7 bar, when the compression is isothermal. Take R = 0.29 kJ/kg K.
5. Write any three applications of gas turbines.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A single cylinder engine working on 4-stroke cycle has a bore of 120 mm and stroke 135 mm and runs at 650 RPM. The mean effective pressure is 6.5 bar. It consumes 10 cc of fuel in 30 seconds. The diesel oil used is having a C.V. of 42000 kJ/kg and specific gravity of 0.85. The brake wheel diameter is 900 mm and rope diameter is 20 mm. The net load on the brake is 0.11 kN. Calculate (a) Mechanical efficiency (b) Indicated thermal efficiency and (c) Brake thermal efficiency.

   (OR)

   In a full load test on an oil engine the following results were obtained: IP = 30 kW, BP = 24 kW, Fuel consumption = 0.128 kg/min, Cylinder circulating water = 5.9 kg/min, Temperature rise of cooling water = 49.5^0C, Temperature of exhaust gas = 387.8^0C, Temperature of engine room = 18.4^0C, Air fuel ratio = 20, Calorific value of oil = 45200 kJ/kg and Specific heat of exhaust gas = 1.05 kJ/kg K. Determine the mechanical and indicated thermal efficiencies and draw up an energy balance on a basis of kJ/min and in percentage.

7. Write any eight differences between reciprocating compressors and rotary compressors.

   (OR)

   Determine the minimum work required to compress 1 kg of air from 1 bar abs and 27^0C to 9 bar abs i 2 stages. The law of compression is $pV^{1.35}$ = C and inter cooling is complete. If the air was compressed in one stage between the same pressure limits, what is the percentage saving of work by compressing it in two stages. Assume R = 0.287 kJ/kg K.
8. Explain the constant pressure gas turbine with neat sketch.

   (OR)

   Explain the turbo-jet unit with a neat sketch.

Course title	Course code	Periods per week	Periods per Semester
Energy Sources & Power Plant Engineering	M - 405	04	60

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Introduction to Renewal Sources of Energy	10	9	3	-	
2	Solar and Wind Energy	14	22	2	2	
3	Fuel Cells and MHD Generator	10	11	1	1	01
4	Bio and Tidal Energy	10	14	2	1	
5	Thermal and Nuclear Power Plants	16	14	2	1	
	Total	**60**	**70+10**	**10**	**5**	**01**

Note: 10 Marks higher order question may be given from the Chapter – 3 or Chapter-4 or Chapter- 5.

Course Objectives and Course Outcomes

Course Objectives			*Upon completion of the course the student shall be able to* 1. Understand the need of Non conventional energy sources.
			2. Understand solar collectors, photo voltaic cells, horizontal axis and vertical axis wind mills.
			3. Understand working of floating type and fixed dome digester, steam power plant layout, PWR, BWR.
Course Outcomes	CO1	M – 405.1	Explain the concept of solar collectors, solar pond, solar space heating, photovoltaic cells, solar water pumping, and horizontal axis and vertical axis wind mill
	CO2	M – 405.2	Explain the working principle of Fuel Cells and MHD Generator.
	CO3	M – 405.3	Describe the working of floating type digester, fixed dome digester and Tidal power plant
	CO4	M – 405.4	Describe the functions of elements of Thermal power plant, and Coal handling system, Ash handling system,
	CO5	M – 405.5	Describe the working of BWR and PWR power plants

PO-CO Mapping

<table>
<tr><td>Course Code:M-603</td><td colspan="4">Course Title: ENERGY SOURCES AND POWER PLANT ENGINEERING
No of COs: 05</td><td>No. Of periods: 60</td></tr>
<tr><td rowspan="2">POs</td><td rowspan="2">Mapped with CO No</td><td colspan="2">CO Periods Addressing PO in Col 1</td><td>Level (1,2,3)</td><td rowspan="2">Remarks</td></tr>
<tr><td>No</td><td>%</td><td></td></tr>
<tr><td>PO1</td><td>CO1 – CO5</td><td>45</td><td>75</td><td>3</td><td rowspan="7">>40% Level 3 (Highly Addressed)
25% to 40% Level 2 (Moderately Addressed)
5% to 25% Level 1
(Low Addressed)
<5% Not Addressed</td></tr>
<tr><td>PO2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO3</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO5</td><td>CO1,CO3,CO4 & CO5</td><td>15</td><td>25</td><td>2</td></tr>
<tr><td>PO6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO7</td><td></td><td></td><td></td><td></td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				1			1	1	
CO2	3				1			1	1	
CO3	3				1			1	1	
CO4	3				1			1	1	
CO5	3				1			1	1	

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of a Question Paper

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction of Renewal Sources of Energy	10	9	9				3				CO1
2	Solar and Wind Energy	14	22	6		16		2		2		CO1
3	Fuel Cells and MHD Generator	10	11	3		8		1		1		CO2
4	Bio and Tidal Energy	10	14	6		8		2		1		CO3
5	Thermal and Nuclear Power Plants	16	24	6		8	10	2		1	1	CO4, CO5
TOTAL		**60**	**80**	**30**		**40**	**10**	**10**		**5**	**1**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter – 3 or Chapter-4 or Chapter- 5. (Here it is taken from Chapter-5)

Learning Outcomes

Upon completion of the course the student shall be able to:

1.0 Introduction to renewable energy sources

1.1 State various energy sources, give examples

1.2 Classify energy sources as renewable and non renewable energy

1.3 State Advantages and disadvantages of renewable and non renewable energy sources

1.4 Appreciate the need of renewable energy sources

1.5 State the different types of renewable energy sources

1.6 State alternate fuels for IC engines.

1.7 Explain the Properties and Methods of using Alcohols as fuels for IC engines.

1.8 Explain the Properties and Methods of using Vegetable Oils as fuels for IC engines.

2.0 **Solar and wind energy**

2.1 State the amount of solar radiation reaching the earth's surface, Determine the solar constant, State the principle of measuring solar radiation by pyranometer and pyrheliometers.
2.2 State the principle of conversion of solar radiation into heat. Explain the function of liquid flat collector. Explain the working principle of solar air heater with a legible sketch, State any three applications of solar air heater.
2.3 Identify different types of concentrating collectors; explain the working principle of concentrating collector (focusing type parabolic trough collector and flat plate collectors with plain reflectors). State any three different methods of storing solar energy.
2.4 Explain the construction details and working principle with a sketch of following :
a) Solar pond & applications of solar pond.
b) Different types of solar water heater.
c) Solar still.
2.5 State the principle of photo –voltaic conversion.
2.6 State the working principle of a solar photovoltaic cell.
2.7 State any four considerations for site selection for installing wind mill.
2.8 Identify the basic components of a wind mill.
2.9 Explain the construction details on the working principle of the Horizontal and Vertical axis wind mills.

3.0 **Fuel Cells and MHD Generator**

3.1 State the working principle of fuel cell
3.2 Explain the construction details and working principle of Bacan's High pressure fuel cell with a legible sketch
3.3 State the different types of fuels used in fuel cells
3.4 Explain the working principle of aluminium air fuel cell with a legible sketch
3.5 Explain the working principle of MHD Generator a legible sketch

4.0 Bio and Tidal Energy

4.1 Define the terms bio-mass and bio-gas. State the principle of bio-gas generation. State the chemical composition and any two properties of bio-gas. List any four applications of bio-gas.
4.2 List any two different types of bio-gas plants. Explain the construction details and working principle of fixed dome type and floating dome type bio-gas plants with sketches.
4.3 State the different materials used for bio-gas generation. Express bio-gas plant capacity.
4.4 Identify the energy available in tides and its usefulness in conversion.
4.5 State the working principle of tidal power plant.
4.6 State the different operation methods of utilisation of tidal energy.
4.7 Explain single basin and double basin arrangements.
4.8 List any four site requirements for installation of tidal power plant.
4.9 List any three advantages and limitations of tidal power generation.

5.0 Thermal and Nuclear Power Plants

5.1 Draw the layout of a thermal power plant. Locate the Boiler, super heater, turbine , Electric Generator, Condenser and hot well pump in the layout. Explain function of circulating water pump, Economiser, Air pre heater, Soot – Blower.
5.2 Explain the dust extraction in Electrostatic precipitator.
5.3 Explain about the ash removal, water cooling. Explain about the feed water treatment.
5.3 Explain about the coal storage. Identify the coal handling equipment.
5.4 List nuclear fuels.
5.5 State any four characteristics of atomic power plants
5.6 Explain the working principle of a nuclear reactor.
5.7 Explain with the help of legible sketch the constructional details and the working principle of: PWR power plant.
5.8 Explain with the help of legible sketch the constructional details and the working principle of BWR power plant.
5.9 Explain about the nuclear power in India.

COURSE CONTENT

1.0 Introduction: Various energy sources, Examples for energy sources, advantages and disadvantages, Need for alternate sources of energy – types of non conventional (renewable) energy sources – solar energy, wind energy, energy from bio- mass and bio-gas, tidal and wave energy, hydrogen energy, fuel cells. Alternate fuels for IC engines - Alcohols as fuels in IC engines - Properties of alcohols as fuels in IC engines. Methods of using alcohols in IC engines; Vegetable Oils as Fuels in IC engines - Important properties, Different methods of using vegetable oils in IC Engines.

2.0 Solar and Wind Energy

Solar Radiation:– solar radiation at earth's surface – Instruments for measuring solar radiation – pyranometer, pyrheliometers.

Solar Energy Collection

Principle of conversion of solar radiation into heat liquid flat collectors - solar air heater Application of solar air heater – concentrating collectors – (focusing type) –

Solar Energy Storage

Methods of storing solar energy – solar pond – working principle and description of solar pond with a schematic diagram – applications of solar pond.

Solar Energy Applications

i) Solar water heater – natural circulation type and forced circulation type.
ii) Solar still.

Photo voltaic conversion

solar cell – working principle – Advantages and disadvantages of solar energy.

Wind Energy

Introduction – site selection considerations – basic components of a wind mill – construction details and working principles – types of wind mill – horizontal axis type and vertical axis type

3.0 Fuel Cells and MHD Generator

Working principle – Bacan's High pressure fuel cell – construction details and working principle – types of fuels used – Aluminium – air fuel cell working principle. Working principle of MHD Generator.

4.0 Bio and Tidal Energy

Bio Energy – Introduction to bio – mass bio-mass conversion into energy bio-gas generation – composition and properties of bio-gas – applications of bio-gas. Classification of bio-gas plants – continuous and batch type, the dome and drum type, floating gas holder and fixed dome type – construction details and working principle of fixed dome type and floating gas holder type bio – gas plants – materials used for bio-gas generation – capacity of bio-gas plant – starting of bio-gas plant.

Tidal Energy : Introduction to tidal power – components of tidal power plants – operation methods and utilisation of tidal energy – single basin and double basin arrangements- site requirements – advantages and limitations of tidal power generation.

5.0 Thermal and Nuclear Power Plants

Thermal Power Plants

Layout of a Thermal Power Plant, Choice of site, List the important elements in layouts:- Such as Boiler, Condenser , Feed water system, Circulating water pumps, Economiser, Air heater, Soot–Blower , Forced draught Fan, Induced draught Fan, Dust collectors, Electro static precipitator. Supporting activities: Such as Water cooling, Feed water treatment, Coal handling, Coal storage , Chimney.

Nuclear – Power Plants

Nuclear energy chain reaction , nuclear materials, reactor, characteristics of atomic power plants, nuclear fuels , working principle of nuclear reactor, classification of reactors, working principle of PWR and BWR nuclear power reactors.

REFERENCE BOOKS

1. Non conventional Energy source by G.D Rai..... Khanna Publishers
2. Energy Technology by S. Rao & Dr. D.B. Palekr
   (Non conventional , Renewable and conventional) ...... Khanna Publishers 2015
3. Solar energy utilisation by G.D.Rai .... Khanna Publishers 1995
4. Introduction to alternate sources of energy by TTTI, Madras
5. Solar energy by S.P. Sukhatme .... TMGH
6. Advances in bio-gas technology by O.P.Chawla...... Publications and information division Indian counsel of Research
8. Thermal Engineering by Arora & S. Domkundwar ... Lakshmi Publications.

C20-M-405

BOARD DIPLOMA EXAMINATION, (C – 20)
MODEL QUESTION PAPER
DME - FOURTH SEMESTER EXAMINATION

ENERGY SOURCES & POWER PLANT ENGINEERING (M-405)

Time: **3** hours] [Total Marks: **80**

PART – A **3*10 = 30**

Instructions: (1) Answer **all** questions.
(2) Each question carries **Three** marks.

1. What is the necessity of alternate sources of energy?

2. Write any three differences between renewable and non-renewable sources of energy.

3. State the alternate fuels that can be used in IC engines.

4. What is concentrating collector? Name any two types of concentrating collectors.

5. List the basic components of wind mill.

6. List different fuels used in fuel cells

7. What is biomass? How it is useful for bio energy production?

8. What are the factors to be considered for selection of site for tidal power plant?

9. Write the purpose of Economiser and air pre-heater.

10. Write any three advantages & disadvantages of nuclear power plants

PART – B **8X5 = 40**

Instructions: (1) Answer all **Five** questions either A or B from each question.
(2) Each question carries **Eight** marks.

11. (A) Explain the working principle of solar pond with a sketch.

(OR)

(B) Explain the construction details and working of horizontal axis windmill with a sketch

12. (A) Explain the construction and working of solar cell with a sketch.

(OR)

(B) Explain the components of wind mill.

13. (A) Explain the principle of Bacon's high pressure fuel cell with a line diagram

(OR)

(B) Illustrate the working of an MHD generator with sketch.

14. (A) Explain the working of fixed dome digester with sketch.

(OR)

(B) Explain single basin and double basin arrangement methods of tidal energy utilisation with the help of sketches

15. (A) Explain the working of Electrostatic precipitator with sketch.

.

(OR)

(B) Explain the working principle of PWR.

PART – C **10*1 = 10**

Instructions: (1) Answer **the** question.
(2) Question carries **Ten** marks.

16. Justify how the Nuclear power plant is better than a conventional Thermal power plant?

- **Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II**

ENERGY SOURCES & POWER PLANT ENGINEERING

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.3
Unit Test – II	From 3.4 to 5.9

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Types of non conventional (renewable) energy sources, Solar constant, Solar cell, Construction details Becan's High pressure fuel cell.	R,U	4	CO1, CO2
2	Need for alternate sources of energy	U	3	CO1
3	Non-Conventional energy sources	U	3	CO1
4	Solar cell	U	3	CO1
5	Types of fuel cells	U	3	CO2
Part - B (24 marks)				
6	Power generation using Wind energy, Photovoltaic cell	Ap	8	CO1
7	Wind energy site selection, Solar applications	Ap	8	CO1
8	Fuel cell	Ap	8	CO2

Unit Test - 2

Q.No	Question from the topic	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Tidal energy, Bio gas, Thermal and nuclear	R,U	4	CO3-CO5
2	Sources of Bio-gas.	U	3	CO3
3	Tidal energy	U	3	CO3
4	Thermal power	U	3	CO4-CO5
5	Nuclear power	U	3	CO4-CO5
Part - B (24 marks)				
6	MHD generator	Ap	8	CO2
7	Bio gas and tidal power plant.	Ap	8	CO3
8	Thermal and Nuclear power plants	Ap	8	CO4-CO5

R-Remember; U-Understanding; Ap-Applying ; An- Analylising

C20-M-405

BOARD DIPLOMA EXAMINATION,

Unit Test - 1

ENERGY SOURCES AND POWER PLANT ENGINEERING

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Tidal Energy is an example of Non-Conventional source of Energy. (True/False)

   (b) According to NASA, the standard value of Solar constant Is ____________ W/m^2.

   (c) Generally solar cells are made of ______________.

   (d) Electrolyte used in Hydrogen-Oxygen fuel cell is _____________ .

2. State the need for alternate Sources of energy.
3. Write down any three advantages of Non-Conventional energy sources.
4. What is a solar cell.
5. What are Primary and Secondary fuel cell. Give an example for each.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain horizontal axis wind mill with a neat sketch.

   (OR)

   Explain the working of a Photo-Voltaic cell. What are the applications of Solar Photovoltaic system.

7. What are various factors to be considered for site selection of Wind energy plant?

   (OR)

   What is Solar Energy. Explain how it is applied for Water heating.

8. Explain the construction and working of Aluminium-Oxygen fuel cell.

   (OR)

   What is fuel cell. How are they classified?

C20-M-405

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

ENERGY SOURCES AND POWER PLANT ENGINEERING

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) The heat from high pressure steam coming from the earth is called ___________ energy.

   (b) In a fuel cell, fuel is supplied to negative electrode. (True/False)

   (c) Pyranometer is used to measure ____________ .

   (d) Electrolyte in Aluminium-Oxygen cell is________________.
2. List out any three sources of Bio-gas.
3. What is Tidal energy.
4. List any six elements used in thermal power plants.
5. List the characteristics of atomic power plant.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain the working principle of MHD generator with a neat sketch.

   (OR)

   Explain the working of aluminium air fuel cell with a neat sketch.
7. Explain the construction details of fixed dome biogas plant.

   (OR)

   Explain working of tidal power plant.
8. Explain about feed water treatment.

   (OR)

   Explain working of Nuclear reactor.

Course Title	Course Code	Periods Per Week	Periods Per Semester
Production Technology-II	M – 406	05	75

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Milling	20	14	02	01	*
2	Gear Making	12	14	02	01	*
3	Grinding and finishing processes	16	14	02	01	
4	Jigs , Fixtures and Jig Boring	12	14	02	01	
5	Modern Machining Processes	15	14	02	01	*
	Total	**75**	**70+10**	**10**	**05**	**01**

Note: * 10 Marks higher order question may be given from the Chapter- 1 or Chapter-2 or Chapter-6.

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to			
COURSE OBJECTIVES	01		Describe construction and working of milling machine and use of about various devices for milling operations,
	02		Explain Gear manufacturing processes, Principles of Grinding and Finishing processes and use of various measuring instruments.
COURSE OUTCOMES	CO1	M406-1	Describe the constructional details of Milling machines .
	C02	M406-2	Explain various gear manufacturing methods.
	C03	M406-3	Describe the working of different grinding machines. Explain the principles of Finishing processes.
	C04	M406-4	Describe types of jigs and Fixtures and working principles of Jig boring machines .
	C05	M406-5	Describe the modern machining processes

PO-CO Mapping

Course Code:406	Course Title: Production Technology-II No of Cos:5				No. Of periods:75
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	%		
PO1	CO1- CO5	39	52	3	**>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed**
PO2					
PO3					
PO4	CO1- CO5	20	26.7	2	
PO5					
PO6					
PO7	CO1- CO5	16	21.3	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	03	1	1
CO2	3			2			1	03	1	1
CO3	3			2			1	03	1	1
CO4	3			2			1	03	1	1
CO5	3			2			1	03	1	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of Question Paper

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Milling	20	24	06		08	10	2		1	1	CO1
2	Gear Making	12	14	06		08		2		1		CO2
3	Grinding and finishing processes	16	14	06		08		2		1		CO3
4	Jigs , Fixtures and Jig Boring	12	14	06		08		2		1		CO4
5	Modern Machining Processes	15	14	06		08		2		1		CO5
TOTAL		**75**	**80**	**30**		**40**	**10**	**10**		**05**	**01**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: * 10 Marks higher order question may be given from the Chapter - 1 or 2 or 6. (Here it is taken from Chapter – 1)

Learning Outcomes :

Upon completion of the course the student shall be able to

1.0. Milling

1.1 Explain the working principle of a Milling machine
1.2 List plain, Universal, vertical milling machines
1.3 Describe the constructional details of milling machine with legible sketch
1.4 Explain the procedure of simple, compound and differential indexing milling operations
1.5 List three milling cutters
1.6 Explain the nomenclature of teeth of milling cutter
1.7 List three materials used for teeth
1.8 Explain selection of tool and work holding devices.
1.9 Explain the different indexing methods.
1.10 Explain the specifications of milling machines.

2.0. Gear Making

2.1. List four methods of producing gears
2.2. Explain the the Gear shaping
2.3. Identify various components of gear hob
2.4. Describe the working of gear hob with legible sketch
2.5. List sequence of operations in gear hobbing machine
2.6. Explain gear finishing processes
2.7. Explain methods of checking gear teeth dimensions
2.8. Explain Specifications of a gear
2.9. List three various gear materials
2.10. List three different heat treatment processes applied to gear

3.0. Grinding and finishing processes

3.1. Explain a)The principle of metal removal by grinding
b) The working of Cylindrical and Principle of centreless grinding.
3.2. List a)Three different abrasives
b)Types of bonds in grinding wheel.
3.3. Identify the grinding wheel from the standard code (Marking system or designation of wheel).
3.4. State the factors for selecting the grinding wheels.
3.5. state the methods of grinding,
3.6. Mention the advantages & limitations of centreless grinding.
3.7. State the methods of wheel maintenance.
3.8. Explain the principles of operations of Honing, Lapping, Super finishing processes, galvanising, tin coating, Parkerizing and anodising.
3.9. Describe a)The principle of electro–plating with a legible sketch.
3.10. List six various organic coatings
3.11. State a)The principles of metal spraying.
3.12. Select the appropriate process for surface roughness of a given application.

4.0 Jigs and Fixtures

4.1 List types of jigs and explain their constructional details with the help of legible sketches
4.2 State general considerations in design of drill jigs
4.3 State the function of drill bush.
4.4 List different types of fixtures and explain their constructional details with the help of legible sketches.
4.5 Differentiate jigs and fixtures.
4.6 List the advantages of Jigs and Fixtures
4.7 Explain basic principle of location.
4.8 Identify different locating methods and devices.
4.9 Explain the basic principle of clamping.
4.10 Identify different types of clamps and their constructional details with the help of legible sketches
4.11. State the principle of working of a jig boring machine.
4.12. Classify the jig boring machines.
4.13. Explain the constructional details and function of open front machine and cross rail type machine with the help of legible sketches.
4.14 Describe the systems of location of holes.

5.0. Modern Machining Process

5.1 Distinguish between non-conventional machining processes and traditional methods.
5.2 State the relative advantages of conventional and non conventional machining processes.
5.3 Explain the principle of working of ultrasonic machining.
5.4 List the equipment used in U.S.M. processes.
5.5 Describe the principle of electric discharge machining with a legible sketch.
5.6 Describe the working of Abrasive jet machining with a legible sketch
5.7 Describe the working of Laser beam machining with a legible sketch
5.8 State the principle of chemical machining.

COURSE CONTENT

1.0 Milling

Introduction. Types of milling machines: plain, Universal, vertical, constructional details – specifications. Milling operations.Indexing: simple, compound and differential indexing.Milling cutters – types – nomenclature of teeth – teeth materials.Tool signature of milling cutter.Tool& work holding devices.

2.0 Gear Making

Manufacture of gears – by casting, moulding – stamping – coining-extruding- rolling – Machining. Gear generating methods: Gear Shaping with pinion cutter & rack cutter. Gear hobbing – Description of gear hob – Operation of gear hobbing machine.Gear finishing processes.Gear materials and specification. Heat treatment processes applied to gears.

3.0 Grinding and finishing processes

Introduction – principles of Metal Removal by Grinding. Abrasives – Natural & Artificial. Types of Bonds: Vitrified, silicate, shellac, rubber, bakellite. Factors effecting the selection of grind wheels – size and shape of wheel – kind of abrasive – grain size – grade and strength of bond – structure of grain – spacing – kinds of bind material. Standard marking systems. Meaning of letters & numbers sequence of marking – Grades of letters. Grinding machines – classification: Cylindrical Grinding machine-construction details – relative merits. Principle of centreless grinding. Advantages & limitations of centreless grinding. Work- holding devices. Wheel maintenance – Balancing of wheels – Dressing and trimming of grind wheels: Coolants used.

Finishing by grinding: Honing, Lapping, Super finishing. Electroplating –. Hot dipping: Galvanizing, Tin coating, parkerising, Anodizing. Metal spraying: wire process, powder process and applications. Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubber base coating. Finishing specifications.

4.0. Jigs, Fixtures and Jig Boring.

Definition of jig - Types of jigs - leaf jig, box and handle jig, template jig, plate jig, Indexing jig, Universal jig, vice jigs. Explain the constructional details of the above jigs. General consideration in the design of drill jigs. Explain drill bush Types of fixtures: vice fixtures, milling fixtures, boring fixtures, grinding fixtures - Explain the constructional details of the above fixtures. Basic principles of location - Explain the locating methods and devices. Explain the basic principles of the clamping - Types of clamps - strap clamps, cam clamps, screw clamps, toggle clamps, hydraulic and pneumatic clamps.

Jig bring - Button boring on lathes- Jig boring on vertical milling machine. Types of jig boring machines - Open front machine - Cross rail type machine.Constructional details & their working - System of location of holes.

5.0 Modern Machining Processes

Introduction – comparison with traditional machining, Ultrasonic machining Principle – Description of equipment - applications. Electric Discharge Machining Principle – Description of equipment – Type of EDM Processes - applications.Abrasive jet machining - principle - description of equipment – applications.Laser beam machining - principle - description of equipment-applications.Chemical machining – Principle – description of equipment - Applications.

REFERENCE BOOKS

1. Manufacturing Technology - P N Rao (MGH Publishers)
2. Production Technology - R.C.Patel
3. Production Technology - Jain & Gupta.
4. Gear Technology - Charrathi
5. A Text Book of Production Engg . - Dora
6. Tool Design - Donaldson
7. Manufacturing Technology - HajraChowdhary,Volume I & II
8. Manufacturing Technology - P.N.Rao Volume II

C20-M-406

BOARD DIPLOMA EXAMINATION

MODEL QUESTION PAPER

DME - FOURTH SEMESTER EXAMINATION

PRODUCTION TECHNOLOGY- II

Time: 3 hours] [Total Marks : 80

PART-A **3x10=30**

Instructions: (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1. List out various milling machines.

2. Write the specifications of a milling cutter.

3. List various methods of gear manufacturing.

4. State the working principle of grinding operation.

5. Mention any three natural types of abrasives.

6. State the function of drill bush.

7. Differentiate jigs and fixtures.

8. State the principle of working of a jig boring machine.

9. List the equipment used in U.S.M. processes.

10. Explain the principle of working of Electric Discharge machining.

PART-B 8x5=40

Instructions: (1) Answer **all five** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. a)Explain the following milling operations with simple sketches:

i) Slab milling	ii) Face milling
iii) End milling	iv) Angular milling

(OR)

b)What are the various types of milling cutters used and state the functions of each cutter.

12. a)Describe with a neat sketch gear shaping process using pinion cutter.

(OR)

b)Describe Gear cutting by using form cutter with the help of sketch.

13. a)What are various methods of grinding. Explain with a neat sketch the principle of Centre less grinding

(OR)

b)Describe the process of super finishing and write its advantages and limitations.

14. a)Explain the constructional details and function of Open- front Jig boring machine with the help of legible sketch.

(OR)

b)Explain the constructional details and function of Cross-rail Jig boring type machine with the help of legible sketch.

15. a)Distinguish between non-conventional machining and traditional machining methods.

(OR)

b)Explain the principle of working of ultrasonic machining.

PART-C 1x10=10

Instructions: **1)** Answer the following question which carries TEN marks.

16. Compare the different indexing methods in milling machine.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-406 :: PRODUCTION TECHNOLOGY - II

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.8a
Unit Test – II	From 3.8b to 6.8

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Milling, Gear Making, Grinding and finishing processes	R,U	4	CO1 – C03,
2	Milling	U	3	CO1
3	Gear Making	U	3	CO2
4	Grinding	U	3	CO3
5	Grinding	U	3	CO3
Part - B (24 marks)				
6	Milling	Ap	8	CO1
7	Gear Making	Ap	8	CO2
8	Grinding	Ap	8	CO3

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Jigs , Fixtures and Jig Boring, Modern Machining Processes	R,U	4	CO4,C05
2	Jigs , Fixtures and Jig Boring	U	3	CO4
3	Jigs , Fixtures and Jig Boring	U	3	CO4
4	Modern Machining Process	U	3	CO5
5	Modern Machining Process	U	3	CO5
Part - B (24 marks)				
6	Jigs , Fixtures and Jig Boring	Ap	8	CO4
7	Modern Machining Process	Ap	8	CO5
8	Modern Machining Process	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-406

BOARD DIPLOMA EXAMINATION,
Unit Test - 1
Production Technology – II

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Specification of grinding wheel.

   (b) Milling cutter is a multi point cutting tool. (True/False)

   (c) Basic difference between milling cutter and hobbing tool.

   (d) Significance of clearance angle machining.

2. Write the specifications of a milling cutter.
3. List various methods of gear manufacturing.
4. State the working principle of grinding operation.
5. Mention any three natural types of abrasives.

PART – B

Instructions: *Part B consists of* ***3*** *Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain the following milling operations with simple sketches:

   i) Slab milling ii) Face milling

   iii) End milling iv) Angular milling

   (OR)

   What are the various types of milling cutters used and state the functions of each cutter.

7. Describe with a neat sketch gear shaping process using pinion cutter.

   (OR)

   Describe Gear cutting by using form cutter with the help of sketch.

8. What are various methods of grinding. Explain with a neat sketch the principle of Centre less grinding

   (OR)

   Explain types of bonds used in grinding wheel making.

C20-M-406

BOARD DIPLOMA EXAMINATION,
Unit Test - 2
Production Technology – II

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Basic purpose of jig.
   (b) Chemical machining is used for ferrous materials (True/False)
   (c) State the function of drill bush
   (d) State any one reason for surface finishing?
2. Differentiate between jigs and fixtures.
3. State the principle of working of a jig boring machine.
4. List the equipment used in U.S.M. processes.
5. List any three organic coatings used in surface finishing.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions..*

6. Explain the constructional details and function of Open- front Jig boring machine with the help of legible sketch.

(OR)

Explain the constructional details and function of Cross-rail Jig boring type machine with the help of legible sketch.

7. Distinguish between non-conventional machining and traditional machining methods.

(OR)

Explain the principle of working of ultrasonic machining.

8. Explain hot dipping and parkerizing.

(OR)

Explain the principle of electro plating.

Course Title	Course Code	Periods/Week	Periods per Semester
Production Drawing	M-407	03	45

TIME SCHEDULE

Sl.No	Chapter/Unit Title	Periods	Weightage of Marks		Short answer Questions	Essay type Questions
			PART A	PART B		
1	Introduction to Production Drawing	03	-		-	-
2	Limits, Fits & Dimensional Tolerances	06	05	05	02	-
	Geometrical Tolerances	03	05	03		
	Surface finish	03	05	03	01	
3	Specification of materials and Standard Components	03	05	04	01	-
4	Preparation of Process sheet	03		05		-
5	Detailed and Part Drawings	24		20		02
Total		45	**20**	**40**	**04**	**02**

Course objectives and Course Outcomes

COURSE OBJECTIVES	Upon the completion of the course the student shall be able to	
	1. Familiarize with knowledge of the conventional representation of different materials and machine parts. 2. Familiarize with limits, fits, tolerances, surface treatment symbols adopted in the production drawings. 3 .Demonstrate the above skills in preparation of detailed drawings	
COURSE OUTCOMES	At the end of the course students shall be able to:	
	CO1	Use the conventions used in a production drawing
	CO2	Use the specifications of material and geometrical tolerances
	CO3	Specify the limits, fits and allocate tolerances for machine components
	CO4	Apply concepts and methods in the preparation of production drawings
	CO5	Convert machine drawings into production drawings

PO-CO Mapping

Course Code: M-407	Course Title: PRODUCTION DRAWING	No of COs:5			No. Of periods:45
POs	Mapped with CO No	CO Periods Addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1 – CO5	30	66.67	3	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2					
PO3					
PO4	CO1 – CO5	12	26.67	2	
PO5					
PO6					
PO7	CO1 – CO5	3	06.67	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	3	1	1
CO2	3			2			1	3	1	1
CO3	3			2			1	3	1	1
CO4	3			2			1	3	1	1
CO5	3			2			1	3	1	1

3: High, 2: Moderate, 1: Low

BLUE PRINT OF QUESTION PAPER

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Introduction to Production Drawing	02	-									*CO1*
2	Limits, Fits & Tolerances and Surface finish	12	10			*10*				*02*		*CO2, CO3*
3	Specification of materials and standard components	03	05			*05*				*01*		*CO3*
4	Preparation of Process sheet	03	05			*05*				*01*		*CO4*
5	Detailed and Part Drawings	29	40			*40*				*02*		*CO1 to CO5*
Total		45	60			***60***				***06***		

R-Remember; U-Understanding; Ap-Application ; An- Analylising

Learning outcomes

Upon completion of the course the student shall be able to

1**. 0 Introduction to Production Drawing**

1.1 Differentiate between machine drawing and production drawing.

1.2 Explain abbreviations for materials, draughting abbreviations

1.3 State the factors that govern the preparation of a production drawing.

1.4 Identify the components of a production drawing

2.0 Limits, Fits &Tolerances and Surface Finish

2.1State definition of limits, allowance, tolerance and fits.

2.2Select dimension from standards to give different type of fit for a given mating parts.

2.3Systems of fits-problems relating Hole basis and Shaft basis system and schematic diagrams-Select dimensions from B. I. S. Tables to obtain clearance, transition and interference fit for a given set of mating parts.

2.4 Selection of fits and tolerances form B. I. S. tables.

2.4Indicate fits on the drawings

2.5 Introduction and indication of form and position tolerances on drawings

2.6 Types of run-out, total run-out and their indication.

2.7 Explain Surface roughness terminology- surface roughness values, Grades and symbols.

2.8 Explain Symbols indicating surface texture

2.9 Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components.Symbols representing direction of lay.

2.10 Heat treatment and surface treatment symbols used on drawings.

3.0 Specification of Materials

3.1 Identify the materials of various components

3.2 Specify the Raw materials as per Commercial/ BIS Standards

3.3 Identify the standard part that can be procured directly from the market and specify the part as per Commercial/ BIS Standards

4.0 Preparation of process sheet.

4.1Indicate the sequence of process of production.

4.2Specify the relevant tools to obtain the accuracy and finish.

4.3Indicate the suitable equipment.

4.4Specify the type of measuring instruments to be used to check the prescribed accuracy.9. Specification of standard components.

5.0 Detailed and part drawings

5.1 Interpretation of Drawings
5.2 Exercises in identifying the type of production, extracting important functional dimensions, checking the number of parts in an assembly. Checking and listing missing dimensions. Identifying the sectional views.
5.3 Prepare the relevant views of the parts of assembly drawing of Rigid Flange Couplings.

5.4 Prepare the relevant views of the parts of assembly drawing of flexible Flange Couplings.

5.5 Prepare the relevant views of the parts of assembly drawing of Universal Coupling,

5.6 Prepare the relevant views of the parts of assembly drawing of Eccentric,

5.7 Prepare the relevant views of the parts of assembly drawing of Foot Step bearing,

5.8 Prepare the relevant views of the parts of assembly drawing of Stuffing box,

5.9 Prepare the relevant views of the parts of assembly drawing of Knuckle Joint,

5.10 Prepare the relevant views of the parts of assembly drawing of Plummer Block

5.11 Prepare the relevant views of the parts of assembly drawing of Screw jack

5.12 Prepare the relevant views of the parts of assembly drawing of revolving centre

5.13 Prepare the relevant views of the parts of assembly drawing of Drill Jig

COURSE CONTENT

1.0 INTRODUCTION TO PRODUCTION DRAWING

Drawing Sheet Sizes, Drawing sheet layout, Title block: 1.Title of the drawing, 2. Sheet number, 3. Scale (s), 4. Symbol, denoting the method of projection, 5. Name of the firm, and 6. Initials of the staff designed, drawn, checked and approved, Standard abbreviations: Draughting, material abbreviations, and shape identification symbols, Conventional representation of materials and machine components, method of indication notes on drawings, welding symbols.

2.0 LIMITS FITS, TOLERANCES AND SURFACE FINISH

State definition of limits, allowance, tolerance and fits, Select dimension from standards to give different type of fit for a given mating parts, Systems of fits-problems relating Hole basis and Shaft basis system and schematic diagrams- Select dimensions from B. I. S. Tables to obtain clearance, transition and interference fit for a given set of mating parts, Selection of fits and tolerances form B. I. S. tables, Indicate fits on the drawings. Definition of datum, datum feature, datum triangle, datum letter, indication of geometrical tolerance on the drawing, indication of feature controlled, indication of form and position tolerances on drawings, types of run-out, total run-out and their indication.

Explain Surface roughness terminology- surface roughness values, Grades and symbols, indicating surface texture, surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Symbols representing direction of lay. Heat treatment and surface treatment symbols used on drawings.

3.0 SPECIFICATIONS OF MATERIALS AND STANDARD COMPONENTS

Materials of the parts of the assembly-size of part, estimation of Raw material required for a component and specification. Standard components Parts like bolts, nuts, and Bearings etc.-specification of standard parts

4.0 PREPERATION OF PROCESS SHEET

Indicate the sequence of process of production, specify the relevant tools to obtain the accuracy and finish.

Indicate the suitable equipment, specify the type of measuring instruments to be used to check the prescribed accuracy, Specification of standard components.

5.0 DETAILED AND PART DRAWINGS

Interpretation of Drawings, Exercises in identifying the type of production, extracting important functional dimensions, checking the number of parts in an assembly. Checking and listing missing dimensions. Identifying the sectional views.

Rigid Flange Coupling	Flexible Flange Coupling	Universal Coupling
Eccentric	Foot Step bearing	Stuffing box
Knuckle Joint	Plummer Block	Screw jack
Revolving Center	Drill Jig	Lathe Tool Post

REFERENCE BOOKS

IS 696 – 1972-Code of Practice for General Engg. Drawing & B.I.S Code– SP. 46. IS 696– 1988- IS Code on fits and tolerances.

K.L. Narayana & P. Kannaiah, Production and Drawing, 3rd edition New Age international Publisher

R.K. Jain, Engineering Metrology, 2016 Khanna Publications

C-20-M-407

BOARD DIPLOMA EXAMINATION,
D.M.E. – IV SEMESTER EXAMINATION
PRODUCTION DRAWING

Time : 3 Hours Total Marks: **80**

Note:
1. Drawing should be neat and proportionate
2. Use first angle projection
1. Use Standard data
2. Assume missing data suitably if any

PART – A

Answer all the questions 4 X 5 = 20

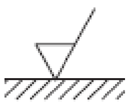
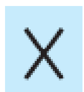
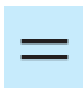
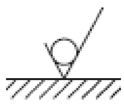
1) Determine the limit dimensions for a clearance fit between the mating parts having nominal diameter of 40mm, providing a minimum clearance of 0.1mm, with the tolerance of the hole as 0.025mm and that of the shaft 0.05mm. Follow hole basis system

2) Draw the symbols for the following geometrical tolerance characteristics.

   (a) Flatness (b) Cylindricity (c) Position (d) Angularity

   (e) Symmetry

3) Write the meaning of the following surface roughness symbols.

   (a)  (b)  (c)  (d)  (e) 

4) Draw the conventions for the following standard machine components.

   (a) Straight knurling (b) bearings (c) Semi elliptic leaf spring

   (d) Worm (e) Spur Gear

Part B

Answer any one question 1 X 40 = 40

5 A) Study the given assembly drawing of Eccentric and

(i) Draw the part drawings.

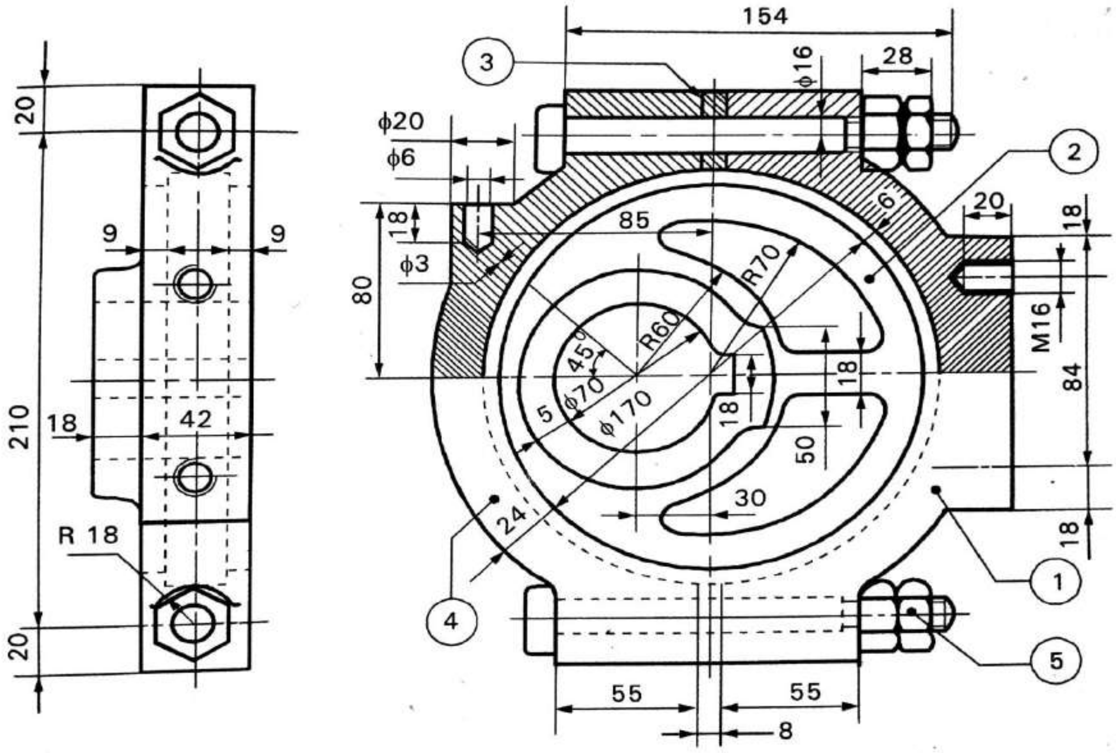
(ii) Mention suitable fits and tolerances wherever required.

(iii) Apply suitable geometrical tolerances.

(iv) Indicate surface roughness values/symbols to the components.

(v) Prepare process sheet for the manufacturing of “Straps”.

(vi) Prepare bill of materials.



Parts List

Sl.No	Name	Material	Qty
1	Strap	CI	1
2	Sheave	CI	1
3	Shim	Brass	2
4	Strap	CI	1
5	Bolts with Nuts	MS	2

(OR)

B) Study the given assembly drawing of Universal coupling and

(a) Draw the part drawings.

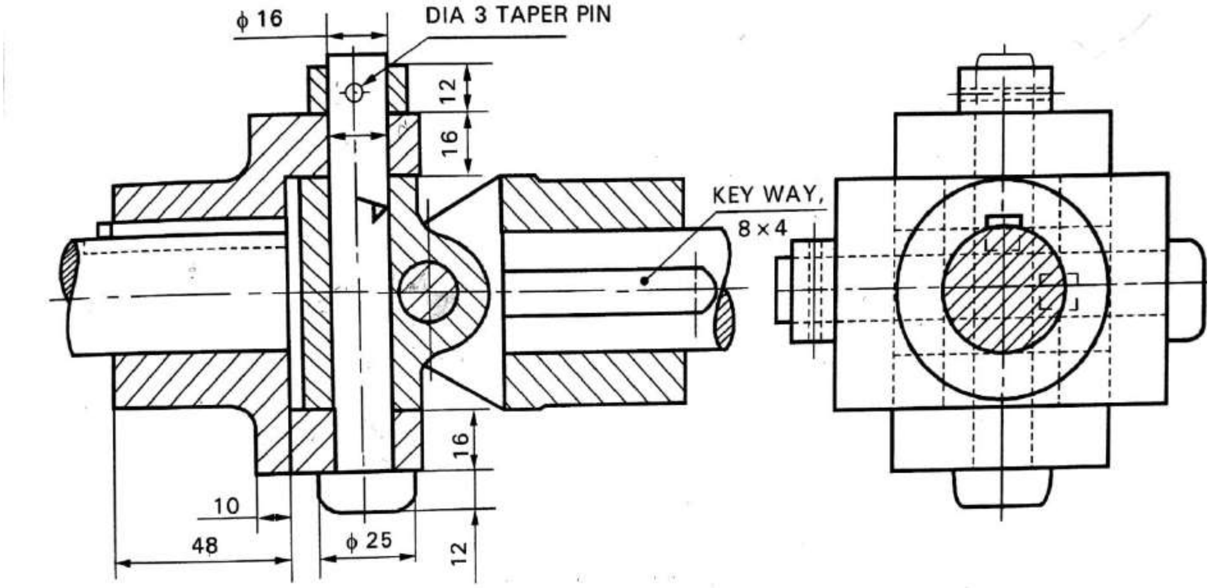
(b) Mention suitable fits and tolerances wherever required.

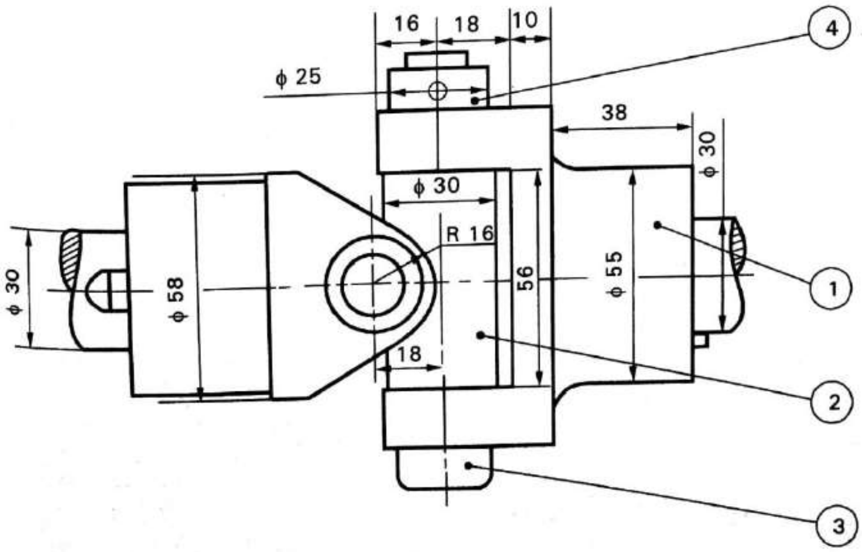
(c) Apply suitable geometrical tolerances.

(d) Indicate surface roughness values/symbols to the components.

(e) Prepare process sheet for the manufacturing of “Centre block”.

(f) Prepare bill of materials.





Parts List

Sl.No	Name	Material	Qty
1	Fork	MS	2
2	Center Block	MS	1
3	Pin	MS	2
4	Collar	MS	2

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
M-408	Communication Skills	3	45	40	60

S. No.	Chapter/Unit Title	No of Periods	COs Mapped
1	**Listening Skills**	6	CO1
2	**Introducing Oneself**	3	CO1, CO2, CO3
3	**Short Presentation (JAM)**	6	CO1, CO2, CO3
4	**Group Discussion**	6	CO1, CO2, CO3
5	**Preparing Resume with Cover Letter**	3	CO3
6	**Interview Skills**	9	CO1, CO2, CO3
7	**Presentation Skills**	9	CO1, CO2
8	**Work place Etiquette**	3	CO1, CO2
Total Periods		**45**	

Course Objectives	To comprehend the features of communication needed for professional success and display the use of these competently
	To present ideas, opinions in group discussions and presentations on topics of general and technical interest
	To prepare for job selection processes

CO No.	Course Outcomes
CO1	Interacts in academic and social situations by comprehending what is listened to when others speak.
CO2	Demonstrates effective English communication skills while presenting ideas, opinions in group discussions and presentations on topics of general and technical interest.
CO3	Exhibits workplace etiquette relevant in classroom situations for easy adaptation in professional setting in the future.

CO-PO Matrix

<table>
<tr><td colspan="2">Course Code
C-408</td><td colspan="3">Course Title: English
Number of Course Outcomes: 3</td><td>No. of Periods: 45</td></tr>
<tr><td rowspan="2">POs</td><td rowspan="2">Mapped with CO No.</td><td colspan="2">CO Periods Addressing PO in Column 1</td><td rowspan="2">Level of Mapping (1,2,3)</td><td rowspan="2">Remarks</td></tr>
<tr><td>Number</td><td>Percentage %</td></tr>
<tr><td>PO1</td><td></td><td colspan="4" rowspan="4">Not directly applicable for Communication Skills Course however interactive activities that use content from science and technology relevant to the Programme taken up by the student shall be exploited for communication in the Course.</td></tr>
<tr><td>PO2</td><td></td></tr>
<tr><td>PO3</td><td></td></tr>
<tr><td>PO4</td><td></td></tr>
<tr><td>PO5</td><td>CO1, CO2, CO3</td><td>11</td><td>25%</td><td></td><td rowspan="3">>60%: Level 3

16 -59%: Level 2

Up to 15%: Level 1</td></tr>
<tr><td>PO6</td><td>CO1, CO2, CO3</td><td>27</td><td>60%</td><td></td></tr>
<tr><td>PO7</td><td>CO1, CO2, CO3</td><td>7</td><td>15%</td><td></td></tr>
</table>

Level 3 – Strongly Mapped
Level 2- Moderately Mapped
Level 1- Slightly Mapped

Mapping Course Outcomes with Program Outcomes:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO 1					✓	✓	✓
CO 2					✓	✓	✓
CO3					✓	✓	✓

Blue Print for evaluation based on Course Outcomes for SA:
Note: Every Question based on CO has to be given marks for the following parameters of communication in the rubric.

- Fluency and Coherence
- Lexical Resource (Vocabulary)
- Grammatical Range and Accuracy

***Rubric Descriptors 'Good/ Competent / Fair /Poor' for Communication**

LEVEL OF COMPETENCE	Fluency and Coherence	Lexical Resource (Vocabulary)	Grammatical Range and Accuracy
GOOD (9-10*)	Speaks at length without noticeable effort or loss of coherence. May demonstrate language-related hesitation at times, or some repetition and/or self-correction.	Uses vocabulary resources flexibly during discussion. Uses paraphrase effectively.	Uses a range of complex structures with some flexibility.
	Uses a range of connectives and discourse markers with some flexibility. **Articulates and adapts to near naturalization.**	Uses some less common vocabulary and shows some awareness of style and collocation	Mostly produces error-free sentences.
COMPETENT (6-8)	Is willing to speak at length, though may lose coherence at times due to occasional repetition, self-correction or hesitation.	Has enough vocabulary to discuss topics and make meaning clear in spite of inappropriacies.	Uses a mix of simple and complex structures, but with limited flexibility.
	Uses a range of connectives and discourse markers but not always appropriately.	Generally paraphrases successfully	May make mistakes with complex structures though these rarely cause comprehension problems.
FAIR (3-5)	Tries to maintain a flow of speech but t uses repetition, self correction and/or slow speech to keep going.	Manages to talk about familiar and unfamiliar topics but uses vocabulary with limited flexibility.	Produces only basic sentence forms, however, errors persist.
	Produces simple speech fluently, but more complex communication causes fluency problems.	Attempts to use paraphrase but with mixed success.	Uses a limited range of more complex structures, but these usually contain errors and may cause some comprehension problems
POOR (0 *-2)	Speaks with long pauses. Pauses lengthy before most words. **Merely imitates**	Uses simple vocabulary to convey personal information	Attempts basic sentence forms but with limited success, or relies on apparently memorized utterances
	Has limited ability to link simple sentences	Has insufficient vocabulary for less familiar topics	Makes numerous errors except in memorized expressions
	Gives only simple responses and is frequently unable to convey basic message	Only produces isolated words or memorized utterances	Struggles to produce basic sentence forms

s*10 marks to be awarded only if competence level shows flawless expertise in English.
***0 marks to be awarded when student shows incoherence and gives irrelevant responses.**

Blue Print for evaluation based on Course Outcomes for SA of each student:
Note: Marks are awarded for each student as per the Rubric descriptors.

S. No.	Questions based on Course Outcomes	Periods Allocated for practical work	Marks Wise Distribution of Weightage	Marks allotment for each Student in the Rubric*				Mapping of COs
				Poor 0-2	Fair 3-5	Competent 6-8	Good 9-10	
1	Describe the given object in a minute	6	10					CO 2
2	Exchange ideas/ views in a group discussion on _________ issue (academic, technical or social)	6	10					CO1, CO 2
3	Present your ideas /opinions on the given issue/Chapter(individual to an audience)	9	10					CO1, CO2, CO 3
4	Role play an imaginary work-place situation	6	10					CO1, CO2, CO 3
5	Individual interaction with the Examiner duly submitting Resume (Facing the Interview) – Introducing oneself and answering questions	12	10					CO1, CO2, CO 3
6	*Listen to and comprehend any audio communication/ content	6	10					CO1, CO2, CO 3
TOTAL		**45**	**60**					

***Listen to and comprehend the given audio content**: Giving the Students time to read the questions (Fill in the Blanks, Select from Alternatives, True or False, Table fill, etc.) in chunks before listening to audio inputs also played in chunks.

Blue Print for evaluation based on Course Outcomes for Formative Assessment:
Note: Every Question based on CO has to be given marks for the following parameters in the rubric.

- Fluency and Coherence
- Lexical Resource
- Grammatical Range and Accuracy

S. No.	Questions based on Course Outcomes	Periods Allocated for practical work	Marks Wise Distribution of Weightage	Marks allotment for each Student in the Rubric*				Mapping of COs
				Poor 0-2	Fair 3-5	Competent 6-8	Good 9-10	
Formative Assessment - 1								
1	Describe the given object in a minute	3	10					CO 2
2	Exchange ideas/ views in a group discussion on _________ issue (academic, technical or social)	6	10					CO1, CO 2
3	Present your ideas /opinions on the given issue/Chapter(individual to an audience)	6	10					CO1, CO2, CO 3
4	*Listen to and comprehend any audio communication/ content	3	10					CO1, CO2, CO 3
Total		**18**	**40**					
Formative Assessment -2								
1	Present your ideas /opinions on the given issue/Chapter(individual to an audience)	3	10					
2	Role play an imaginary work-place situation	6	10					CO1, CO2, CO 3
3	Individual interaction with the Examiner duly submitting Resume (Facing the Interview) – Introducing oneself and answering questions	15	10					CO1, CO2, CO 3

4	*Listen to and comprehend any audio communication/ content	3	10					CO1, CO2, CO 3
TOTAL		**27**	**40**					

Learning Outcomes

1. **Listening Skills:**
   1.1 Listen to audio content (dialogues, interactions, speeches, short presentations) and answer questions based on them
   1.2 Infer meanings of words / phrases / sentences / after listening to audio content as mentioned above
2. **Introducing Oneself:**
   2.1 Prepare a grid different aspects for presentation about a person / oneself
   2.2 Present a 1 or 2 minute introduction of oneself for an audience
3. **Short Presentation:**
   3.1 Define an object
   3.2 Describe an object, phenomenon, event, people
   3.3 Speak on aChapterrandomly chosen
4. **Group Discussion:**
   4.1 Practice Group Discussion. Techniques
   4.2 Participate in group discussions
5. **Resume Writing and Cover Letter:**
   5.1 Prepare resumes of different sorts – one's own and others.
   5.2 Write an effective cover letter that goes with a resume

6. **Interview Skills:**
   6.1 Prepare a good Curriculum Vitae
   6.2 Exhibit acceptable (Greeting, Thanking, Answering questions with confidence)
7. **Presentation Skills:**
   7.1 Prepare Posters, Charts, PPT's on issue of general and technical interest
   7.2 Present one's ideas before an audience with confidence using audio visual aids and answer questions that are raised.
8. **Workplace Etiquette:**
   8.1 Show positive attitude & adaptability / appropriate body language to suit the work place
   8.2 Display basic of etiquette like politeness, good manners.

Course Title	Course Code	Total No. of Periods	Total Periods Per Semester
Thermal Engineering Lab Practice	M – 409	03	45

TIME SCHEDULE

S. No.	EXERCISE TITLE	Periods
1.	Economic Speed Test on S.I and C.I engines	09
2.	Morse Test	06
3.	Performance tests on S.I and C.I engines	09
4.	Heat Balance Sheet	09
5.	Valve timing diagram and Port timing diagram	06
6.	Performance of Air compressor	06
Total No. Periods		**45**

Course Objectives and Course Outcomes

Course Objectives	Upon completion of the course the student shall be able to: (i) To familiarise with the knowledge of materials and tools used in conducting performance tests on I C Engines and on Air compressors. (ii) To reinforce the concepts economic speed, heat balance, valve timing and port timing diagrams by conducting corresponding experiments		
Course Outcomes		Upon completion of the course the student shall be able to:	
	CO1	M 409-1	Conduct the tests to determine the performance of I C Engines using given apparatus.
	CO2	M 409-2	Conduct the tests to determine the performance of Air compressors.
	CO3	M 409-3	Perform precise operations with I C Engines and Air Compressors.
	CO4	M 409-4	Analyse the experimental results to draw inferences, to make recommendations
	CO5	M 409-5	Use ethics and etiquette while working in a group and display professionalism while communicating as a member and a leader in a group.

PO-CO Mapping

Course Code:409	Course Title: Thermal Engineering Lab Practice No. of COs Addressed : 05				No. Of periods:45
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1,CO2,CO4	15	33	2	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2					
PO3					
PO4	CO1,CO2,CO3	20	45	3	
PO5	CO5	5	11	1	
PO6					
PO7	CO1 – CO4	5	11	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2			3			1	2	1	1
CO2	2			3			1	2	1	1
CO3	2			3			1	2	1	1
CO4	2			3			1	2	1	1
CO5	2			3	1			1	1	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes
Upon on completion of the course the student shall be able to:

1.0 Conduct an experiment to determine the economical speed test on given I C Engine

1.1 Apply lubricant between the mating parts of the engine
1.2 Check the fuel oil supply line
1.3 Place the thermometers at required positions
1.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine
1.5 Start the engine using decompression lever
1.6 Run the engine for a certain period of time before loading
1.7 Measure speed of the engine with tachometer
1.8 Adjust spark timing in case of SI engine
1.9 Adjust the throttle valve to control the fuel supply in case of CI engine
1.10 Apply the loads
1.11 Record brake load, speed of rotation (RPM) at different loads and the rate of fuel consumption
1.12 Remove the load

2.0 Conduct an experiment to find the performance on a multi cylinder engine

2.1 Apply lubricant between the mating parts of the engine
2.2 Check the fuel oil supply line
2.3 Place the thermometers at required positions
2.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine
2.5 Start the engine using decompression lever
2.6 Run the engine for a certain period of time before loading
2.7 Measure speed of the engine with tachometer
2.8 Apply the load
2.9 Record brake load, speed of rotation (RPM), the rate of fuel consumption
2.10 Cut off the first cylinder
2.11 Record brake load, speed of rotation (RPM), the rate of fuel consumption
2.12 Repeat the above act for all the cylinders

3.0 Conduct an experiment to determine the performance parameters

3.1 Apply lubricant between the mating parts of the engine
3.2 Check the fuel oil supply line
3.3 Place the thermometers at required positions
3.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine
3.5 Start the engine using decompression lever
3.6 Run the engine for a certain period of time before loading
3.7 Measure speed of the engine with tachometer
3.8 Adjust spark timing in case of SI engine
3.9 Adjust the throttle valve to control the fuel supply in case of CI engine
3.10 Apply the load
3.11 Record brake load, speed of rotation (RPM) and the rate of fuel consumption
3.12 Remove the load

4.0 Conduct an experiment to draw the heat balance sheet for given I C Engine

4.1 Apply lubricant between the mating parts of the engine
4.2 Check the fuel oil supply line
4.3 Place the thermometers at required positions
4.4 Circulating the cooling water through the engine jacket before starting engine and after shutting down the engine
4.5 Start the engine using decompression lever
4.6 Run the engine for a certain period of time before loading
4.7 Measure speed of the engine with tachometer
4.8 Adjust spark timing in case of SI engine
4.9 Adjust the throttle valve to control the fuel supply in case of CI engine
4.10 Apply the load
4.11 Record brake load, speed of rotation (RPM), the rate of fuel consumption, the rate of flow of cooling water and water inlet and outlet temperatures of engine jacket
4.12 Record exhaust gas temperature at calorimeter outlet

5.0 Conduct an experiment to draw the valve and port timing diagrams

5.1 Place the spirit level, metal tape and piece of chalk near the engine
5.2 Erase the previous chalk marks on the flywheel
5.3 Apply lubricate in the piston and valve mechanism
5.4 Fix the graduated disc to the crank shaft
5.5 Adjust the pointer to zero position of graduated disc
5.6 Mark the TDC and BDC on the disc using the spirit level
5.7 Mark the operations (Suction, Compression, Ignition, Expansion and Exhaust)
5.8 Measure the circumference of flywheel
5.9 Locate exact position of inlet valve/port opening and inlet valve/port closing by inserting feeler gauge between inlet roller and cam
5.10 Find exact position of Ignition starting and ignition tripping
5.11 Locate exact position of exhaust valve/port opening and exhaust valve/ port closing by inserting feeler gauge between inlet roller and cam
5.12 Measure the circumferential distances between the valve/port opening, closing, ignition starting and ignition tripping with respect to the TDC and BDC

6.0 Conduct an experiment to Performance of Air compressor

6.1 Check the lubricating oil level in the crank case
6.2 Opening and closing of storage outlet valve
6.3 Checking orifice and its diaphragm condition
6.4 Fill water in U-tube manometer
6.5 Check function and usage of tachometer
6.6 Check function and usage of stop watch
6.7 Record time taken for 10 revolutions of energy meter disc
6.8 Record compressor speed (RPM) using tachometer
6.9 Record manometer readings
6.10 Record pressure gauge reading

Course Title	Course Code	Periods/Week	Periods/Semester
HYDRAULICS & FLUID POWER SYSTEMS LAB PRACTICE	M-410	03	45

TIME SCHEDULE

S.No	**EXERCISE TITLE**	Periods allocated
1	Verification Of Bernoulli's Theorem	06
2	Determination of Coefficient of Discharge of Venturi Meter	03
3	Determination Of Friction Factor For A Given Pipe Line	03
4	Performance Test On Pelton Wheel	03
5	Performance Test On Francis Turbine	06
6	Performance Test On Kaplan Turbine	06
7	Performance Test On Centrifugal Pump	06
8	Performance Test On Reciprocating Pump	06
9	Demonstration of Hydraulic Circuits	03
10	Demonstration of Pneumatic Circuits	03
Total		**45**

Course Objectives and Course Outcomes

COURSE OBJECTIVES	Upon completion of the course the student shall be able to	
	Familiarize with knowledge in verification of principles of fluid flow	
	Use skills in measuring pressure, discharge and velocity of fluid flow	
	reinforce theoretical concepts by conducting experiments for Major and Minor Losses	
	reinforce theoretical concepts by conducting experiments in performance testing of Hydraulic Turbines and Hydraulic Pumps	
	Familiarize with the main components of the hydraulic and pneumatic systems and design, draw circuits and conduct experiments hydraulic and pneumatic circuits for a given problem.	
COURSE OUTCOMES	CO1	Perform experiments to determine the coefficient of discharge of Venturi meter.
	C02	Demonstrate the experiments to determine the co-efficient of friction of flow in a pipe and minor losses in pipe joints
	C03	Demonstrate the experiments on hydraulic turbines to draw characteristic curves
	C04	Demonstrate the experiments on pumps to draw characteristic curves
	C05	Identify the common hydraulic and pneumatic components, their uses and symbols

PO-CO Mapping

Course Code:410	Course Title: FM&HM LAB PRACTICE No. of COs : 5				No. Of periods:45
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1 – CO5	12	26.67	2	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2					
PO3					
PO4	CO1 – CO5	25	55.55	3	
PO5	CO5	04	08.89	1	
PO6					
PO7	CO1 – CO5	04	08.89	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2			3			1	3	1	1
CO2	2			3			1	3	1	1
CO3	2			3			1	3	1	1
CO4	2			3			1	3	1	1
CO5	2				1		1	1	1	1

3: High, 2: Moderate,1: Low

Learning outcomes

Upon the completion of the course the student shall be able to

1.0 Verification Of Bernoulli's Theorem

1.1 State Bernoulli's theorem

1.2 Identify the apparatus required

1.3 Explain the Test procedure to verify Bernoulli's experiment.

2.0 Determination of C_d of Venturimeter

2.1 State the practical applications of venturimeter.

2.2 Record the manometric head readings from U-tube manometer

2.3 Record the time taken for collecting discharge by varying the discharge

2.4 Calculate the areas of the pipe and throat of the given venturimeter

2.5 Calculate coefficient of discharge of venturimeter.

3.0 Determination of loss of head due to friction in a given pipe

3.1 Measure the length of the given pipe

3.2 Record the pressure head readings from U-tube manometer

3.3 Record the time taken for collecting discharge by varying the discharge

3.4 Calculate the loss of head through the pipe

3.5 Calculate the friction factor

4.0 Determination of Power and Efficiency of Pelton Wheel

4.1 Identify the components of Pelton wheel
4.2 Start turbine by switching on jet of water slowly
4.3 Apply load steadily
4.4 Record load, speed
4.5 Calculate brake power and efficiency of turbine

5.0 Determination of Power and Efficiency of Kaplan Turbine

5.1Identify the components of Kaplan Turbine
5.2 Start turbine by giving input water supply
5.3 Apply load steadily
5.4 Record load, speed
5.5 Calculate power and efficiency of turbine

6.0 Determination of Power and Efficiency of Francis Turbine

6.1 Identify the components of Francis Turbine
6.2 Start turbine by switching on jet of water slowly
6.3 Apply load steadily
6.4 Record load, speed
6.5 Calculate power and efficiency of turbine

7.0 Determination of Power required and Efficiency of Centrifugal Pump

7.1 Identify the components of centrifugal pump
7.2 Record the suction and delivery pressures from pressure gauges
7.3 Record the time taken for collecting the discharge
7.4 Record the energy meter readings and calculate input power
7.5 Calculate the power input
7.6 Calculate the efficiency

8.0 Determination of of Power required and Efficiency of Reciprocating Pump

8.1 Identify the components of reciprocating pump
8.2 Record the suction and delivery pressures from pressure gauges
8.3 Record the time taken for collecting the discharge
8.4 Record the energy meter readings and calculate input power
8.5 Calculate the power input
8.6 Calculate the efficiency

9.0 Identification of Hydraulic circuits

9.1 Explain Hydraulic Circuit
9.2 Identify & List Symbols used in Hydraulic circuits.
9.3 List all the hydraulicapplications.
9.4 Classify the actuators.
9.5 List different types of valves.
9.6 Explain the function of a valve.
9.7 Identify the components of a valve.
9.8 Identify about ports and positions.
9.9 List the Applications of valves.

10.0 Identification of Pneumatic Circuits

10.1 Explain Pneumatic Circuit
10.2 Identify & List Symbols used in Pneumatic circuits.
10.3 Explain the phenomena of compressed air for transmitting power.
10.4 List all the pneumatic applications.
10.5 Define Pneumatic actuator.
10.6 Classify the actuators.
10.7 Explain Linear actuators and Rotary actuators.
10.8 List different types of valves.
10.9 Explain the function of a valve.
10.10 Identify the components of a valve.
10.11 Identify about ports and positions.
10.12 List the Applications of valves.

COURSE CONTENT

1. VERIFICATION OF BERNOULLI'S THEOREM
2. DETERMINATION OF FRICTION FACTOR FOR A GIVEN PIPE LINE
3. VENTURIMETER
4. PERFORMANCE TEST ON PELTON WHEEL
5. PERFORMANCE TEST ON FRANCIES TURBINE
6. PERFORMANCE TEST ON KAPLAN TURBINE
7. PERFORMANCE TEST ON CENTRIFUGAL PUMP
8. PERFORMANCE TEST ON RECIPROCATING PUMP
9. HYDRAULIC CIRCUIT
10. PNEUMATIC CIRCUIT

Course Title	Course Code	Periods/Week	Periods per Semester
Workshop Practice-II	M-411	03	45

Course Objectives	Upon the completion of the course the student shall able • To Familiarize Milling Machine • To handle milling, Slotting, Grinding and Welding Operations safely • To reinforce theoretical concepts by practising relevant exercises of Milling, slotting, Grinding and Welding Operations • Obtain skill in Milling, slotting, Grinding, Shaping and Welding Operations		
Course Outcomes	CO1	M-411.1	Operate Milling machine to perform various operations.
	CO2	M-411.2	Operate Slotter & shaper to perform various operations.
	CO3	M-411.3	Operate Grinding Machine to perform various operations.
	CO4	M-411.4	Fabricate the useful objects by welding.

TIME SCHEDULE

S.NO	EXERCISE TITLE	NO.OF PERIODS
1	Hands on practice on Milling Machine T-Slot cutting Spur Gear Cutting Helical Gear Cutting	9
2	Hands on practice on Slotting Machine Keyway Cutting	9
3	Hands on practice on shaper Keyway Cutting	9
4	Hands on practice on Surface Grinding Machine Preparation of Rectangular Block	9
5	Hands on practice on Arc Welding Machine Fabrication of Window Grill Fabrication of Stool	9
TOTAL		45

CO-PO Mapping

<table>
<tr><td>Course Code:M-411</td><td colspan="3">Course Title: Workshop Practice-II
No of Cos:4</td><td></td><td>No. Of periods:45</td></tr>
<tr><td rowspan="2">POs</td><td rowspan="2">Mapping with CO No</td><td colspan="2">CO Periods Addressing PO in Col 1</td><td rowspan="2">Level (1,2,3)</td><td>Remarks</td></tr>
<tr><td>No</td><td>%</td><td rowspan="8">>40% Level 3 (Highly Addressed)
25% to 40% Level 2 (Moderately Addressed)
5% to 25% Level 1
(Low Addressed)
<5% Not Addressed</td></tr>
<tr><td>PO1</td><td>CO1,CO2,CO3,CO4</td><td>5</td><td>11.1</td><td>1</td></tr>
<tr><td>PO2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO3</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO4</td><td>CO1,CO2,CO3</td><td>35</td><td>77.8</td><td>3</td></tr>
<tr><td>PO5</td><td>CO1,CO2,CO3,CO4</td><td>5</td><td>11.1</td><td>1</td></tr>
<tr><td>PO6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO7</td><td></td><td></td><td></td><td></td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1			3	1					1
CO2										1
CO3				3						1
CO4	1				1					1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes:
Upon completion of the course the student shall be able

Perform T-slot cutting on milling machine

1.1 Select proper tool to perform the job
1.2 Set the Job on Machine
1.3 Select the speed for milling operation
1.4 Practice T-slot cutting operation on a milling machine
1.5 Use measuring instruments for checking dimensions.

Perform Spur gear cutting on milling machine

2.1 Select milling cutter to perform the job

2.2 Set the Job on Machine

2.3 Index the job

2.4 Select the speed for gear cutting operation

2.5 Practice gear cutting operation on a milling machine

2.6 Use measuring instruments for checking dimensions

Perform helical gear cutting on milling machine

3.1 Select milling cutter to perform the job

3.2 Set the Job on Machine

3.3 Index the job

3.4 Select the speed for helical gear cutting operation

3.5 Practice helical gear cutting operation on a milling machine

3.6 Use measuring instruments for checking dimensions

Perform keyway cutting on slotting machine

4.1 Select cutter to perform the job

4.2 Set the Job on Machine

4.3 Select the speed for Slotting operation

4.4 Practice slotting operation on a slotting

4.5 Use measuring instruments for checking dimensions

Perform surface grinding on rectangular block

5.1 Identify the functional application of different levers, stoppers, adjustments on surface grinding machine.

5.2 Identify different lubrication points of surface grinder

5.3 Identify lubricants and their usage for application in surface grinder

5.4 5 Identify different work and tool holding devices and acquaint with functional application of each device

5.5 Mount the work and tool holding devices with required alignment and check for its functional usage to perform the surface grinding operations on a rectangular block.

5.6 Observe safety procedure during mounting as per standard norms

Perform keyway cutting on shaping machine

6.1 Select cutter to perform the job

6.2 Set the Job on Machine

6.3 Select the speed for Shaping operation

6.4 Practice key way cutting on a shaper

6.5 Use measuring instruments for checking dimensions

Fabrication of Iron Window Grill by arc welding method

7.1 Plan and select the type & size of electrode, welding current.

7.2 Prepare edge as per requirement

7.3 Prepare, set arc welding machine as per sketch.

7.4 Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.

7.5 Clean the welded joint thoroughly.

7.6 Carry out visual inspection for appropriate weld joint

Fabrication of stool frame by arc welding method

8.1 Prepare the angle iron pieces as per drawing

8.2 Plan the sequence of steps

8.3 Plan and select the type & size of electrode, welding current.

8.4 Prepare edge as per requirement

8.5 Prepare, set arc welding machine as per sketch.

8.6 Deposit the weld maintaining appropriate arc length, electrode angle, welding speed, weaving technique and safety aspects.

8.7 Clean the welded joint thoroughly.

8.8 Carry out visual inspection for appropriate weld joint

REFERENCE BOOKS

1. A text book of welding Technology –Khanna O.P. DhanpathRai Publications
2. Workshop practice –Swarna Singh
3. Elements Of Workshop Technology - Volume II - Machine Tools, Media Promoters Pvt, Ltd

V SEMESTER

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

Course Code	Course Title	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
				THEORY				
M-501	Industrial Management and Entrepreneurship	5	-	75	3	20	80	100
M-502	Industrial Engineering and Estimation & Costing	5	-	75	3	20	80	100
M-503	Theory of Machines	4	-	60	3	20	80	100
M-504	Heat Power Engineering-II	4	-	60	3	20	80	100
M-505	Refrigeration and Air Conditioning	5	-	75	3	20	80	100
M-506	Computer Aided Manufacturing Systems	4	-	60	3	20	80	100
				PRACTICAL				
M-507	507-A CAD Lab Practice 507-B CAM Lab Practice	-	3+3	45+45	3	20 20	30 30	100
M-508	Life skills Lab Practice	-	3	45	3	40	60	100
M-509	R&AC Lab Practice	-	3	45	3	40	60	100
M-510	Project Work	-	3	45	3	40	60	
TOTAL		**27**	**15**	**630**		**280**	**720**	**1000**

Note: All the students should appear for both 507-A and 507-B examinations. Separate external examiners shall be appointed

Course Title	Course Code	Periods/Week	Periods per Semester
Industrial Management and Entrepreneurship	M-501	05	75

TIME SCHEDULE

<table>
<tr><th>Sl. No.</th><th>Chapter/Unit Title</th><th>Periods</th><th>Weightage of Marks</th><th>Short Answer Questions (3M)</th><th>Essay Type Questions (8M)</th><th>Higher Order Question (10M)</th></tr>
<tr><td>1.</td><td>Basics of Industrial Management.</td><td>06</td><td>03</td><td>01</td><td></td><td></td></tr>
<tr><td>2</td><td>Organisation structure & Organisational behaviour</td><td>15</td><td>11</td><td>01</td><td>01</td><td rowspan="4">01</td></tr>
<tr><td rowspan="3">3</td><td>Production Management</td><td>10</td><td>11</td><td>01</td><td>01</td></tr>
<tr><td>Materials Management</td><td>10</td><td>14</td><td>02</td><td>01</td></tr>
<tr><td>Maintenance Management & Industrial Safety</td><td>10</td><td>11</td><td>01</td><td>01</td></tr>
<tr><td>4</td><td>Entrepreneurship Development</td><td>12</td><td>11</td><td>01</td><td>01</td><td></td></tr>
<tr><td>5</td><td>New Trends in Management</td><td>12</td><td>09</td><td>03</td><td></td><td></td></tr>
<tr><td colspan="2">Total</td><td>75</td><td>70+10</td><td>10</td><td>05</td><td>01</td></tr>
</table>

Note: 10 Marks higher order question may be given from the Chapter -2 or Chapter - 3

Course Objectives and Course Outcomes

COURSEOBJECTIVES		Upon completion of the course the student shall be able to (i) Familiarise the concepts of management, ownership styles and organisation structures. (ii) Exposure to organisational behavioural concepts, basics of project and operational management and materials management in industries. (iii) Understand the modern trends of management in industries.	
COURSE OUT COMES	CO1	M-501.1	Understand the principles of management as applied to industry
	C02	M-501.2	Explain types of ownerships, the organisation structure of different business organisations and the behaviour of an individual in an organisation, motivational and leadership models
	C03	M-501.3	Explain the different aspects of production management, Materials Management and Maintenance activities in industries.
	CO4	M-501.4	Describe the role of entrepreneur in economic development
	CO5	M-501.5	Explain the latest trends and technologies which are essential for the overall progress of Entrepreneur.

CO-PO MAPPING

POs	**Mapped with CO No**	**No of Cos: 05**			**No. Of periods: 75**
		CO Periods Addressing PO in Col 1		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1	6	8	1	**>40% Level 3 (Highly Addressed)** **25% to 40% Level 2 (Moderately Addressed)** **5% to 25% Level 1 (Low Addressed)** **<5% Not Addressed**
PO2	CO3	30	40	3	
PO3					
PO4					
PO5	CO4	12	16	1	
PO6	CO2	15	20	1	
PO7	CO5	12	16	1	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	1							1		
CO2		1								2
CO3	3								2	2
CO4						3		1	2	
CO5							2	1	2	

3: High, 2: Moderate,1: Low

Note:

The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of the Question Paper

S. No	Chapter/Unit Title	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage			
				R	**U**	**Ap**	**An**	**R**	**U**	**Ap**	**An**
1	Basics of Industrial Management	06	03	03				01			
2	Organisation Structure & Organisational Behaviour	15	21	03		08	10	01		01	01
	Production Management	10	11	03		08		01		01	
3	Materials Management	10	14	06		08		02		01	
	Maintenance Management & Industrial Safety	10	11	03		08		01		01	
4	Entrepreneurship Development	12	11	03		08		01		01	
5	New Trends in Management	12	09	09				03			
Total		**75**	80	**30**		**40**	**10**	**10**		**05**	**01**

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter- 2 or Chapter -3 (Here it is taken from Chapter – 2)

Learning Outcomes

Understand the principles of management as applied to industry.

1.0 Basics of Industrial Management

1.1 Define industry, commerce (Trade) and business.
1.2 Know the need for management.
1.3 Understand functions of Management.
1.4 List the principles of scientific management by F.W.Taylor
1.5 List the principles of management by Henry Foyal.
1.6 Differentiate management, administration and organisation
1.7 Differentiate lower, middle and Top level management
1.8 Explain the importance of managerial skills (Technical, Human, Conceptual)

2.0 Organisation Structure & Organisational Behaviour

2.1 Know types of ownerships, the organisation structure of an industry and the behaviour of an individual in an organisation.

2.2 Understand the philosophy and need of organisation structure of an industry.

2.3 Understand the line, staff and line &staff organisations

2.4 Outline the communication process

2.5 State

a. Motivation theories.

b. Explain Maslow's Hierarchy of needs.

2.6 Explain

a. Different leadership models

b. Trait theory of leadership

c. Behavioural theory of Leadership

d. The process of decision making.

2.7 Assessing Human resource requirements

2.8 Understand

a. the process of recruitment, selection, training and development

b. types of business ownerships

3.(a)Production Management

3.1 Understand the different aspects of production management.

3.2 Identify the factors of Plant Location

3.3 Know the objectives of plant Layout

3.4 Understand the principles of plant Layouts

3.5 Explain the types of plant Layouts

3.6 Relate the production department with other departments.

3.7 Explain

(a)Function of Production, planning and control.

(b) Break Even Analysis

3.8 Draw PERT/CPM networks.

3(b) Materials Management

3.9. Understand the role of materials management industries.

3.10. Explain the importance of materials management in Industry.

3.11. Know the functions of Materials Management

3.12. Explain ABC analysis.

3.13. Define (a) Safety stock. (b) Reorder level

3.14. Derive an expression for economic ordering quantity.

3.15. Know the functions of Stores Management, types of store layouts, stores records

3.16. Describe the Bin card, Cardex method

3.17. Explain

(a) General purchasing procedures

(b) Tendering, E-tendering and E-procurement procedures

(c) Purchase records.

3(c) Maintenance Management & Industrial Safety

3.18. Comprehend the Importance of Maintenance Management & Safety procedures

3.19. Explain the importance of maintenance management in Industry.

3.20. Know the

(a)Objectives of maintenance management

(b)Activities of maintenance management

(c)Importance of Preventive maintenance

(d) Need for scheduled maintenance

3.21. Differentiate scheduled and preventive maintenance

3.22. Know the principles of 5 s for good house keeping

3.23.Explain

(a) The importance of safety at Work place.

(b) The important provisions related to safety.

(c) Hazard and accident.

(d) Different hazards in the industry.

(e) The causes of accidents, prevention

3.24. Explain the direct and indirect cost of accidents.

4. Entrepreneurship Development.

4.1. Understand the role of entrepreneur in economic development and in improving the quality of life.

4.2. Define the word entrepreneur.

4.3. Explain

(a) The requirements of an entrepreneur.

(b) The role of entrepreneurs in promoting Small Scale Industries.

4.4. Describe

(a) The details of self-employment schemes.

(b) Characteristic of successful entrepreneurs

4.5. Explain the method of site selection.

4.6. List out

(a) the financial assistance programmes for entrepreneurial development

(b) the organisations that help an entrepreneur

4.7. Know the use of EDP Programmes

4.8. Understand

(a) the concept of make in India, Zero defect and zero effect

(b) the importance for start-ups

(c) the conduct of demand surveys

(d) the conduct of a market survey

(e)Evaluation of Economic and Technical factors.

4.9. Prepare feasibility report study

5. New Trends in Management

5.1. Understand the new concepts adopted in modern management
5.2. Know the differences between data and information
5.3. Understand the information as a resource
5.4. Explain
(a) the use of Information technology in the organizational functions
(b) the applications of RFID
(c) the concept of quality.
(d) the quality systems and elements of quality systems.
(e) the principles of quality Assurance.
(f) the basic concepts of TQM
5.5. Know the Pillars of TQM
5.6. List the
(a) ISO standards.
(b) Beneficiaries of ISO 9000.
5.7. Explain
(a) ISO standards and ISO 9000 series of quality systems.
(b) the concepts of ISO 14000

Smart Technologies

5.8. Get an overview of IoT
5.9. Define the term IoT
5.10. Know how IoT work
5.11. List the key features of IoT
5.12. List the components of IoT : hardware, software, technology and protocols
5.13. List the advantages and disadvantages of IoT
5.14. List the applications of IOT

Course Content

1.0 Basics of Industrial Management

Introduction: Industry, Commerce and Trade; Definition of management; Functions of management; Principles of scientific management: – F.W.Taylor, Principles of Management: Henry Fayol; Administration organisation and management; Nature of management; levels of management; managerial skills;

2.0 Organisation Structure & Organisational Behaviour

Organizing - Process of Organizing; Line, Staff and line & staff Organizations, Communication, Motivational Theories; Leadership Models; Decision making, Human resources development; Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations, Corporations, Boards.

3. (a)Production Management

Definition and importance; Plant location and layout; Types of production -job, batch and mass; production Planning and Control: relation of production department with other departments, routing, scheduling, dispatching and follow up; Break even analysis; Application of CPM and PERT techniques; simple numerical problems;

3.(b) Materials Management

Materials in industry, Basic inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores Management: Stores layout, stores equipment, Stores records, purchasing procedures, e-tendering, e-procurement; purchase records, Bin card, Cardex system.

3.(c)Maintenance Management & Industrial Safety

Objectives and importance of plant maintenance, Different types of maintenance, Nature of maintenance problems, Range of maintenance activities, Schedules of preventive maintenance, Advantages of preventive maintenance,5 S principles; Importance of Safety at work places; Causes of accidents-cost of accidents-prevention- industrial hazards

4. Entrepreneurship Development

Definition of Entrepreneur; Role of Entrepreneur; Concept of Make In India, ZERO defect, Zero Effect, Concept of Start-up Company, Entrepreneurial Development: Role of SSI, MSME, DICs, Entrepreneurial development schemes; Institutional support, financial assistance programmes; Self-employment schemes, Market survey and Demand survey; Preparation of Feasibility study reports

5.0 New Trends in Management

Introduction to Management Information System (MIS); RFID application in materials management; Total Quality Management (TQM)- Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo. Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, Stages of development of ISO9000 series , ISO-14000,

Smart Technologies : Over view of IoT - Define IoT, how IoT work, key features of IoT, components of IoT : hardware, software, technology and protocols, advantages and disadvantages of IoT –Applications of IoT-Smart Manufacturing.

REFERENCE BOOKS

1.Industrial Engineering and Management -by O.P Khanna

2. Production Management- by Buffa.

3. Engineering Economics and Management Science - by Banga & Sharma.

4. Personnel Management by Flippo.

5. Production and Operations Management –S.N. Chary

6. Converging_Technologies for Smart Environments and Integrated Ecosystems IERC Book Open Access 2013 pages-54-76

C-20-M-501

BOARD DIPLOMA EXAMINATION,
D.M.E. – V SEMESTER EXAMINATION
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Time : 3 Hours Total Marks: **80**

PART – A

Answer all questions 10 X3=30

1. With line diagram, show the managerial skills needed at various levels of management
2. Differentiate job description and job specification
3. List out types of production and explain any one of them
4. List out different stores records
5. What is meant by inventory control
6. List out the advantages of preventive maintenance
7. List out the organizations that help an Entrepreneur
8. List out ISO 9000 series
9. Define Quality as stated by Ishikava and by P.B.Crosby
10. List out the components of IoT

PART B

Answer all questions 5 X 8=40

11. A) Explain the process of communication

OR

B) Explain Maslows needs of hierarchy motivation theory

12. A) Explain the factors to be considered while selecting a plant location

OR

B) For the following data of a project, Draw the network, Find out critical path and project duration .

Activity.	1--2	1--6	2--3	2-4	3--5	4--5	6--7	5--8	7-8
Optimistic time days	2	2	5	1	5	2	3	2	7
Most likely time days	5	5	11	4	11	5	9	2	13
Pessimistic time days	14	8	29	7	17	14	27	8	31

13. A) Explain purchasing procedure

OR

B) (i) Derive expression for Economic order quantity
(ii) Explain ABC analysis with graphical illustration

14 A) Explain the Direct and Indirect cost of accidents

OR

B) Explain the various Industrial hazards

15 A) Describe the details of the self-employment schemes

OR

B) Explain the Entrepreneurial Development schemes

PART C

Answer all questions 1 X 10=10

16. Explain line and staff organization structure with line diagram and explain how it is useful for large industries.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-501 :: Industrial Management and Entrepreneurship

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.17 (including problems)
Unit Test – II	From 3.18 to 5.14

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
	Part - A (16 marks)			
1	Basics of Industrial Management, Organisation structure & Organisational behaviour, Production Management, Materials Management.	R,U	4	CO1 CO2, CO3,
2	Basics of Industrial Management	U	3	CO1
3	Organisation structure & Organisational behaviour	U	3	CO2
4	Production Management	U	3	CO3
5	Materials Management	U	3	CO3
	Part - B (24 marks)			
6	Organisation structure & Organisational behaviour	Ap	8	CO2
7	Production Management	Ap	8	CO3
8	Materials Management	Ap	8	CO3

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
	Part - A (16 marks)			
1	Maintenance management & Industrial Safety, Entrepreneurship Development, New Trends in Management	R,U	4	CO3 CO4, CO5
2	Maintenance management & Industrial Safety	U	3	CO3
3	Entrepreneurship Development	U	3	CO4
4	New Trends in Management	U	3	CO5
5	Smart technologies	U	3	CO5
	Part - B (24 marks)			
6	Maintenance management & Industrial Safety	Ap	8	CO3
7	Entrepreneurship Development	Ap	8	CO4
8	New Trends in Management	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

BOARD DIPLOMA EXAMINATION,

Unit Test - 1

M-501 Industrial Management and Entrepreneurship

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one-mark questions, and remaining 4Questions carry 3 marks each*

1.(a) The highest skill required for top level management is ------------------------

(b)Who stated the Needs of hierarchy theory?

(c)PERT is event oriented approach (Yes/No)

(d) Choose the correct answer

Bin card are used in (planning department/stores/marketing department/finance department)

2. List out functions of management

3. Distinguish between Job description and job specification

4. List out phases of PPC

5. State the duties of store keeper

PART – B

Instructions: *Part B consists of **3**Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6.(a) Explain Staff organisation with the aid of sketch and state advantages and disadvantages.

(OR)

*(b)*What is meant by communication? Explain the process of communication

*7.(a)*Explain various types of plant layouts

(OR)

(b)For the following data of a project, Draw the network. Find out critical path and project duration

Activity.	1--2	1--3	1--4	2--5	3--5	3--6	4--6	5--7	6--7
Days.	5	4	7	6	10	7	8	5	6

8(a) Derive expression for EOQ

(OR)

(b) Explain about E-tendering system

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

M-501 Industrial Management and Entrepreneurship

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one-mark questions, and remaining 4Questions carry 3 marks each*

1.(a) Chose the correct answer

Which type of maintenance implies that repairs are made after the equipment is out of order

i) Break down maintenance ii) Scheduled maintenance iii) Preventive maintenance

(b)Write the full form of MSME

(c)Choose the correct answer

ISO means Indian organisation for standardisation (Yes/No)

(d) I oT means ---------------------

2. List out causes for accidents in the industry

3. What are the expectations of entrepreneur

4. What are the pillars of TQM

5. List out components of IoT

PART – B

Instructions: *Part B consists of **3**Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6.(a) Explain various industrial hazards .

(OR)

*(b)*Explain any two types of maintenance generally carried out in industries

*7.(a)*Explain any four self-employment schemes

(OR)

(b)Explain the Entrepreneurial Development schemes existing in our country

8(a) what are the advantages and disadvantages of ISO 9000series of standards

(OR)

(b) Explain various elements of quality systems

Course Title	Course Code	Periods/Week	Periods per Semester
Industrial Engineering and Estimation & Costing	M-502	05	75

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Work Study	15	14	2	1	*
2	Statistical Quality Control (SQC)	15	14	2	1	
3	Fundamentals of Estimation and Costing.	15	14	2	1	
4	Estimation of Weights and Machining Times.	15	14	2	1	*
5	Estimation of Forging and Welding Costs.	15	14	2	1	*
	Total	75	70+10	10	05	01

Note: * 10 marks higher order question may be given from Chapter-1 or Chapter -4 or Chapter -5

Course Objectives and Course Outcomes

Course Objectives			**Upon completion of the course the student shall be able to** • Contribute to improving efficiency, productivity and/or quality of products manufactured or services provided in the organizations. • Address the underlying concepts, methods and application of Engineering Costing & Estimating
Course Out Comes	CO1	M-502.1	Explain principle of work study and contribution of work study to productivity and wage systems.
	CO2	M-502.2	Differentiate various inspection methods. Illustrate various statistical quality control methods.
	CO3	M-502.3	Explain how to estimate the cost of a manufactured product.
	CO4	M-502.4	Estimate weight of material and machining times for a product to be manufactured or machined.
	CO5	M-502.5	Estimation the cost of a product manufactured or fabricated by using Forging and Welding Techniques.

CO-PO MAPPING

<table>
<tr><td rowspan="3">POs</td><td rowspan="3">Mapped with CO No</td><td colspan="3">Course Title : Industrial Engineering and Estimation & Costing

No of COs:05</td><td>Course Code : M-502

No. Of periods: 75</td></tr>
<tr><td colspan="2">CO Periods Addressing PO in Col 1</td><td>Level (1,2,3)</td><td rowspan="2">Remarks</td></tr>
<tr><td>No</td><td>%</td><td></td></tr>
<tr><td>PO1</td><td>CO1-CO5</td><td>41</td><td>54.7</td><td>3</td><td rowspan="7">>40% Level 3 (Highly Addressed)
25% to 40% Level 2 (Moderately Addressed)
5% to 25% Level 1 (Low Addressed)
<5% Not Addressed</td></tr>
<tr><td>PO2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO3</td><td>CO2-CO5</td><td>19</td><td>25.33</td><td>2</td></tr>
<tr><td>PO4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO5</td><td>CO1, CO4,CO5</td><td>15</td><td>20</td><td>1</td></tr>
<tr><td>PO6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO7</td><td>-</td><td></td><td></td><td>-</td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3				1			2	1	
CO2	3		2					2	1	
CO3	3		2					2	1	
CO4	3		2		1			2	1	
CO5	3		2		1			2	1	

3: High, 2: Moderate,1: Low
Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.
Suggestive activities for further strengthening of CO-PO mapping:

1. Seminars may be arranged by industrial experts to make case studies on method study and time study.
2. Students shall be asked to carry a mini project on estimation and costing of an item.
3. Assignment on approaching the industries for obtaining assistance under corporate social responsibility.

Blue Print of the Question Paper

S. No	Chapter /Unit Title	Periods Allocated	Weightage of Marks	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Work Study	15	14	03	03	08	10	01	01	01	01	CO1
2	Statistical Quality Control (SQC)	15	14	03	03	08		01	01	01		CO2
3	Fundamentals of Estimation and Costing	15	14	03	03	08	-	01	01	01	-	CO3
4	Estimation of Weights and Machining Times	15	14	03	03	08	-	01	01	01	-	CO4
5	Estimation of Forging and Welding Costs.	15	14	03	03	08	-	01	01	01	-	CO5
Total		**75**	**70+10**	**15**	**15**	**40**	**10**	**05**	**05**	**05**	**01**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: * 10 marks higher order question may be given from Chapter-1 or Chapter -4 or Chapter -5. (Here it is taken from the Chapter- 1)

Learning Outcomes

Upon completion of the course the student shall be able to

1.0. Work Study

1.1. Define Production, Productivity, Work study, Method Study and Work Measurement
1.2. State objectives and applications of Work study, Method Study and Work Measurement
1.3. Explain the Steps: Define, Record, Critical Examination, Develop, Install and maintain for conduct of method study to increase the productivity.
1.4. Explain process chart symbols with examples.
1.5. Explain the use of flow diagram and string diagram and chrono-cycle graph.
1.6. Identify various therbligs used in the micro-motion study.
1.7. Explain the use of therbligs with a SIMO chart.
1.8. Explain Time study Procedure by using a stop watch.
1.9. Compute the standard time for an operation by adding its constituent elements.
1.10. Explain the procedure of Predetermined Motion Time Standards (PMTS)
1.11. Explain the method of conducting work sampling.
1.12. State the terms involved in wage systems.
1.13. State different incentive plans.
1.14. Solve simple problems on Halsey, Rowan and Emerson efficiency plans.

2.0 Statistical Quality Control (SQC).

2.1. State the different inspection methods.
2.2. Explain briefly different methods of inspection with advantages and limitations.
2.2. Define the concept of the term Quality and Quality control.
2.4 Explain the need of Statistical Quality Control of the products
2.5. List basic quality control tools.
2.6 Explain causes of quality variation.
2.7 State the characteristics of normal distribution curve.
2.8 Explain control charts with classification, advantages and applications.
2.9 Construct control charts for variables data and attributes data .
2.10 Interpret control charts for " Process in control" or Process out of control".
2.11 List advantages and disadvantages of acceptance sampling over 100% inspection.
2.12 State the Principles of random sampling.
2.13 Explain the procedure for accepting a lot by single sampling plan only.
2.14 Explain the concept of Six Sigma.

3.0 Fundamentals of Estimation and Costing.

3.1. Define Estimation and Costing.
3.2. List objectives of Estimation and Costing.
3.3. Differentiate between estimation and costing of a product.
3.4 Outline Estimation procedure
3.5. Explain various Elements of costing
3.6. Explain various components of costing.
3.7 Calculate selling price of a Product
3.8. Solve simple numerical problems on selling price of products.
3.9 Define Depreciation
3.10. Explain the causes of depreciation
3.11. List various methods of calculating depreciation.
3.12 Compute depreciation charges by 1) Straight Line method 2) Sinking Fund Method and 3) Sum of Years' Digits method.

4**. Estimation of Weights and Machining Times**

4.1 Calculation of volume, weight and material cost of manufacturing a given component.
4.2 Estimation of Machining times - calculation of turning, knurling, facing, drilling, boring, reaming, threading, tapping, shaping, planning and grinding operation times performed on the given component.

5. Estimation of Forging and Welding Costs

5.1 Explain various forging losses.
5.2 Estimate the length for a given component by forging.
5.3 Estimate the weight of material required for a given component by forging
5.4 Estimate the cost of forging
5.5 Estimate the cost of Fabrication by Gas welding
5.6 Estimate the cost of Fabrication by Arc welding.
5.7 Estimate the cost of Gas cutting.

COURSE CONTENT

1.0 Work Study

Industrial Engineering : Definition of Production and productivity;

Work Study: Definition, objectives and scope of work study.

Method Study: Definition, objectives, procedure of conducting method study –

Process chart symbols – Explanation with Operation process chart, Flow process chart and Two handed process charts only - Uses of flow diagram and string diagram.

Micro-motion study: Therbligs used in the micro-motion study - SIMO chart – Chrono cycle graph.

Work Measurement or Time study: Definition, objectives - Work measurement techniques.

Time Study: Procedure by using a stop watch to measure the standard time- Constituents of standard time: Normal time- rating factor- allowances – Simple Problems.

Standard data - Determination of standard time by using Predetermined Motion Time Standards (PMTS) - Determination of standard time by using work sampling.

Wage and incentive plans : Definitions of wage, nominal wage, real wage, living wage, minimum wage , fair wage and incentive- List different incentive plans - Solve simple problems on Halsey, Rowan and Emerson efficiency plans only.

2.0 Statistical Quality Control (SQC)

The Meaning of Quality - objectives of inspection - methods of inspection – floor or patrolling inspection - centralised inspection –trial run inspection- first piece inspection - pilot piece inspection - sample inspection – merits and demerits of the above -

Statistical Quality Control: Definition - Chance and assignable causes – Quality control tools – Types of statistical data – variables and attributes data – Normal distribution curve;

Control Charts for variables data- Construction of Control Charts for X-Bar and R- Charts. Interpretation of control charts to know whether the process is out of control or in control - Simple Numerical Problems.

Control charts for attributes data: Fraction defective (p), percent defective (100p) , Number of Defectives (np) charts - Simple Numerical Problems.

Acceptance sampling plan – advantages and disadvantages of sampling plan over 100% inspection – Single sampling plan for accepting a lot with a flow chart – Principles of random sampling;

Six sigma: Importance – Objectives – advantages.

3.0 Fundamentals of Estimation and Costing

Estimating: Importance and objectives, Estimating Procedure

Costing- Definition – objectives - Difference between Estimating and Costing

Elements of costs – Components of costs - Calculate selling price of a Product- Numerical Problems -

Depreciation: Definition – Causes - methods of depreciation - Simple problems on calculation of depreciation Fund by 1) Straight Line method 2) Sinking Fund Method and 3) Sum of Years' Digits method.

4.0 Estimation of Weights and Machining Times

Estimation of Weight of given compoent**:** Calculation of volume, weight and material cost of manufacturing a given component - Simple Numerical Problems.

Estimation of Machining times - calculation of turning, knurling, facing, drilling, boring, reaming, threading, tapping, shaping, planning and grinding operation times performed on the given component- Simple Numerical Problems.

5.0 **Estimation of Forging and Welding Costs.**

Forging Cost : Types of forging operations, Estimation procedure – Forging losses - estimating forging cost of given component by considering losses – Simple Numerical Problems.

Welding cost : Type of welding processes - Types of joints - Calculate arc welding and gas welding costs for making the given joint by considering material, labour, and power costs - Gas cutting cost - Simple numerical problems.

REFERENCE BOOKS

1. Work study – by Ralph Banes.
2. Work study – by I.L.O.
4. Industrial Engineering & Management Science - by T.R. Banga
5. S.Q.C – by Grant & Levenworth
6. S.Q.C -by Juran
7. S.Q.C -by Gupta
8. Mechanical Estimating & Costing - B.P.Sinha
9. Estimating & Costing - Agarwal.
10. Estimating & Costing - Narang & charya.
11. Estimating & Costing - T.R. Banga – Sharma.

C20-M-502

BOARD DIPLOMA EXAMINATION
D.M.E. – V SEMESTER EXAMINATION
INDUSTRIAL ENGINEERING & ESTIMATION and COSTING

Time : 3 Hours Total Marks: **80**

PART – A

10 X3 = 30

Instructions: *Part A consists of **10** questions. Answer **all** questions and each question carries **three** marks.*

1. List six advantages of work study?
2. Define Standard time?
3. State the causes of variation in a process.
4. Differentiate between inspection and quality control
5. Differentiate between estimating and costing.
6. Give three examples of administrative over heads.
7. Estimate the machining time to turn a MS Rod from 4 cm to 3.5 cm diameter for a length of 15cm in a single cut. Assume cutting speed 30m/min and feed 0.4mm/rev.
8. Calculate the time required to face both ends of a rod of diameter 5 cm in one cut. Take speed of rotation of the job as 200 rpm and cross feed as 0.3 mm/rev.
9. Why the forging losses are considered in estimation in forging shop.
10. List the costs involved in the estimation of welding cost of a product.

PART – B

5 X 8 = 40

Instructions: *Part B consists of **5 Questions**. Each question carries 8 marks and may have sub questions.*

11 (a) Describe the procedure adopted for method study to improve the productivity of the manufacturing Industry.

(OR)

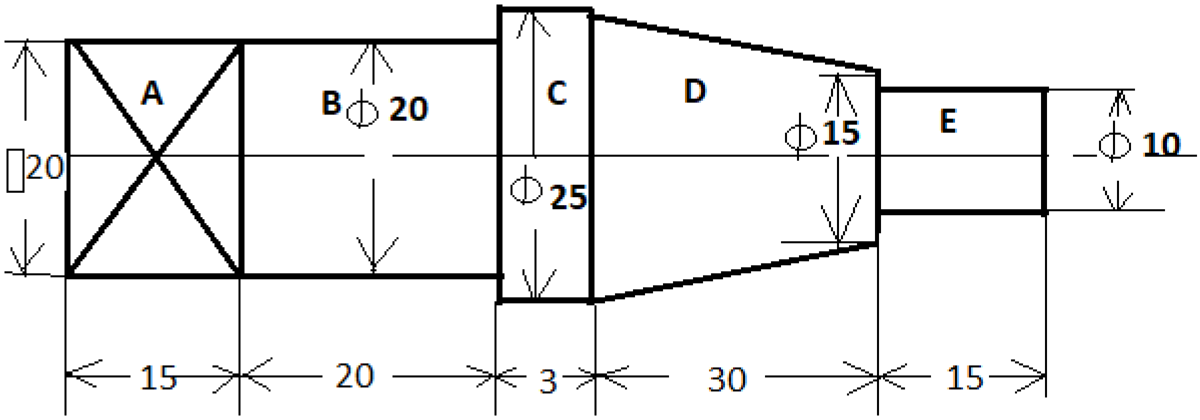
(b) The standard time for a job is 8 hours and the hourly rate is Rs.15. Compute (a) the total wage of the worker (b) earning of the worker per hour, if he completed the job in 6 hours by Rowan Incentive Plan.

12 (a) An N.C. machine was purchased for Rs. 15,00,000 and its life is estimated as 15 years. Its scrap value is Rs. 75,000. Calculate (1) Rate of depreciation (2) Total depreciation fund at the end of four years; (3) Value of the machine at the end of 12 years.

(OR)

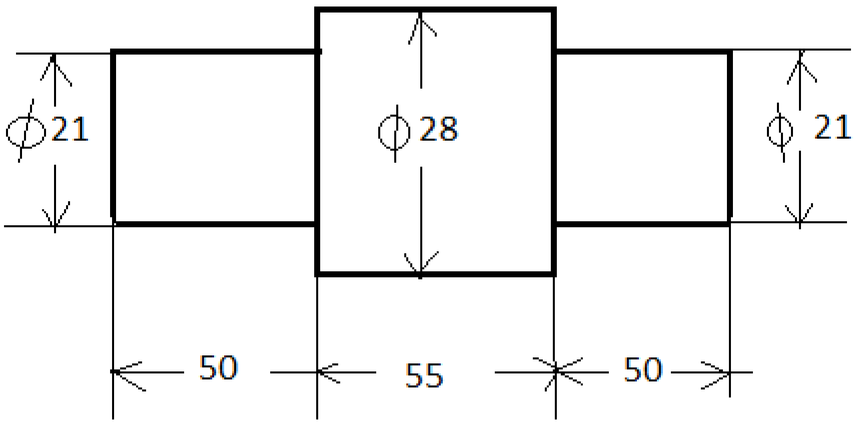
(b) The market price of a product is Rs. 200. The discount allowed is 20% of the market price. The selling expenses are equal to factory cost and the relation between material cost, labour cost and factory expenses is 1: 3 : 2. If the labour cost is Rs.30, what profit is being made on this product?

13. (a) Calculate the cost of brass casting shown in the fig. Density of brass may be taken as 8.6gm/cc. The cost of brass material is Rs.60 per kg. All dimensions are in mm.



(OR)

(b) Estimate the time required to turn 35mm diameter bar to the dimensions shown in fig. Cutting speed is 15.4m/min and feed is 2mm/rev. All cuts are 3.5mm deep.



14. (a) Two one meter long MS plates10 mm thick are to be welded by a lap joint with 6 mm electrodes. Calculate the cost of welding if: Electrical supply is 250 amps and 30 volts: Welding speed: 10 m/hr; Electrodes used: 0.5kg/m of welding; Labour charges: Rs.15 per hour; Power charges: 1/kWh; Cost of electrode: Rs.15/kg; Efficiency of welding machine: 60%.

(OR)

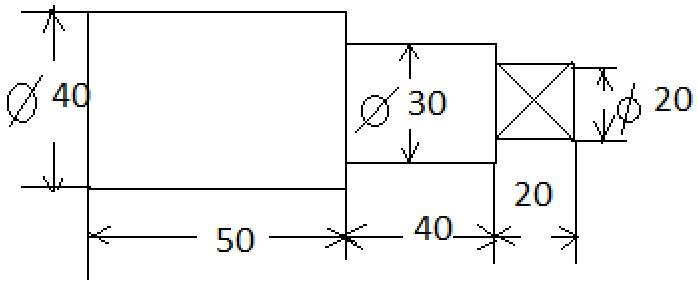
(b) 100 M.S. pieces of component as shown in Fig. are to be drop forged from a 4cm dia bar stock. Estimate the cost of manufacturing, using given data .

a). Cost of material = Rs.100/-meter

b). Forging charges = 0.05Rs./cm2 surface area.

c). on cost = 10% of material cost.

Consider all possible losses during operations.



15. (a) The following data was recorded for constructing Mean and Range charts. Sample Size is 6. Number of samples are 12. Calculate (a) Upper & Lower control limits (b) Draw Mean and Range charts. (c) Comment on the process.

Sample Number	1	2	3	4	5	6	7	8	9	10	11	12
Mean, $\bar{x}$	325	315	285	510	410	300	430	290	210	250	350	325
Range, R	42	46	62	43	62	75	51	39	42	58	38	37

(OR)

(b) The daily production in machine shop is 1000 components. These components are inspected by GO and NO GO gauges. A sample of 100 is inspected daily for continuously ten days. The samples are taken at random. Compute the control limits and draw P chart and np chart.

Date	1	2	3	4	5	6	7	8	9	10
Rejections	2	10	6	20	18	14	15	12	8	6

PART – C

1X 10 = 10

Instructions: *Part C consists of **1** question which carries 10 marks.*

16. Discuss the importance of work sampling technique over stop watch method for calculating the standard time for the given job.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-502 :: INDUSTRIAL ENGINEERING & ESTIMATION and COSTING

Unit Test	Learning Outcomes to be covered
Unit Test – I	1.1 – 2.14
Unit Test – II	3.1 – 5.7

Unit Test - 1

Q.No	Question from the Chapter/ Unit	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1,2	Work Study	R	6	CO1
3	Work Study	U	4	CO1
4,5	Statistical Quality Control (SQC)	U	6	CO2
Part - B (24 marks)				
6	Work Study	U	8	CO1
7	Work Study	U	8	CO1
8	Statistical Quality Control (SQC)	Ap	8	CO2

Unit Test - 2

Q.No	Question from the Chapter/ Unit	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Fundamentals of Estimation & Costing	U	4	CO3
2, 3	Estimation of Weights and Machining Times	U	6	CO4
4, 5	Estimation of Forging & Welding Costs	R,U	6	CO5
Part - B (24 marks)				
6	Fundamentals of Estimation and Costing	U	8	CO3
7	Estimation of Weights and Machining Times	Ap	8	CO4
8	Estimation of Forging & Welding Costs	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-502

BOARD DIPLOMA EXAMINATION

Unit Test - 1

INDUSTRIAL ENGINEERING & ESTIMATION and COSTING

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Write the formula for Halsey wage plan.
   (b) Standard of output is the factor to rate the employee (True/False)
   (c) In Emerson's efficiency plan the bonus is calculated on the basis that bonus must be ------ of his daily rages if the efficiency exceeds 100%
   (d) What is the Purpose of Incentive?
2. What are the objectives of method study?
3. Draw Symbols for the following
   a)Inspection b)Transport c) Storage d) Delay.
4. Differentiate between inspection and quality control.
5. Differentiate discrete data and continuous data?
   .

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain the procedure for work measurement by stopwatch method.

   (OR)

   What are the constituents of standard time? Define each terms involved in computing standard time high lighting the allowances.
   .
7. Explain Basic Feature of Halsey Premium Plan and discuss the merits and demerits of the plan
   .

   (OR)

   Explain Basic Feature of Emerson's efficiency Plan and discuss the merits and demerits of the plan
8. The daily production in machine shop is 1000 components. These components are inspected by GO and NO GO gauges. A sample of 100 is inspected daily for continuously ten days. The samples are taken at random. Compute the control limits and draw P chart

Date	1	2	3	4	5	6	7	8	9	10
Rejections	2	10	6	20	18	14	15	12	8	6

(OR)

Analyze the differences between variable charts and Attribute charts?

C20-M-502

BOARD DIPLOMA EXAMINATION

Unit Test - 2

INDUSTRIAL ENGINEERING & ESTIMATION and COSTING

Time : 90 Minutes | Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Define Estimation.
   (b) Estimation Requires Technical Knowledge (True/False)
   (c) In a Plant, Number of manpower is 200 and number of components produced per week in plant is 20. The Labour Productivity is----
   (d) Define depreciation.

2. Write the formula for finding the volume of (a) Cone (b) Circular ring and (c) Frustum of Pyramid?
3. List out the indirect materials used in foundry.
4. List out various forging losses?
5. What are the costs generally considering while calculating the Gas welding cost?

PART – B

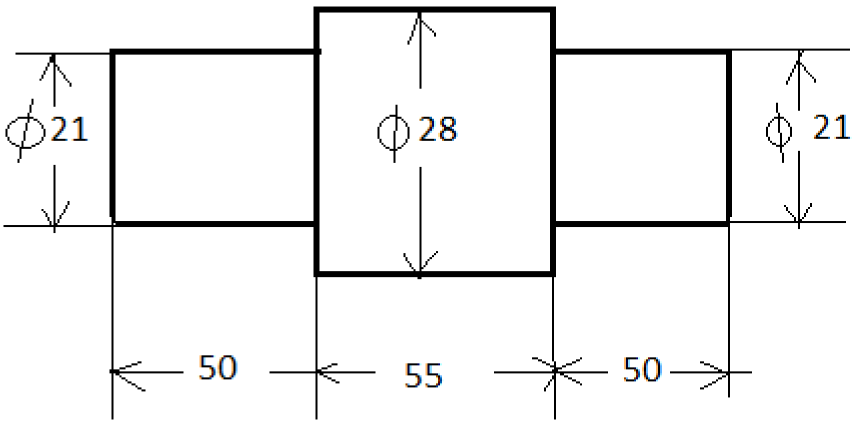
Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Illustrate the Procedure to determine selling price of a component.

(OR)

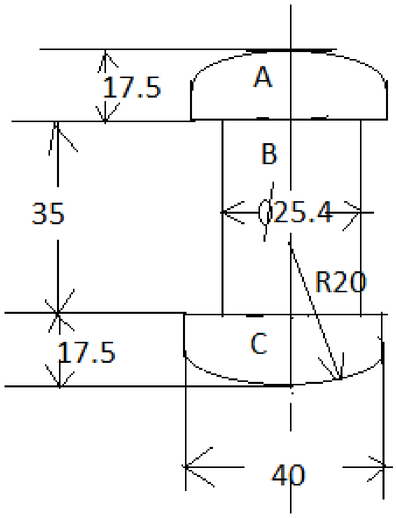
Explain i) Straight line method ii) sum of Years' method for finding depreciation

7. Estimate the time required to turn 35mm diameter bar to the dimensions shown in fig. Cutting speed is 15.4m/min and feed is 2mm/rev. All cuts are 3.5mm deep.

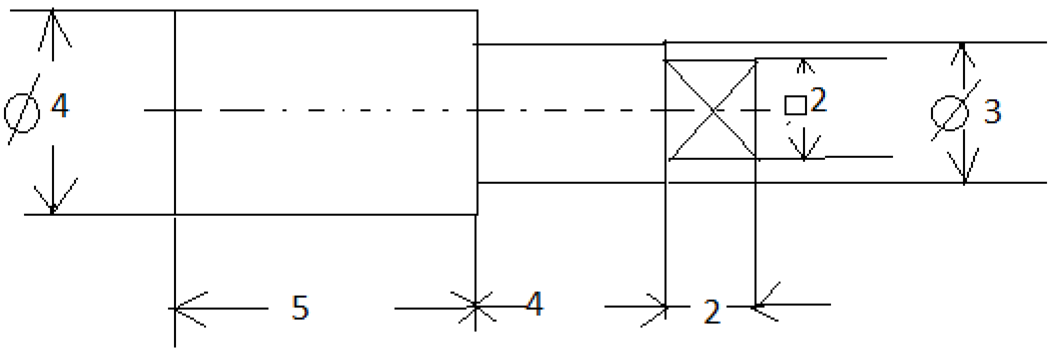


OR

Estimate the number of rivets made from 4.5kg of mild steel as shown in the fig. The density of the material is 7.87 grams/cm3. All dimensions are in mm.



8. 200 pieces of a component as shown in the figure. are to drop forged from a 4cm diameter bar stock. Calculate the cost of manufacturing if (a) Material cost is Rs.100 per meter length. (b). Forging charges@ Rs. 010 per cm2 of surface area to be forged. (c) On cost is 10% of material cost. Assume all possible forging losses and all dimensions are centimetre.



(OR)

Two one meter long MS plates10 mm thick are to be welded by a lap joint with 6 mm electrodes. Calculate the cost of welding if: Electrical supply is 250 amps and 30 volts: Welding speed: 10 m/hr; Electrodes used: 0.5kg/m of welding; Labour charges: Rs.15 per hour; Power charges: 1/kWh; Cost of electrode: Rs.15/kg; Efficiency of welding machine: 60%.

Course Title	Course Code	Periods/Week	Periods/Semester
Theory of Machines	M–503	04	60

TIME SCHEDULE

S. No	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Belts and chain drives	12	14	2	1	*
2	Gear drives	12	14	2	1	*
3	Fly wheels and Governors	12	14	2	1	-
4	Cams	12	14	2	1	*
5	Mechanical Vibrations	12	14	2	1	
Total		**60**	**70+10**	**10**	**05**	**01**

Note: * 10 Marks higher order question may be given from the Chapter-1 or Chapter- 2 or Chapter - 4.

Course Outcomes and Course Objectives

Course objectives	Upon completion of course the student shall be able to understand the working principles and applications of various mechanisms like belts, chains, gears and clutches and other machine controlling elements viz., flywheel, governor and cams in Mechanical Engineering.		
Course outcomes	**CO1**	M-503.1	Design the belt drive to transmit the given power by considering the centrifugal tension
	CO2	M-503.2	Design the gear train like 1. Simple, 2. Compound and 3. Reverted gear train for practical applications
	CO3	M-503.3	Design the gear based on Lewis equation by taking the dynamic effect of the load into consideration in the form of velocity factor.
	CO4	M-503.4	Explain the functions of the machine control elements like Flywheel, Governor, and Cam
	CO5	M-503.5	Explain the basics of mechanical vibrations

PO-CO Mapping

Course Code : M-503	Course Title: Theory of Machines	Number of Course Outcomes: 05			No. of Periods:60
POs	Mapped with CO No.	CO Periods addressing PO in Column 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1, CO2, CO3, CO4, CO5	27	45	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2	CO1, CO2, CO3	08	13	1	
PO3	CO1, CO2, CO3	15	25	2	
PO4					
PO5					
PO6					
PO7	CO1, CO2, CO3, CO4, CO5	10	17	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	1	2				1	1	3	1
CO2	3	1	2				1	1	3	1
CO3	3	1	2				1	1	3	1
CO4	3						1	1	3	1
CO5	3						1	1	3	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

BLUE PRINT OF THE QUESTION PAPER

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage			
				R	U	Ap	An	R	U	Ap	An
1	Belt and Chain drives	12	14	03	03	8	-	1	1	1	-
2	Gear drives	12	14	03	03	8	10	1	1	1	1
3	Fly wheels and Governors	12	14	03	03	8	-	1	1	1	-
4	Cams	12	14	03	03	8	-	1	1	1	-
5	Mechanical Vibrations	12	14	03	03	8	-	1	1	1	
Total		**60**	**70+10**	**15**	**15**	**40**	**10**	**05**	**05**	**05**	**01**

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: * 10 Marks higher order question may be given from the Chapter-1 or Chapter- 2 or Chapter - 4. (Here it is taken from the Chapter– 2)

LEARNING OUTCOMES

Upon completion of the course student shall be able to

1.0 Belts and Chain Drives

1.1 List the different power drives and compare the flexible drives with the rigid drives
1.2 Classify the belt drives on different criteria and list the belt materials
1.3 Explain the effect of slip and creep on power transmission
1.4 Write the expression for calculating the length of open and cross belts.
1.5 Write the expression for calculating the angle of contacts of open and cross belts.
1.6 Write the expression for i) ratio of belt tensions ii) centrifugal tension in the belt
1.7 Explain the effect of centrifugal tension on power transmission
1.8 Write the condition for maximum power transmission
1.9 Solve the numerical problems related to the lengths, angle of contact, ratio of tensions, power transmitted by the belt drives.
1.10 Design the cross-sectional dimensions of flat belt (V-belts are excluded)
1.11 Design the cone pulley for open and cross belts
1.12 List the different elements of chain drive
1.13 Classify the chain drives
1.14 Differentiate belt and chain drives

2.0 Gear Drives

2.1 List the advantages and disadvantages of gear drives over belt and chain drives
2.2 Define gear train and List different types of gear trains
2.3 Write the expression for the velocity ratio / Train value for different gear trains except Epi-cyclic gear trains
2.4 Explain the working of simple, compound, epy-cyclic and reverted gear trains.
2.5 Solve the problems related to simple, compound and reverted gear trains
2.6 Explain with a neat sketch the working of back gear assembly of a lathe
2.7 Design a 3-Speed gear box of an automobile – simple problems .
2.8 Explain the nomenclature of spur gear tooth.
2.9 Differentiate the involute profile from Cycloidal profile
2.10 List the required properties of gear materials
2.11 Write the Lewis bending equation.
2.12 Design the gear based on Lewis equation –Simple Problems only

3.0 Flywheels and Governor

3.1 State the function of flywheel, list its applications.
3.2 Explain the terms related to flywheel
3.3 Write the expression for maximum fluctuation of energy
3.4 Define Mass Moment of Inertia
3.5 Design the rim type flywheel for the given maximum fluctuation of energy.
3.6 Solve simple problems on fly wheel.
3.7 Explain the function of governor.
3.8 Classify the governors
3.9 Distinguish Governor from Flywheel
3.10 Describe the working of Watt governor with legible sketch.
3.11 Describe the working of governor with legible sketch.
3.12 Define the terms – sensitiveness, stability, isochronism, hunting, effort and power of governor.

4.0 Cams

4.1 Explain the function of cam assembly
4.2 Classify the cams and followers
4.3 Define the terms related to cam profile.
4.4 Draw displacement diagram for different the following motion of the followers
a) Uniform velocity. b) S.H.M. c) Uniform acceleration & retardation
4.5 Draw cam profiles in above three cases for knife edge and roller followers. **(Off-set followers are omitted)**

5.0 Introduction to Mechanical Vibrations

5.1 Define periodic motion, frequency, time period, amplitude, circular frequency, degree of freedom
5.2 Classify the mechanical vibrations on different criteria.
5.3 Explain the Simple Harmonic motion and its properties, Natural frequency and resonance
5.4 List various elements of mechanical vibrating systems.
5.5 Explain the following terms (a) spring element (b) damping element (c) Inertia element
5.6 List the types of damping.
5.7 Define the terms (a) Viscous damping (b) Coulomb damping (c) Structural damping
5.8 Appreciate the study of vibrations in the analysis and design of mechanical systems.
5.9 Write the expression for the natural frequency of single degree spring-mass system-simple problems. **(Derivation omitted)**
5.10 Write the expression for the natural frequency of single degree Simple pendulum - simple problems. **(Derivation omitted)**
5.11 Explain the sources of vibrations in mechanical systems
5.12 Explain the methods of controlling the vibrations in mechanical systems

COURSE CONTENT

1. **Belt and Chain Drives**

   Factors to be considered while selecting the type of power drive – Advantages and Disadvantages of Belt drives - Types of belt drives - Belt materials - Belt joints.

   Mathematical expression for the length and angle of contacts of open and crossed belts - Mathematical expression for the limiting ratio of belt tensions - Concept of centrifugal tension and initial tension – Mathematical expressions for the centrifugal tension in the belt and initial tension– Mathematical expression for the maximum power transmission **(Derivations for mathematical expressions are omitted)**

   Simple Numerical Problems on finding the length, angle of contact, stresses, cross-sectional dimensions, power transmission and maximum power transmission considering with or without the centrifugal tension.

   Design of stepped pulley;

   Chain drives – Advantages of chain drives - Types of chains – Roller and silent chains - (problems on chain drives omitted)

2. **Gear drives**

   Advantages and disadvantages of gear drives over other drives - Gear train - Simple, compound, reverted & Epi-cyclic gear trains. – Calculating the number of teeth for simple, compound and reverted gear trains for a given speed ratio and sketching the arrangement-Applications of gear trains –back gear assembly of lathe with a neat sketch;

   Design of 3-Speed gear box of an automobile – Simple problems.

   Involute and Cycloidal profiles – Comparison of these two profiles – Nomenclature of spur gear tooth – Gear materials.

   Design of spur gear based on Lewis equation by considering static load only. **(Velocity factor is not included in the problems)**

3 **Fly wheels and Governors**

   Function and applications of fly wheels -Turning Moment diagram for 4-stroke single cylinder engine – Definition of Coefficient of fluctuation of speed, maximum fluctuation in energy and Coefficient of fluctuation of energy – Mathematical expression for energy stored in the flywheel **(without proof)** –Importance of mass moment of inertia - Design of rim type flywheel knowing the fluctuation of energy– simple problems

   Governor – functions – Difference between Flywheel and Governor - Classification - Explanation of Simple Watt governor and Porter governor – Definitions of Sensitiveness, Stability, Isochronism, Hunting, Effort and Power of governor.

4. Cams

Function of cam - Classification of cams and followers –Working principle of plate and cylindrical cams.

Nomenclature of radial cam profile.

Motions of follower – Uniform velocity, uniform acceleration and retardation and simple harmonic motion – Time vs displacement diagrams only –

Construction of cam profile of a radial cam with knife edge & roller follower for all three types of motions stated above.

Problems on drawing of cam profiles as stated above for knife edge & roller followers **(offset followers not included).**

5. Introduction to Mechanical vibrations

Periodic Motion – frequency, time period, amplitude, circular frequency, degree of freedom; Elements of mechanical vibrating systems - (a) spring element (b) damping element (c) Inertia element.

Types of damping – viscous, Coulomb and structural damping

Classification of mechanical vibrations – free, damped, forced and damped forced vibrations

SHM – Natural frequency – resonance – problems on determining the natural frequency of single degree of freedom systems for spring mass system and simple pendulum.

Sources of vibrations in mechanical systems

Methods of controlling the vibrations in mechanical systems.

REFERENCES

1.	Machine Design	-	Pandya and Shah.	CHAROTAR
2.	Design of Machine Elements	–	V B Bhandari	[Tata Mc Graw Hill]
3.	Machine Design	-	R.S.Khurmi	[S.CHAND]
4.	Theory of machines	-	S.S. RATHAN	[Tata Mc Graw Hill]
5.	Mechanical Vibrations	-	S.S. RAO	Addison Wesley

C-20-M-503

BOARD DIPLOMA EXAMINATIONS
MODEL QUESTION PAPER
DME – V-SEMESTER
THEORY OF MACHINES

PART – A

Instructions: Answer all the questions **3 x 10=30**
Each question carries THREE marks

01. Linear mass density of a belt material is 1.5 kg/m. Find the velocity of the belt at which it will transmit maximum power if the maximum tension in the belt is 800 N.
02. List any three advantages and disadvantages of chain drive compared to belt drive
03. Write the differences between involute and cycloidal tooth profiles
04. Write the expression for the velocity ratio of compound gear train
05. Define (a) sensitivity (b) stability (c) isochronism of a governor
06. Write any six differences between flywheel and governor
07. Define pitch curve, prime circle and profile of a cam
08. List different followers used in cam assembly.
09. Find the natural frequency of a spring-mass system in Hz, if the mass is 10 kg and stiffness of the spring is 10 N/mm.
10. Find the length of a simple pendulum if its time period is 3 sec and acceleration due to gravity is 9.81m/s^2

PART - B

Instructions: Answer all the questions **5 x 8=40**
Each question carries EIGHT marks

11. A cross belt drive transmits 8 kW of power from a shaft rotating at 240 rpm to another shaft rotating at 160 rpm. The diameter of the smaller pulley is 600 mm and the two shafts are 5 m apart. The coefficient of friction is 0.25. If the maximum stress in the belt is limited to 3 MPa and the maximum torque is 30% more than the rated torque, find the width of the belt by taking its thickness as 1/10th of the width.

OR

A blower is driven by an electric motor though a belt drive. The motor runs at 750 r.p.m. For this power transmission, a flat belt of 8 mm thickness and 250 mm width is used. The diameter of the motor pulley is 350 mm and that of the blower pulley 1350 mm. The centre distance between these pulleys is 1350 mm and an open belt configuration is adopted. The pulleys are made out of cast iron. The frictional coefficient between the belt and pulley is 0.35 and the permissible stress for the belt material can be taken as 2.5 N/mm^2 with sufficient factor of safety. The mass of a belt is 2 kg per metre length. Find the maximum power transmitted without belt slipping in any of the pulleys.

12. (a) Explain the methods of controlling the vibrations in mechanical systems.

OR

(b) Explain the sources of vibrations in mechanical systems.

13. (a) A three speed sliding gear box of a motor car is required to give speed ratios of 4:1, 2.5:1 and 1.5 :1 for the first, second and third gear respectively. Diametral pitch of all gears is 0.3 /m and the centre distance between mating gears is 70 mm. Find the suitable number of teeth for various gears, if the number of teeth on pinion is 14. Sketch the arrangement.

OR

(b) A lathe is run by an electric motor. The stepped pulley of the motor is connected to the cone pulley of lathe by an open flat belt. The sizes of the cone pulley steps are 100 mm, 150 mm, 200 mm and 250 mm. Calculate the speeds available with (a) direct (b) back gear, if the motor shaft runs at 250 rpm. Assume both the pulleys are identical.

14. (a) A rimmed flywheel made of grey cast iron (mass density = 7100 kg/m^3) is used on punching press running at a mean speed of200 rpm. The punching operation consists of one-quarter revolution during which the flywheel is required to supply 3000 N-m of energy. The coefficient of speed fluctuations is limited to 0.2. The rim, which contributes90% of the required moment of inertia, has a mean radius of 0.5 m due to space limitations. The cross-section of the rim is square. Determine its dimensions.

OR

(b) Explain the working of porter governor with a neat sketch.

15. (a) A cam drives a knife edge reciprocating follower in the following manner :

During first 120° rotation of the cam, follower moves outwards through a distance of 40 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with uniform acceleration and retardation. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam for a radial translating knife edge follower.

OR

(b) A cam with 30 mm as minimum diameter is rotating clockwise at a uniform speed of 1200 r.p.m. and has to give the following motion to a roller follower 10 mm in diameter:

(i) Follower to complete outward stroke of 25 mm during 120° of cam rotation with equal uniform velocity

(II) Follower to dwell for 60° of cam rotation;

(*III*) Follower to return to its initial position during 90° of cam rotation with uniform acceleration and retardation;

(iv) Follower to dwell for the remaining 90° of cam rotation.

Draw the cam profile if the axis of the roller follower passes through the axis of the cam.

PART - C

Instructions: Answer the following question which carries TEN marks. 1 x 10=10

16. Analyse the following data and design the gear train having permissible stresses for pinion and drive gear materials are 130 N/mm^2 and 110 N/mm^2 respectively. The gear train has to transmit 30 kW power when the pinion rotates at 400 r.p.m. The gear ratio is 1: 4, The pinion gear has 22 teeth and face width 12 times the module. Compute *(a)* module and *(b)* face width. Assume tooth factor, y = 0.124 – (0.684/T).

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-503 :: THEORY OF MACHINES

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 2.8
Unit Test – II	From 2.9 to 5.12

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO1, CO2
2	Belt & Chain Drives	U/R	3	CO1
3	Belt & Chain Drives	U/R	3	CO1
4	Gear Drives (Gear Trains)	U/R	3	CO1
5	Gear Drives (Gear Trains)	U/R	3	CO2
Part - B (24 marks)				
6	Belt & Chain Drives	U/Ap	8	CO1
7	Belt & Chain Drives	U/Ap	8	CO1
8	Gear Drives (Gear Trains)	U/Ap	8	CO2

Unit Test - 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Definitions and Statements	R	4	CO3 – CO5
2	Flywheels & Governors	U/R	3	CO3
3	Flywheels & Governors	U/R	3	CO4
4	Cams	U/R	3	CO4
5	Mechanical Vibrations	U/R	3	CO5
Part - B (24 marks)				
6	Design of Gears & Mechanical Vibrations	U/Ap	8	CO3, CO5
7	Flywheels & Governors	U/Ap	8	CO4
8	Cams	U/Ap	8	CO4

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-503

BOARD DIPLOMA EXAMINATION,
UNIT TEST - 1
THEORY OF MACHINES

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Define Slip in belt drive

   (b) State the condition for maximum power transmission in the belt drive

   (c) Define velocity ratio of Gear train.

   (d) Define circular pitch of gear
2. The diameter of a driver pulley which rotates at 120 rpm is 400 mm. If the Linear mass density of a belt material is 1.2 kg/m find the centrifugal tension in the belt.
3. List the parts (components) of roller chain
4. The number of teeth on input and output gears of a reverted gear train is 24 and 48. The gear which is in contact with the input gear is having 30 teeth. If the velocity ratio of the train is 2 find the number of teeth on the gear in contact with the output gear.
5. A simple gear train is consisting of four gears. The number of teeth on driver and driven gears is 20 and 60 respectively. The intermediate gears are having 30 and 40 teeth. Find the ratio of speeds of driver and driven gears and their directions.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A cross belt drive transmits 8 kW of power from a shaft rotating at 240 rpm to another shaft otating at 160 rpm. The diameter of the smaller pulley is 600 mm and the two shafts are5m apart. The coefficient of friction is 0.25. If the maximum stress in the belt is limited to 3 MPa and the maximum torque is 30% more than the rated torque, find the width of the belt by taking its thickness as $1/10^{th}$ of the width.

(OR)

Two parallel shafts that are 2.5 m apart are connected by two pulleys of 1 m and 400 mm diameters, the larger pulley being the driver runs at 220 rpm. The maximum tension in the belt is not to exceed 1.8 kN. The coefficient of friction is 0.28. Owing to slip on one of the pulleys, the velocity of the driven shaft is 520 rpm only. Determine, (a) Tension in each side (b) Power transmitted

7. Design a set of stepped pulleys to drive a machine from a counter shaft running at 300 rpm. It is needed to have the following speeds of the driven shat, 140 rpm, 180 rpm and 220 rpm. The centre distance between the axes of the shafts is 3 m. The diameter of the smallest pulley is 300 mm. The two shafts rotate in the same direction.

(OR)

A flat belt is required to transmit 35 kW from a pulley of 1.5 m effective diameter running at 300 r.p.m. The angle of contact is spread over 11/24 of the circumference and the coefficient of friction between belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 9.5 mm, density of its material is 1100kg/m3 and the related permissible working stress is 2.5 MPa.

8. A lathe is run by an electric motor. The stepped pulley of the motor is connected to the cone pulley of lathe by an open flat belt. The sizes of the cone pulley steps are 100 mm, 140 mm, 180 mm and 230 mm. Calculate the speeds available with (a) direct (b) back gear, if the motor shaft runs at 300 rpm. Assume both the pulleys are identical.

(OR)

A three speed sliding gear box of a motor car is required to give speed ratios of 4:1, 3:1 and 2 :1 for the first, second and third gear respectively. Module of all the gears is 4 mm and the centre distance between mating gears is 80 mm. Find the suitable number of teeth for various gears, if the number of teeth on pinion is 18. Sketch the arrangement.

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BOARD DIPLOMA EXAMINATION,

UNIT TEST - 2

THEORY OF MACHINES

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Define isochronous governor
   (b) Define insensitivity of governor
   (c) Define pitch curve of a radial cam
   (d) Define Natural Frequency
2. Write the differences between flywheel and governor
3. Write the classification of governors
4. Define, base circle, cam profile and pressure angle related to cam
5. Write different types of damping

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A pair of spur gears with 20° full-depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an allowable tensile strength of 200 N/mm^2. The pinion rotates at 1450 rpm. Design the gear for module.

(OR)

(a) Explain the sources of vibrations in mechanical systems
(b) Write in brief about the methods of controlling vibrations in mechanical systems

7 A rimmed flywheel made of grey cast iron (ρ = 7100 kg/m^3) is required to keep down fluctuations in speed from 200 to 220 rpm. The cyclic fluctuations in energy is 30, 000 N-m. The outside diameter of the flywheel should not exceed 2 m. It can be assumed that there are six spokes and the rim contributes 90% of the required moment of inertia. The cross-section of the rim is rectangular and the ratio of width to thickness is 2. Determine the dimensions of the rim.

(OR)

Explain the working of an inertia governor with a neat sketch

8. A cam drives a knife edged reciprocating follower in the following manner :
During first 120° rotation of the cam, follower moves outwards through a distance of 40 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with uniform acceleration and retardation. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam for a radial translating knife edge follower.

(OR)

A cam with 30 mm as minimum diameter is rotating clockwise at a uniform speed of 1200 r.p.m. and has to give the following motion to a roller follower 10 mm in diameter:
(*a*) Follower to complete outward stroke of 25 mm during 120° of cam rotation with equal uniform velocity
(*b*) Follower to dwell for 60° of cam rotation;
(*c*) Follower to return to its initial position during 90° of cam rotation with uniform acceleration and retardation;
(*d*) Follower to dwell for the remaining 90° of cam rotation.
Draw the cam profile if the axis of the roller follower passes through the axis of the cam.

Course Title	Course Code	Periods/Week	Periods per Semester
Heat Power Engineering - II	M-504	04	60

TIME SCHEDULE

S. No.	Chapter/Unit Title	Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1	Properties of Steam	12	17	03	01	
2	Steam Boilers	12	14	02	01	01
3	Steam Nozzles	12	14	02	01	
4	Steam Turbines	14	11	01	01	
5	Steam Condensers	10	14	02	01	
	Total	**60**	**70+10**	**10**	**05**	**01**

Note: 10 Marks higher order question may be given from the Chapter 2 or 3 or 4.

Course Objectives and Course Outcomes

Course Objectives			Upon completion of the course the student shall be able to: Apply the principle and concepts of Heat Power Engineering to solve the contemporary real time applications
Course Outcomes	CO1	M-504.1	Determine the properties of pure substance
	CO2	M-504.2	Explain the Working of 1.Steam Boilers, 2.Steam Nozzles, 3.Steam Turbines and 4.Steam Condensers
	CO3	M-504.3	Evaluate the Performance of Boilers, Nozzles, turbines and Condensers from the basics of thermodynamics
	CO4	M-504.4	Solve numerical problems related to steam in the Mechanical Engineering devices

PO-CO Mapping

<table>
<tr><th colspan="2">Course Code: M-504</th><th colspan="3">Course Title: Heat Power Engineering- II</th><th>No. of Periods: 60</th></tr>
<tr><th rowspan="2">PO No</th><th rowspan="2">Mapped with CO Number</th><th colspan="2">CO Periods addressing PO in Col 1</th><th rowspan="2">Level (1,2,3)</th><th rowspan="2">Remarks</th></tr>
<tr><th>No</th><th>%ge</th></tr>
<tr><td>PO1</td><td>CO1 – CO4</td><td>15</td><td>25</td><td>2</td><td rowspan="7">>40% Level 3 Highly addressed
25% to 40% Level 2 Moderately Addressed
5 to 25% Level 1 Low addressed
<5% Not addressed</td></tr>
<tr><td>PO2</td><td>CO1 – CO4</td><td>30</td><td>50</td><td>3</td></tr>
<tr><td>PO3</td><td>CO4</td><td>05</td><td>08</td><td>1</td></tr>
<tr><td>PO4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO5</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>PO7</td><td>CO1 – CO4</td><td>10</td><td>17</td><td>1</td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3					1	2	3	
CO2	2	3					1	2	3	
CO3	2	3					1	2	3	
CO4	2	3	1				1	2	3	

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Blue Print of the Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Properties of Steam	12	17	03	06	08		01	02	01		CO1
2	Steam Boilers	12	14	03	03	08		01	01	01		CO2, CO3, CO4
3	Steam Nozzles	12	14	03	03	08		01	01	01		CO2, CO3, CO4
4	Steam Turbines	14	21	-	03	08	10	-	01	01	01	CO2, CO3, CO4
5	Steam Condensers	10	14	03	03	08		01	01	01		CO2, CO3, CO4
TOTAL		**60**	**80**	**12**	**18**	**40**	**10**	**04**	**06**	**05**	**01**	

R-Remember; U-Understanding; Ap-Application ; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter - 2 or 3 or 4. (Here it is taken from chapter – 4)

Learning Outcomes

Upon on completion of the course the student shall be able to:

1.0 Properties of Steam

1.1 Define the terms (a) Dryness fraction (b) Degree of super heat of steam.

1.2 Define the properties: enthalpy, internal energy and entropy of the steam.

1.3 Compute the enthalpy, internal energy and entropy at a given pressure.

1.4 Use the steam tables to calculate the enthalpy and entropy.

1.5 Compute the enthalpy and entropy values using Mollier chart.

1.6 Solve simple problems on the specific volume, enthalpy and entropy.

1.7 Compute the heat transfer, work transfer, change in internal energy, change in enthalpy and change in entropy of steam in Isochoric, Isobaric, Isothermal, Adiabatic Throttling and Polytropic processes.

1.8 Represent the above process on p-V and T-s diagrams

1.9 Calculate dryness fraction by using Steam calorimeters.

2.0 Steam Boilers

2.1 State the function of a boiler and list the uses of boilers
2.2 Describe with a legible sketch the working of Cochran Boiler and Babcock Wilcox Boiler
2.3 Distinguish between water tube and fire-tube boilers
2.4 State the need of high pressure modern boilers
2.5 Explain the working principle of Lamont and Benson Boilers with legible sketches.
2.6 Explain the function of the mountings such as pressure gauge, water level indicator, safety valve fusible plug, blow down cock and stop valve.
2.7 Illustrate the function of the accessories such as feed pump, air preheater, economiser, Super Heater, Steam traps and steam Separators.
2.8 Define and explain the terms (a) Equivalent evaporation (b) Factor of evaporation (c) Boiler Power (d) Boiler efficiency
2.9 Solve problems on Boiler Power, Boiler Efficiency, Equivalent evaporation and Factor of evaporation.
2.10 Prepare heat balance sheet for boiler performance
2.11 List various draught systems.
2.12 Explain draught systems : Natural, forced & induced with a legible sketches

3.0 Steam Nozzles

3.1 Explain the Flow of steam through nozzle
3.2 Derive an expression for Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
3.3 Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
3.4 Write the expression for 1. Discharge of steam through nozzles and 2. Critical pressure ratio.
3.5 Calculate cross-sectional area at throat and at exit for the maximum discharge
3.6 Explain the Effect of friction in nozzles.
3.7 Explain the Working of steam jet injector with a legible sketch.
3.8 Solve simple problems on flow through nozzles.

4.0 Steam Turbines

4.1 Explain the principle of working of a steam turbine.
4.2 Classify the Turbines with examples.
4.3 Differentiate an impulse turbine from a reaction turbine
4.4 Explain the Principle of working of a simple De-Laval turbine with a line diagram.
4.5 Draw velocity triangles for a simple impulse turbine
4.6 Derive formula for work done, axial thrust, energy lost, power and efficiencies.
4.7 State the necessity of compounding a turbine.
4.8 Describe the methods of reducing rotor speeds with the help of legible sketch (3 compounding methods)
4.9 Explain the working principle of Parson’s Reaction Turbine with a line diagram.
4.10 Draw Velocity triangle for Parson’s reaction turbine.
4.11 Solve simple problems on Single stage Impulse turbines (without blade friction) and reaction turbines (including data on blade height)
4.12 Define the terms bleeding & reheating.
4.13 State the necessity of governing of a steam turbine.
4.14 Explain various methods of governing systems in turbines.

5.0 Steam Condensers

- 5.1 Define a Steam condenser and State functions of steam condenser
- 5.2 Classify the condensers based on three criteria
- 5.3 Describe the working principle of 1. Low level counter Flow and 2. Parallel flow jet condensers with legible sketch
- 5.4 Explain the working principle of a High level Jet condenser with legible sketch
- 5.5 List the three Advantages and three Disadvantages of High- Level Jet condenser
- 5.6 Describe the working principle of Ejector condenser with Shell and Tube Surface condenser with legible sketch
- 5.7 Distinguish between down flow and central flow surface condenser
- 5.8 Explain the working principle of Evaporative condenser with legible sketch
- 5.9 List the three Advantages and three Disadvantages of Surface condenser
- 5.10 Distinguish between Jet Condenser and Surface Condenser
- 5.11 Write the Formulae for cooling water required, Condenser efficiency, corrected vacuum, absolute pressure and Vacuum efficiency .
- 5.12 Solve simple problems on Condenser efficiency and Vacuum efficiency

COURSE CONTENT

1.0 Properties of steam

Formation of steam under constant pressure, dryness fraction and degree of superheat, specific volume. Determination of enthalpy, internal energy, internal latent heat, entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart.

Compute the heat transfer, work transfer, change in internal energy, change in enthalpy and change in entropy of steam in Isochoric, Isobaric, Isothermal, Adiabatic Throttling and Polytropic processes.

Simple direct problems on the above using tables and charts.

Vapour processes – simple problems using tables and charts.

Steam calorimeters – Separating, throttling, Combined Separating and throttling calorimeters – problems.

2.0 Steam Boilers

Function and use of steam boilers. Classification of steam boiler with examples. Brief explanation with line sketches of Cochran and Babcock Wilcox Boilers. Comparison of water tube and fire tube boilers.

Description with line sketches of modern high pressure boilers- Lamont and Benson boilers.

Brief explanation of boiler mountings namely, pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valves (dead weight type, spring loaded type).

Brief explanation of boiler accessories such as feed pump, economiser, super heater and air pre-heater only.

Study of steam traps & separators.

Define the terms : Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency. Simple direct problems on the above.

Explain various Draught systems (Natural, forced & induced).

3.0 Steam Nozzles

Flow of steam through nozzle.

Velocity of steam at the exit of nozzle in terms of heat drop by analytical and Mollier diagram. Discharge of steam through nozzles. Critical pressure ratio.

Methods of calculation of cross – sectional areas at throat and exit for maximum discharge.

Effect of friction in nozzles .

Working of steam jet injector. Simple problems on nozzles.

4.0 Steam Turbines

Classification of steam turbines with examples. Difference between impulse & reaction turbines.

Principle of working of a simple De-Laval turbine with line diagrams. Velocity diagrams. Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency.

Methods of reducing rotor speed, compounding for velocity, for pressure or both pressure and velocity.

Working principle with line diagram of a Parson's Reaction turbine – velocity diagram. Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height.

Bleeding, re- heating and re-heating factors (Problems omitted).

Governing of steam turbines -Throttle, By-pass & Nozzle control governing.

5.0 Steam Condensers

Steam condenser, its functions, Classifications. Low level counter flow and parallel flow jet condensers, High level Jet condenser and Ejector condenser. Advantages and Disadvantages of High- Level Jet condenser.

Shell and Tube Surface condenser, Down flow, Central flow Surface Condenser and Evaporative condenser.

Advantages and Disadvantages of Surface condensers.

Write the formulae for cooling water required, Condenser efficiency, Corrected vacuum, Absolute pressure and Vacuum efficiency – Simple problems.

REFERENCE BOOKS

1. P.L.Ballaney, Thermal Engineering, 1966, Khanna Publishers
2. R.C. Patel & C.J. Karamchandani, Elements of Heat Engines –Volume II, 1963, Acharya Book Depot
3. Arora & S. Domkundwar, A course in Thermal Engineering, 2016, Dhanpat Rai
4. A.S.Sarao, Thermal Engineering, 2016, Satya Publications

C-20-M-504

BOARD DIPLOMA EXAMINATION,
D.M.E. – V SEMESTER EXAMINATION
HEAT POWER ENGINEERING -II

Time : 3 Hours Total Marks: **80**

PART – A

10 x3 = 30

Instructions: *Part A consists of **10** questions. Answer **all** questions and each question carries **three** marks.*

1. Define dryness fraction of steam and write the mathematical expression.
2. Find the mass of 2 m^3 of steam under the pressure of 40 bar and temperature 450^0C.
3. Explain the principal of throttling calorimeter.
4. Classify boilers based on any three criteria.
5. Write any three advantages of water tube boilers over fire tube boiler.
6. Write any three applications of steam nozzles.
7. Apply the steady flow energy equation to the flow of steam in the nozzle and derive the expression for exit velocity.
8. Write any three differences between impulse steam turbines and reaction steam turbines.
9. Define the term vacuum efficiency and condenser efficiency.
10. Write any three advantages of surface condensers over jet condensers.

PART – B **5 x 8 = 40**

Instructions: *Part B consists of **5** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

11. A) One kg of steam having a pressure of 8.4 bar abs and dryness fraction 0.9 is expanded in a cylinder to a pressure of 0.35 bar abs. If the expansion is hyperbolic, determine the quantity of the heat which passes through the cylinder walls into the steam.

(OR)

B) If 1 kg of steam at a pressure of 4 bar abs and a dryness fraction of 0.9 expands adiabatically in a cylinder to a pressure of a bar abs, find the work done on the piston. Then, assuming the expansion followed a law of PV^n = constant, find the value of index n. Check the former value of the work done by using this value of index n.

12. A) The observations were record in a boiler trail

Steam pressure = 12 bar abs.; Coal used = 250 kg/hr; Water evaporated =2500 kg/hr; Calorific value = 32000 kJ/kg; Dryness fraction = 0.9; Feed water temperature = 35^0 C. Calculate (a) Factor of evaporation (b) Equivalent evaporation at 100^0C (c) Boiler Efficiency

(OR)

B) The following observations were made in one hour.

Steam generation = 560 kg; Fuel burned = 60 kg; Pressure of steam = 10 bar, 0.9 dry; CV of fuel = 32000 kJ/kg; Feed water temperature = 40^0C; Boiler house temperature = 30^0C; Flue gas temperature =360^0C; Specific heat of flue gases = 8 kg/kg of fuel; Moisture in fuel = 2% by mass. Draw the heat balance sheet.

13. A) A nozzle is to be supplied with steam at 10 bar and 200^{0}C and is to discharge 180 kg/hr into a turbine wheel chamber where the pressure is 1 bar. The efficiency of the nozzle may be taken as 85%. Calculate the throat and exit diameters of the nozzle for maximum discharge.

(OR)

B) Find the mass flow rate of steam in a nozzle having inlet pressure and temperature are 12 bar and 250^{0}C, back pressure is 1 bar. The throat diameter is 15 mm.

14. A) Explain pressure compounding and velocity compounding of steam turbines with the help of pressure and velocity variation graphs.

(OR)

B) Explain bleeding and reheating in the steam turbines.

15. A) The following observations were recorded during a test on a surface condenser

Mean condenser temperature = 35^0 C; Hot well temperature = 30^{0}C; Condenser vacuum = 700 mm of Hg; Barometer reading = 760 mm of Hg; Condensate collected = 16.75 kg/ min; Cooling water = 660 kg/min; Inlet temperature of cooling water = 20^{0}C; Outlet temperature of cooling water = 34^{0}C;

Determine (i) Mass of air present per m^3 of condensate (ii) Dryness fraction of steam as it enters the condensate (iii) Vacuum efficiency

(OR)

B) A surface condenser deals with 12000 kg of steam per hour. Air leakage into the condenser is found to be 4 kg/hr. The vacuum and temperature at the air pump suction are 700 mm of Hg and 36^{0}C respectively. The barometric pressure is 760 mm of Hg. Compute the volumetric capacity in m^3/min of wet air pump.

PART – C **1 x 10 = 10**

Instructions: *Part C consists of **1** question which carries 10 marks.*

16. In a De-lavel steam turbine the blade angles are 35^0 at inlet and exit. The steam leaves the nozzle at 500 m/s and the blade speed 100 m/s. If the relative velocity of steam is reduced by 15% during its passage through the blades. Draw the inlet and outlet velocity diagrams and find (a) nozzle angles at inlet and outlet (b) the power developed per unit mass (c) the blade efficiency.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-504 :: Heat Power Engineering- II

Unit Test	**Learning Outcomes to be covered**
Unit Test – I	From 1.1 to 3.3
Unit Test – II	From 3.4 to 5.12

Unit Test - 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Properties of Steam, Steam Boilers, Steam Nozzles	R,U	4	CO1,CO2
2	Properties of Steam	U	3	CO1
3	Properties of Steam	U	3	CO1
4	Steam Boilers	U	3	CO2
5	Steam Nozzles	U	3	CO2
Part - B (24 marks)				
6	Properties of Steam	Ap	8	CO4
7	Steam Boilers	Ap	8	CO3, CO4
8	Steam Boilers	Ap	8	CO3, CO4

Unit Test - 2

Q.No	Question from the topic	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Steam Nozzles, Steam Turbines, Steam Condensers	R,U	4	CO2, CO3
2	Steam Nozzles	U	3	CO2
3	Steam Turbines	U	3	CO2
4	Steam Turbines	U	3	CO2
5	Steam Condensers	U	3	CO2
Part - B (24 marks)				
6	Steam Nozzles	Ap	8	CO3, CO4
7	Steam Turbines	Ap	8	CO3, CO4
8	Steam Condensers	Ap	8	CO3, CO4

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-504

BOARD DIPLOMA EXAMINATION,

Unit Test - 1

Heat Power Engineering - II

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Dryness fraction of saturated liquid is _________.
   (b) What is the function of blow off cock?
   (c) In the induced draught, ID fan is placed at the bottom of the chimney. (True/False)
   (d) Write the formula for exit velocity in the convergent nozzle.
2. Write the expressions for enthalpy of super heated steam, specific volume of superheated steam and entropy of super heated steam.
3. Determine the mass and enthalpy of 0.5 m^3 of wet steam with a degree of wetness equal to 10% and a pressure of 10 bar.
4. Explain the boiler mounting fusible plug with a neat sketch.
5. Steam enters a steam nozzle at a pressure of 1.8 Mpa and at a temperature of 350^0C and expands to a pressure of 0.12 Mpa with 95% dry. Calculate the exit velocity of the steam.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. One kg of steam having a pressure of 8.4 bar abs and dryness fraction 0.9 is expanded in a cylinder to a pressure of 0.35 bar abs. If the expansion is hyperbolic, determine the quantity of heat which passes through the cylinder walls into the steam.

   (OR)

   2 kg of steam initially at a pressure of 12 bar and a temperature of 250^0C expands polytropically to 1.2 bar. Find (a) the final condition (b) work done (c) heat transfer (d) change in entropy
7. Explain the Cochran boiler with a neat sketch.

   (OR)

   Explain the La Mont boiler with a neat sketch.
8. During a test on a boiler the following data were collected. Steam pressure : 9.487 bar gauge, steam condition : dry and saturated, feed water temperature : 35^0C, Rate of evaporation : 12 kg / kg of coal and calorific value : 37500 kJ/kg. Determine (a) Thermal efficiency (b) Factor of Evaporation (c) Equivalent Evaporation.

   (OR)

   The following data were obtained during a trial on a steam boiler, coal fired with natural draught: Trial time - 90 minutes; Mass of feed water supplied - 6750 kg; Steam pressure – 10 bar; Temperature of feed water – 70^0C; Quality of steam – 0.95; Coal burnt – 600 kg; Moisture of fuel - 4.25% by mass; Higher calorific value of fuel – 39480 kJ/kg; Temperature of flue gases – 280^0C; Boiler room temperature – 30^0C; Composition of coal – C-89%, H_2-3%, N_2-4%, Ash-4%; Heat in vapour – 3000 kJ/kg. Draw up the heat balance sheet.

C20-M-504

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

Heat Power Engineering - II

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Critical pressure ratio of convergent divergent nozzle when the steam is superheated at the entrance is _________.
   (b) The degree of reaction for the Parson's reaction turbine is 0.5. (True/False)
   (c) The value of the reheat factor is of the order of
   (A) 0.9 to 1.0 (B) 1.02 to 1.05 (C) 1.1 to 1.5 (D) 1.5 to 2.5
   (d)
2. Steam st 15 bar and 300^0C expands in a nozzle to a pressure of 1 bar. If the efficiency of the nozzle is 88%, calculate the mass of steam discharged when the exit area is 180 mm^2.
3. Write any three differences between impulse and reaction turbines.
4. Explain the reheating in the steam turbines with a line diagram.
5. List out the elements of the steam condensing plant.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Wet steam at 15 bar and dryness fraction of 0.97 is discharged through a convergent-divergent nozzle to a back pressure of 0.2 bar. If the mass flow rate is 0.55 kg/s, determine the throat and exit diameters. Assume friction factor 0.88 in the divergent portion of the nozzle.

   (OR)

   Wet steam passes through a convergent-divergent nozzle from a pressure of 9 bar and dryness fraction 0.9 to a pressure of 2 bar abs. Find for the maximum discharge, the ratio of cross sectional area at throat to that of the outlet of the nozzle. Assume 10% loss of total heat drop in the divergent portion of the nozzle.
7. Explain the velocity compounding of impulse turbines with a line diagram write two advantages of velocity compounding.

   (OR)

   The angles at inlet and discharge of the blading of reaction turbine are 35^0 and 20^0 respectively at the mean blade ring diameter. The speed of rotation is 25 rps and at a particular moving ring the mean blade ring diameter os 0.6 m and the steam condition is 1.4 bar and 0.96 dry. Estimate (a) The required height of the blade to pass 3.26 ks/s of steam and (b) Power developed by the ring

8. Explain the low level contra flow jet condenser with a neat sketch.

   (OR)

   The following observations were recorded during a test on a surface condenser. Mean condenser temperature – 35^0C; Hot well temperature – 30^0C; Condenser vacuum – 700 mm of Hg; Barometric reading – 765 mm of Hg; Condensate collected – 15.5 kg/hr; Cooling water – 36800 kg/hr; Rise of cooling water temperature – 12.5^0C. Calculate (a) dryness fraction of steam entering (b) mass of air present / m^3 of condenser and (c) vacuum efficiency.

Course Title	Course Code	Periods/Week	Periods per Semester
Refrigeration & Air Conditioning	**M-505**	**05**	**75**

TIME SCHEDULE

SNo.	Chapter/Unit Title	No. of Periods	Weightage of Marks	Short Answer Questions (3M)	Essay Type Questions (8M)	Higher Order Question (10M)
1.	Fundamentals of Refrigeration	10	14	02	01	
2.	Vapour compression & Vapour absorption Refrigeration Systems	18	14	02	01	*
3.	Refrigeration equipment & Applications of Refrigeration.	16	14	02	01	*
4.	**Air Conditioning & Psychrometry**	15	14	02	01	
5.	**Air Conditioning Equipment** & Applications of Air Conditioning.	16	14	02	01	*
Total		**75**	**70+10**	**10**	**05**	**01**

Note: * 10 Marks higher order question may be given from the Chapter-2 or 3 or 5.

Course Objectives and Course Outcomes

Course Objectives			*Upon completion of the course the student shall be able to:* Apply the principles and concepts of thermodynamics and Psychrometry to design the Refrigeration and Air Conditioning Systems
Course Outcomes	CO1	M-505.1	Analyse air refrigeration cycles, Vapour Compression and Vapour Absorption Refrigeration cycles.
	CO2	M-505.2	Explain the use of Refrigerants and their effect on environment
	CO3	M-505.3	Describe the Working of Refrigeration and Air Conditioning equipment.
	CO4	M-505.4	Explain the various psychometric properties and Processes
	CO5	M-505.5	Explain the applications of Refrigeration and Air Conditioning systems.

PO-CO Mapping

Course Code: M-505		Course Title: Refrigeration and Air Conditioning No of Cos: 05			No. of Periods: 75
PO No	Mapped with CO number	CO Periods addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%ge		
PO1	CO1 – CO5	40	53.33	3	>40% Level 3 Highly addressed 25% to 40% Level 2 Moderately Addressed 5 to 25% Level 1 Low addressed <5% Not addressed
PO2					
PO3	CO1, CO3	20	26.67	2	
PO4	CO3, CO5	8	10.67	1	
PO5	CO2	7	09.33	1	
PO6					
PO7					

CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3		2					2	2	
CO2	3				1			2	2	
CO3	3		2	1				2	2	1
CO4	3							2	2	
CO5	3			1				2	2	1

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:
(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Suggestive activities for further strengthening of CO-PO mapping:

1. Seminar with an industrial expert may be arranged on emerging refrigerants, ozone depletion potential and global warming potential of refrigerants.

Blue Print of a Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	U	Ap	An	R	U	Ap	An	
1	Fundamentals of Refrigeration	10	14	03	03	08		01	01	01		CO1
2	Vapour Compression & Vapour Absorption Refrigeration Systems	18	24	03	03	08	10	01	01	01	01	CO1
3	Refrigeration equipment & Applications of Refrigeration.	16	14	03	03	08		01	01	01		CO2,CO3, CO5
4	Air Conditioning & Psychrometry	15	14	03	03	08		01	01	01		CO3
5	Air Conditioning Equipment & Applications of Air Conditioning.	16	14	03	03	08		01	01	01		CO4,CO5
TOTAL		**75**	**80**	**15**	**15**	**40**	**10**	**05**	**56**	**05**	**01**	

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Note: 10 Marks higher order question may be given from the Chapter -2 or 3 or 5 (Here it is taken from chapter- 2)

Learning Outcomes

Upon on completion of the course the student shall be able to:

1.0 Fundamentals of Refrigeration

1.1 Define the term 'Refrigeration'.

1.2 Explain different methods of refrigeration such as ice refrigeration, dry-ice refrigeration, steam jet refrigeration, liquid gas refrigeration. Define the term 'Ton of Refrigeration'. Give the value in S.I units.

1.3 Define the term 'Coefficient of Performance'.

1.4 Estimate the power required per ton of refrigeration.

1.5 Explain the principle of open air refrigeration.

1.6 Explain the Carnot refrigeration cycle by plotting it on p-V and T-s diagrams.

1.7 Explain the Bell-Coleman air refrigeration cycle plotting it on p-V and T-s diagrams.

1.8 Calculate the COP of Carnot refrigeration cycle

1.9 Calculate the COP of Bell-Coleman air refrigeration cycle

1.10 Explain the principle of Open air refrigeration system.

1.11 Explain the principle of closed air refrigeration system.

1.12 Distinguish between open refrigeration system and closed air refrigeration system.

2.0 Vapour Compression and Vapour Absorption Refrigeration Systems.

2.1 Describe the Main components of a vapour compression refrigeration system with flash chamber and accumulator.
2.2 Explain vapour compression refrigeration system with the help of T-s and p-H diagrams.
2.3 Distinguish between wet and dry compression.
2.4 Explain the effects of under cooling and super heating on COP in vapour compression refrigeration system.
2.5 Explain the effects of pressure changes on COP in vapour compression refrigeration system.
2.6 Calculate COP of vapour compression refrigeration Cycle – simple problems .
2.7 Explain the principle of simple vapour absorption refrigeration system.
2.8 List the refrigerant – Absorber pairs in the vapour absorption refrigeration system. Write the desirable properties of refrigerant and absorbent pairs.
2.9 Describe the working principle of a vapour absorption refrigeration system with the help of a legible sketch. Calculate "COP" of the ideal vapour absorption refrigeration system.
2.10 Differentiate between the two fluid and the three fluid absorption systems.
2.11 Describe the working of Electrolux refrigerator with the help of a legible sketch.
2.12 Describe the working of a solar powered vapour absorption refrigeration system with the help of a legible sketch.
2.13 Distinguish between primary and secondary refrigerants.
2.14 List the properties of the refrigerants and commonly used refrigerants.

3.0 Refrigeration Equipment & Applications of Refrigeration.
3.1 Explain different types of compressors such as reciprocating and rotary compressors.
3.2 State the function of a condenser and classify the condensers.
3.3 Describe the different types of condensers such as shell & tube, shell and coil type with the help of legible sketches.
3.4 State the function of evaporator and classify the evaporators.
3.5 Explain the working of shell & tube, shell and coil, flooded type evaporators with the help of legible sketches.
3.6 State the function of expansion devices and classify expansion devices.
3.7 Explain the working of expansion devices such as capillary tube, thermostatic expansion valves and solenoid valves with the help of a legible sketch.
3.8 Explain the refill type and throw away type dryers.
3.9 Describe the working of a domestic refrigerator with the help of a legible sketch.
3.10 Describe the working of an ice plant with the help of a legible sketch.
3.11 Describe the working of a water cooler with the help of a legible sketch.
3.12 Describe the working of a cold storage with the help of a legible sketch.

4.0 Air Conditioning & Psychrometry
4.1 Define air conditioning.
4.2 List modern applications of air conditioning.
4.3 Explain Air conditioning as applied to human comfort.
4.4 Define Psychrometry- Define the terms :humidity, Relative humidity, dew point, DBT & WBT, Absolute humidity, humidity ratio relative to Psychrometry – Simple problems .
4.5 Explain the features of Psychrometric chart.
4.6 List and explain various Psychrometric processes with the help of Psychrometric chart.

5.0 Air Conditioning Equipment & Applications of Air conditioning

5.1 Describe various air conditioning equipment like fans, ducts, filters (wet, dry, electric & viscous types), centrifugal dust collector with the help of legible sketches.
5.2 Explain the use of heating and cooling coils.
5.3 Explain various air distribution systems.
5.4 Describe the working of an air cooler with a neat sketch.
5.5 Describe the working of a window air – conditioner with a neat sketch.
5.6 Purpose of cooling towers – Classification;
5.7 Explain the working of Natural draft cooling tower with a neat sketch.
5.8 Explain the working of induced draft and forced draft cooling towers with neat sketches.
5.9 Explain the working of centralised air conditioning system.
5.10 Illustrate the working of summer air conditioning system.
5.11 Illustrate the working of winter air conditioning system.
5.12 Illustrate the working of year round air conditioning system.

COURSE CONTENT

1.0 Fundamentals of Refrigeration

Introduction – Definition and meaning of refrigeration, methods of refrigeration – unit of refrigeration – Refrigeration effect – Coefficient of Performance.

Thermodynamic analysis of Carnot refrigeration cycle – Air refrigeration cycle (Bell – Coleman) - Simple Numerical Problems.

Open air and closed air systems of refrigeration.

2.0 Vapour Compression & Vapour Absorption Refrigeration Systems.

Working and analysis of vapour compression refrigeration system with the help of T-s & p-H diagrams – wet, dry and superheated compression – Refrigerating effect – Simple problems.

Effect of pressure changes on C.O.P- Effect of sub – cooling of COP and capacity – Effect of super heating of vapour before compression –

Refrigerants - Primary and secondary refrigerants with examples – Requirements of a refrigerant – properties of refrigerants – Commonly used refrigerants.

Principle of vapour absorption refrigeration cycle - C.O.P of vapour absorption system – Simple Problems.

Properties Refrigerant and absorbent pairs properties – two fluid & three fluid systems – Electrolux refrigerator - Solar powered refrigeration system – comparison of vapour absorption and vapour compression systems.

3.0 Refrigeration Equipment and Applications of Refrigeration.

Equipment used in Refrigeration systems;

Compressors – types of compressors – Working of Hermetically sealed compressor with sketches – Working of vane type rotary compressor with a neat sketch.

Condensers – types of condensers – Working of Air cooled, Water cooled and Evaporative type condensers with sketches.

Evaporators – types of evaporators – Working principle of shell and tube, flooded type evaporators with sketches.

Expansion devices – types of expansion devices – Working of capillary tube, thermostatic expansion devices with neat sketches.

Refill type and throw away type driers.

Applications of Refrigeration: Working of Domestic refrigerator, ice plant, Water cooler and cold storage plant with neat sketches.

AIR CONDITIONING

4.0 Air Conditioning & Psychrometry

Definition of air conditioning – Applications- Classification - Human comfort – Factors effecting human comfort - effective temperature – Factors governing effective temperature conditions that affect body heat – comfort chart.

Psychrometry – Definitions of Psychrometric terms– dry air, wet air, moist air, saturate air, Partial pressure, humidity, Relative humidity, dew point, DBT & WBT, Absolute humidity, humidity ratio, Degree of saturation, sensible heat, latent heat and total heat of moist air.

Explanation of Sling Psychrometer and Aspirating Psychrometer;

Psychrometric chart - List and explanation of various psychrometric processes with the help of Psychrometric chart – Sensible heat factor -mixing of air streams.

Cooling load: definition – List the components involved in computation of cooling load.

Heating load: definition – List the components involved in computation of heating load.

Solving simple problems using psychrometric chart and mathematical formulas.

5.0 Air Conditioning Equipment & Applications of air conditioning

Air Conditioning equipment such as fans, supply ducts, outlets, return outlets and ducts-Grills –dampers – registers -humidifiers – dehumidifiers-

Filters & dust collectors – wet, dry, electrostatic and viscous types- Heating and cooling coils

Air distribution: Radial perimeter, loop perimeter and extended plenum systems – Simple Ejector system -Downward air distribution system – Upward air distribution system.

Applications of Air conditioning: Illustrate working of Air coolers –Split type window air conditioner

Working of Cooling Towers:- Natural , induced draft and forced draft cooling towers.

A/C systems: Working of Summer, winter, year round air conditioning systems - Central A/C system – unitary system.

REFERENCE BOOKS

1. Arora C P, Refrigeration and Air Conditioning, 2009, MGH Publishers
2. P N Ananthanarayana, Basic Refrigeration and Air conditioning, 2013, MGH Publishers
3. John Tomczyk, Troubleshooting and Servicing Modern Air Conditioning and Refrigeration Systems, 1995, Esco Press

BOARD DIPLOMA EXAMINATION, (C – 20)
MODEL QUESTION PAPER
DME – FIFTH SEMESTER EXAMINATION

REFRIGERATION & AIR CONDITIONING (M-505)

Time: **3** hours] [Total Marks: **80**

PART – A **3 x 10 = 30**

Instructions: (1) Answer **all** questions.
(2) Each question carries **Three** marks.

1. Define Refrigeration. Mention three methods of refrigeration.
2. Draw the line diagram of Air refrigeration system and label the parts.
3. What are the advantages and disadvantages of vapour compression refrigeration system?
4. State any six desirable thermodynamic properties of refrigerants.
5. What is a hermitic Compressor? State its applications.
6. State the function of capillary tube. What are its advantages and limitations?
7. State the modern applications of air conditioning.
8. Why the filter used in air conditioning system? List different types of filters.
9. Define the following terms
   (i) Dry bulb temperature
   (ii) Specific Humidity
10. What is the cooling tower? State the need of a cooling tower.

PART – B **5 x 8 = 40**

Instructions: (1) Answer all **Five** questions either A or B from each question.
(2) Each question carries **Eight** marks.

11. (A) Explain any two methods of refrigeration systems with neat diagrams.

(OR)

(B) In an open type air refrigeration system 550 kg of air is circulated per hour. The air is drawn from the cold chamber at 3^0C at 1bar and compressed to 5bar. It is then cooled to 20^0C at the same pressure. Air is then led to expander, where it is expanded isentropically down to 1bar and is discharged to cold chamber. Find
   (i) Heat extracted from the cold chamber
   (ii) Heat rejected to cooling water / hour
   (iii) COP of the system

12. (A) An ammonia refrigerator produces 30 tonnes of ice from and at 0^0C per day. The cycle works between the temperature limits of 25^0C and -150C. The vapour is dry saturated at the end of compression. Find (i)COP and (ii) Power required to run the compressor. The properties of refrigerant are shown in table. Latent heat of ice is 335KJ/Kg.

Temperature, ^0C	Enthalpy, KJ/Kg		Entropy, KJ/KgK	
	Liquid, h_f	Vapour, h_g	Liquid, S_f	Vapour, S_g
-15^0C	-54.7	1310	-0.2142	5.07784
25^0C	100.4	1324	0.3486	4.5024

(OR)

(B) Explain the working of an Electrolux refrigerator with a neat sketch.

13. (A) Explain the working of flooded type evaporator with a sketch.

(OR)

(B) Explain the working of a ice plant with the help of a sketch.

14. (A) Explain various psychrometric processes with the help of Psychrometric chart.

(OR)

(B) Explain different types of Dust Collectors used in air conditioning systems.

15. (A) Explain the working of Air cooler with a sketch.

(OR)

(B) Explain working of Window air conditioner with the help of a sketch.

PART – C **10*1 = 10**

Instructions: (1) Answer **the** question.
(2) Question carries **Ten** marks.

16. Analyse the result from the following data: A simple vapour compression plant produces 5 tons of refrigeration. The enthalpy values at the inlet to compressor, at the exit of compressor and at exit from the condenser are 183.2KJ/Kg, 209.4KJ/Kg and 74.6KJ.Kg respectively. Calculate:
(i) The refrigerant flow rate
(ii)The COP
(iii)The power required to drive the compressor

.

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II

M-505 :: REFRIGERATION AND AIRCONDITIONING

Unit Test	**Learning Outcomes to be covered**
Unit Test – I	From 1.1 to 3.5
Unit Test – II	From 3.6 to 5.12

Unit Test – 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Fundamentals of Refrigeration, Vapour compression & Vapour absorption Refrigeration Systems, Refrigeration equipment	R,U	4	CO1,CO2, CO3
2	Fundamentals of Refrigeration	U	3	CO1
3	Vapour compression & Vapour absorption Refrigeration Systems	U	3	CO1
4	Vapour Compression & Vapour absorption Refrigeration Systems	U	3	CO1
5	Refrigeration equipment & Applications of Refrigeration	U	3	CO3, CO4, CO5
Part - B (24 marks)				
6	Fundamentals of Refrigeration	Ap	8	CO1
7	Vapour compression & Vapour absorption Refrigeration Systems	Ap	8	CO1
8	Refrigeration equipment & Applications of Refrigeration	Ap	8	CO2, CO3

Unit Test – 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Refrigeration equipment & Applications of Refrigeration. Air Conditioning and Psychrometry , Air Conditioning Equipment & Applications of Air Conditioning	R,U	4	CO3, CO4, CO5
2	Refrigeration equipment & Applications of Refrigeration.	U	3	CO3, CO5
3	Air Conditioning and Psychrometry	U	3	CO3
4	Air Conditioning Equipment & Applications of Air Conditioning	U	3	CO4, CO5
5	Air Conditioning Equipment & Applications of Air Conditioning	U	3	CO4, CO5
Part - B (24 marks)				
6	Refrigeration equipment & Applications of Refrigeration Refrigeration equipment & Applications	Ap	8	CO3, CO5
7	Air Conditioning and Psychrometry	Ap	8	CO3
8	Air Conditioning Equipment & Applications of Air Conditioning	Ap	8	CO4, CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

C20-M-505

BOARD DIPLOMA EXAMINATION,
Unit Test - 1
REFRIGERATION AND AIRCONDITIONING

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1^{st} Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) One ton of refrigeration is _______kJ/s.
   (b) If the condenser pressure increases the power consumption of compressor increases. (True/False)
   (c) What are the three fluids used in the vapour absorption refrigeration system?
   (d) Write the chemical name of R-22.
2. List out the refrigeration methods.
3. Why the wet compression is not desirable in the vapour compression refrigeration system?
4. An absorption type of refrigeration system heating, cooling and refrigeration takes place at the temperature of 100 ^{0}C, 20 ^{0}C and -10^{0}C. Find the theoretical COP of the system.
5. Write any three requirements of the refrigerants.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. A cold storage is supplied with 4000 kg of fish at 22^{0}C. The fish has to be cooled to -10^{0}C. Freezing point of the fish is -2^{0}C. If the capacity of the plant is 10 tons, how long will it take to cool the fish? Specific heats of the fish above and below the freezing point are 3 kJ/kg K and 1.25 kJ/kg K respectively. Latent heat of freezing = 220 kJ/kg.

   (OR)

   A 5 ton refrigerating machine operating on Bell-Coleman cycle has pressure limits of 10 bar and 1 bar. The temperature of air before compression and is 10^{0}C. The compressed air is cooled to 40^{0}C before it enters an expander. Assuming both compression and expansion are adiabatic with γ = 1.4. Determine (a) COP (b) Mass of air circulated per min. (c) Power Rating of the motor assuming 90% mechanical efficiency.
7. A simple vapour compression refrigeration plant produces 5 tons of refrigeration. The enthalpy values at inlet to compressor, at exit of compressor and at exit from the condenser are 183.19, 209.41 and 74.59 kJ/kg respectively. Estimate (i) The refrigeration flow rate (ii) The COP (iii) The power required to drive the compressor (iv) The rate of heat rejection to the condenser.

   (OR)

   Explain the actual vapour absorption refrigeration system with neat sketch.

8. Explain the working of hermitically sealed compressor with a neat sketch.

   (OR)

   Explain the working of air cooled condenser with a neat sketch.

C20-M-505

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

REFRIGEREATION AND AIRCONDITIONING

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Give two examples of desiccant material used in the drier.

   (b) Effective temperature for human comfort in the summer is 19^0C. (True/False)

   (c) the ratio of actual mass of moisture in a given volume of air to the mass of moisture when the same volume is saturated at the same temperature is known as

   (a) Relative humidity (b) Humidity ratio (c) Degree of saturation (d) none of the above

   (d) Constant dew point temperature lines are _______ lines in the psychrometric chart.
2. Write any three advantages of dry ice as refrigerant.
3. Classify the air conditioning systems based on any three criteria.
4. The air supplied to a room of a building in winter is to be at 17^0C and have a percentage of relative humidity of 60%. If the barometric pressure is 1.01326 bar, calculate the specific humidity.
5. Write any three advantages of unitary air conditioning systems.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Explain the working of thermostatic expansion valve with a neat sketch.

   (OR)

   Explain the working of cold storage plant with a neat sketch.
7. Write the requirements of air distribution and list out the duct systems in the air conditioning.

   (OR)

   Explain the dry filter used in the air conditioning system with a neat sketch.
8. A steam of outdoor air is mixed with a steam of return air in an air conditioning system that operates at 101 kPa pressure. The flow rate of outdoor air is 2 kg/s and its condition is 35^0C dry bulb temperature. The flow rate of return air is 3 kg/s, and its condition is 24 ^{0}C and 50% relative humidity. Determine (a) the enthalpy of the mixture (b) the humidity ratio of the mixture (c) the dry bulb temperature of the mixture.

   (OR)

   Explain the summer air conditioning system for a hot and dry conditions with a neat sketch.

Course Title	Course Code	Periods per week	Period per semester
Computer Aided Manufacturing Systems	M-506	04	60

TIME SCHEDULE

<table>
<tr><th>S. No.</th><th>Chapter/Unit Titles</th><th>Periods</th><th>Weightage of Marks</th><th>Short Answer Questions (3M)</th><th>Essay Type Questions (8M)</th><th>Essay Type Question (10M)</th></tr>
<tr><td>1</td><td>Introduction to Computer aided manufacturing</td><td>07</td><td>06</td><td>02</td><td></td><td></td></tr>
<tr><td>2</td><td>NC, CNC and DNC Systems</td><td>13</td><td>14</td><td>02</td><td>01</td><td rowspan="2">01</td></tr>
<tr><td>3</td><td>CNC programming</td><td>14</td><td>18</td><td>00</td><td>01</td></tr>
<tr><td>4</td><td>Material handling systems of CAM</td><td>10</td><td>17</td><td>03</td><td>01</td><td></td></tr>
<tr><td>5</td><td>Flexible manufacturing systems and Rapid Prototyping</td><td>16</td><td>25</td><td>03</td><td>02</td><td></td></tr>
<tr><td></td><td>Total</td><td>60</td><td>70+10</td><td>10</td><td>05</td><td>01</td></tr>
</table>

Note: Higher order question may be given from Chapter 2 or 3.

Course Outcomes and Course Objectives

<table>
<tr><td colspan="4">Upon completion of the course the student shall be able to</td></tr>
<tr><td rowspan="2">COURSE OBJECTIVES</td><td colspan="2">01</td><td>Describe computer aided manufacturing systems, develop CNC part programming</td></tr>
<tr><td colspan="2">02</td><td>Explain the material handling systems, flexible manufacturing system and computer integrated manufacturing systems.</td></tr>
<tr><td rowspan="5">COURSE OUTCOMES</td><td>CO1</td><td>M-506.1</td><td>Explain computer aided manufacturing, integrated CAD/CAM system, group technology, advantages and limitations of group technology.</td></tr>
<tr><td>C02</td><td>M-506.2</td><td>Describe manufacturing methodology of numerical control, CNC and DNC systems, advantages and applications</td></tr>
<tr><td>C03</td><td>M-506.3</td><td>Write CNC part programming by using G codes and M codes and APT language</td></tr>
<tr><td>C04</td><td>M-506.4</td><td>Explain material handling systems AGV and robots in CAM</td></tr>
<tr><td>C05</td><td>M-506.5</td><td>Explain the importance and functions of FMS, CIMS, Rapid Prototyping and Reverse Engineering</td></tr>
</table>

PO-CO Mapping

Course Code: M-505	Course Title: COMPUTER AIDED MANUFACTURING SYSTEMS No of COs:5				No. of periods: 60
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1,	6	10	1	**>40% Level 3 (Highly Addressed)** **25% to 40% Level 2 (Moderately Addressed)** **5% to 25% Level 1 (Low Addressed)** **<5% Not Addressed**
PO2	CO2	10	16.7	1	
PO3	CO3	6	10	1	
PO4	CO4,CO5	25	41.6	3	
PO5					
PO6	CO5	8	13.3	1	
PO7	CO3	5	8.3	1	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1							3	1	2
CO2		1						3	1	2
CO3			1				1	3	1	2
CO4				3				3	1	2
CO5				3		1		3	1	2

3: High, 2: Moderate,1: Low

Blue Print of the Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Marks Wise Distribution of Weightage				Question Wise Distribution of Weightage				CO's Mapped
				R	**U**	**Ap**	**An**	**R**	**U**	**Ap**	**An**	
1	Introduction to Computer aided manufacturing	07	09	03	03			1	1			CO1, CO3, CO5
2	NC, CNC and DNC Systems	13	14	03	03	8		1	1	1		CO3, CO4
3	CNC programming	14	18		03	08	10		1	1	1	CO1, CO2, CO5
4	Material handling systems of CAM	10	14	03	03	08		1	1	1		CO1, CO2, CO5
5	Flexible Manufacturing Systems and Rapid prototyping	16	25	03	06	16		1	2	2		CO3, CO5
TOTAL		**60**	**80**	**12**	**18**	**40**	**10**	**04**	**06**	**05**	**01**	

R-Remember; U-Understanding; Ap-Application ; An- Analylising

Note: Higher order question may be given from Chapers 2 or 3.(here it is taken from chapter – 3)

Learning Outcomes:

Upon completion of the course student shall be able to

1.0. Introduction to Computer aided manufacturing (CAM)

1.1. Explain the necessity of computer monitoring and control of manufacturing process
1.2. Define various computer aided manufacturing support functions viz.CAD, CADD, CAE, CAPP, CATD etc.
1.3. List six benefits of computer aided manufacture (CAM)
1.4. Explain the product cycle of a traditional manufacturing system and CAM system
1.5. Describe an integrated CAD/CAM,FMS and Computer Integrated Manufacturing Systems
1.6. State the concept, three advantages and three limitations of group technology

2.0. Numerical Control

2.1. Define1.Numerical control (NC) 2.Computer Numerical control (CNC) 3. Direct numerical control (DNC)
2.2. List the advantages, limitations and applications of NC manufacturing system in comparison to tradition manufacturing system
2.3. Explain the functions of three NC machine tool principal elements
2.4. Explain with a block diagram the manufacturing methodology of an NC system
2.5. Explain with illustrations the PTP, 1-axis, 2-axis, 3-axis numerical control modes
2.6. Illustrate a CNC machine tool and explain the functions of its principal elements
2.7. State the principal differences between NC and CNC systems
2.8. State three advantages of CNC systems over NC systems
2.9. Explain DNC system with a neat sketch
2.10. List three advantages and three applications of DNC
2.11. Compare NC, CNC and DNC systems
2.12. Explain the features and working of CNC-CMM

3.0. CNC Programming

3.1. Explain with a block diagram the various steps involved in developing a part program
3.2. Define manual part programming
3.3. Explain the syntax of each word in a block of a CNC program code in word address format as per ISO
3.4. Differentiate Geometry (G) from Miscellaneous (M) codes
3.5. Explain with syntax five popular G & M codes
3.6. Write a CNC program for a simple turning job in G & M codes
3.7. State the necessity of tool length and nose radius compensation in CNC programming
3.8. Define Computer aided part programming (CAPP)
3.9. State the advantages of CAPP over manual programming
3.10. Importance of APT among all popular CAPP languages
3.11. Illustrate with a block diagram the configuration of CAPP with APT
3.12. Explain the syntax of popular 1.Geometry statements, 2.Motion statements,3.post processor statements,4.compiler statements of APT language
3.13 Write a program in APT language for a simple drilling job from a given drawing
3.14. Name the commercially available GUI based CAPP languages and state their advantages over APT

4.0 **Material handling systems in CAM**

4.1. State the requirements of material handling systems in CAM
4.2. Differentiate between Primary and Secondary material handling systems
4.3. Define an automated guided vehicle (AGV)
4.4. Explain four types of AGVs with illustrations
4.5. State the applications of above AGVs
4.6. Define a Robot
4.7. State the necessity of Robots in manufacturing environment
4.8. Explain various types of Robots with illustrations
4.9. Describe the functions of the Principal components of a Robot

5.0 **Flexible manufacturing systems, CIMS & Rapid Prototyping**

5.1. State the necessity of FMS
5.2. Explain the meanings of Machine flexibility, Production flexibility, Mix flexibility, Product flexibility, Routing flexibility, Volume flexibility, Expansion flexibility
5.3. Describe the layout of a typical FMS showing the principal components
5.4. Explain the functions of principal components of an FMS
5.5. State the features, advantages and applications of FMS
5.6. Illustrate design functions module, manufacturing functions module and Business functions module of a manufacturing system
5.7. State the necessity of integrating the various modules of a manufacturing system
5.8. Define CIMS
5.9. Describe CIMS showing the principal components
5.10. State the benefits of CIM
5.11 Define Rapid Prototyping
5.12. State any six the advantages of Rapid Prototyping
5.13. Classify Rapid Prototyping based on initial form of its material
5.14. Explain RP Techniques: Stereo Lithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modelling (FDM), Three Dimensional Printing (3DP) and Laminated Object Manufacturing (LOM) with a legible sketch.
5.15 Define Reverse Engineering
5.16 State any six reasons for Reverse Engineering a product or part.
5.17 Explain the process of Reverse Engineering with a flow diagram.

CONTENTS:

1.0 Introduction to Computer aided manufacturing (CAM)

Role of computers in manufacturing–Computer aided monitoring and control –computer aided manufacturing support functions viz. CAD, CADD,CAE, CAPP– Benefits of CAM - Product cycle in traditional and computerized manufacturing environments – linkage of various manufacturing functions through computerized database– Integrated CAD/CAM - Types of production systems –Transfer line production – Flexible manufacturing system – Standalone CNC system – features and applications of each type - Group Technology – advantages and limitations

2.0 Introduction to NC, CNC and DNC systems.

Introduction to NC - advantages over conventional manufacturing system – Limitations – applications , Working principle of NC machine tool- elements of NC machine tool ,Manufacturing methodology of NC systems – Part drawing – Part program – Program tape – Tape reader – Controller – Machine tool, Numerical control modes – Point to point control – One axis control – Simultaneous two axes control – Simultaneous three axes control

CNC and DNC systems - Working principle of CNC machine tool – major differences over NC systems – advantages over NC system, Direct Numerical control – concept – features – advantages –applications, Comparative treatment of NC, CNC, and DNC systems, CNC Co-ordinates measuring machine (CNC-CMM) – Principle of working – Principal components – features – advantages – applications

3.0. CNC programming

Steps involved in development of part program – Process planning –Axes nomenclature for CNC turning and machining centres – Tool selection – Cutting process parameters selection – Job and tool setup planning – Machine tool path planning – Part program writing – Part program verification, Manual part programming (as per ISO) – Word address format –meaning of each word – List of preparatory functions – List of miscellaneous functions , Tool length compensation – Nose radius compensation – Cutter radius compensation, Computer aided part programming (CAP) – advantages over manual part programming, List of Geometry, Motion, Post processor and Compiler commands used in APT, Sample programs for simple turning jobs in G & M codes, Sample programs in APT for simple Drilling jobs, Overview of commercially available GUI based CAP programming languages – advantages over APT language

4. Material handling systems in CAM

Material handling systems – functions in CAM environment – Primary and secondary systems – automated guided vehicle systems (AGVS), AGV types – Towing vehicles – Unit load vehicles – Pallet trucks – Fork trucks – Light load vehicles – Assembly line vehicles – their applications, Robots – areas of application – types of robots, Layout of an industrial robot – functions of each component

5. Flexible manufacturing systems (FMS) and Rapid Prototyping

Flexible manufacturing systems (FMS) :Different types of flexibilities – Machine flexibility – Production flexibility – Mix flexibility – Product flexibility – Routing flexibility – Volume flexibility – Expansion flexibility, Layout of a typical FMS showing principal components, Components of FMS – CNC machine centres –Features of FMS – advantages – applications

Computer Integrated Manufacturing Systems (CIMS)- Components of a manufacturing system – Design functions module – Manufacturing functions module – Business functions module – Necessity of Integration , Concept of CIM– Benefits of CIM

Rapid Prototyping –Definition, advantages and applications; Working Principle, Work flow of RP process; RP Techniques: Stereo Lithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modelling (FDM), Three Dimensional Printing (3DP) and Laminated Object Manufacturing (LOM); Reverse Engineering

REFERENCE BOOKS

1	Numerical Control and Computer Aided Manufacturing	T.K.Kundra,P.N.Rao	TMH
2	Computer Aided Manufacturing	T. K. Kundra, P.N. Rao	MGH Publishers
3	CAD/CAM	Groover and Zimmers	Pearson Education India
4	Rapid Prototyping	Chua C.K, Leong K.F ,Lim C.S	World Scientific Publishing Co.Pte.Ltd

C20-M-506

BOARD DIPLOMA EXAMINATION
MODEL QUESTION PAPER
DME - FIFTH SEMESTER EXAMINATION
COMPUTER AIDED MANUFACTURING SYSTEMS

Time: **3** hours] [Total Marks: **80**

PART – A **3 X 10 = 30**

Instructions: (1) Answer **all** questions.
(2) Each question carries **Three** marks.

1. List any six benefits of computer aided manufacture (CAM).
2. State any three limitations of FMS.
3. Define group technology.
4. State three advantages of CNC systems over NC systems
5. List any three applications of DNC
6. Differentiate between Primary and Secondary material handling systems
7. List any six applications of industrial Robots
8. Name various flexibilities defined under FMS.
9. State any six reasons for Reverse Engineering a product or part.
10. State any six benefits of CIM.

PART – B **8 X 5 = 40**

Instructions: (1) Answer all **Five** questions either A or B from each question.
(2) Each question carries **Eight** marks.

11. (A) Explain DNC system with a neat sketch.

(OR)

(B) Explain with a block diagram the manufacturing methodology of an NC system.

12. (A) Explain with a block diagram the configuration of CAPP with APT.

(OR)

(B) Name any four commercially available GUI based CAPP languages and state their advantages over APT.

13. (A) Describe the functions of the Principal components of a Robot.

(OR)

(B) What are the types of AGVS? Describe them with illustrations.

14. (A) Describe the layout of a typical FMS showing the principal components.

(OR)

(B) Describe CIMS showing the principal components.

15. (A) Explain Rapid Prototyping technique Stereo Lithography Apparatus (SLA) with a schematic diagram.

(OR)

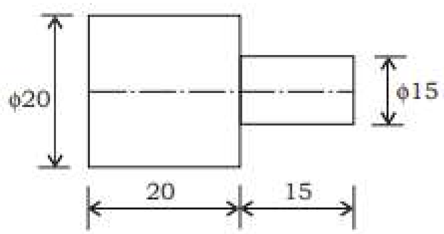
(B) Explain the process of Reverse Engineering with a flow diagram.

PART – C **10*1 = 10**

Instructions: (1) Answer the question.

(2) Question carries **Ten** marks.

16. Develop a part program with appropriate assumptions for the following job from a shaft 25 mm diameter and 38 mm length to make a stepped shaft with the dimensions as shown in the figure given below. Take speed = 3000 r.p.m. and feed = 30 mm/min.



(all dimensions are in mm)

Table specifying the scope of syllabus to be covered for Unit Test-I & Unit Test-II
M-506 :: COMPUTER AIDED MANUFACTURING SYSTEMS

Unit Test	Learning Outcomes to be covered
Unit Test – I	From 1.1 to 3.14
Unit Test – II	From 4.1 to 5.17

Unit Test - 1

Q.No	Question from the topic	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Introduction to Computer aided manufacturing, NC, CNC and DNC Systems,	R,U	4	CO1, CO2,CO3
2	Introduction to Computer aided manufacturing	U	3	CO1
3	NC, CNC and DNC Systems	U	3	CO2
4	NC, CNC and DNC Systems	U	3	CO2
5	CNC programming	U	3	CO3
Part - B (24 marks)				
6	Introduction to Computer aided manufacturing	U	8	CO2
7	NC, CNC and DNC Systems	U	8	CO3
8	CNC programming	Ap	8	CO5

Unit Test - 2

Q.No	Question from the topic	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Material handling systems of CAM, Flexible manufacturing systems, CIMS &Rapid Prototyping	R,U	4	CO4,CO5,
2	Material handling systems of CAM	U	3	CO4
3	Flexible manufacturing systems and Rapid Prototyping	U	3	CO5
4	Flexible manufacturing systems and Rapid Prototyping	U	3	CO5
5	Flexible manufacturing systems and Rapid Prototyping	U	3	CO5
Part - B (24 marks)				
6	Material handling systems of CAM	U	8	CO4
7	Flexible manufacturing systems and Rapid Prototyping	U	8	CO5
8	Flexible manufacturing systems and Rapid Prototyping	U	8	CO5

R-Remember; U-Understanding; Ap-Application ; An- Analylising

C20-M-506

BOARD DIPLOMA EXAMINATION,

Unit Test - 1

COMPUTER AIDED MANUFACTURING SYSTEMS

(M-506)

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Automation of manufacturing activities with the aid of computer is called ----------
   (b) A ----------- in an NC system is set of instructions which informs the machine tool what is to be done and when.
   (c) CMM stands for-------------
   (d) Macros also called as --------
2. List out six benefits of CAM?
3. State any three advantages of NC system?
4. Write the meaning of the following codes.(i) G-02 (ii) G-71(iii) G-94
5. Define group technology

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. State the concept, three advantages and three limitations of group technology.

   (OR)

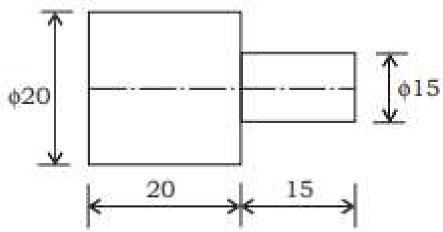
   Explain the product cycle of a traditional manufacturing system and CAM system

7. Explain with a block diagram the manufacturing methodology of an NC system

   (OR)

   State the Four principal differences between NC and CNC systems.

8. Develop a part program with appropriate assumptions for the following job from a shaft 25 mm diameter and 38 mm length to make a stepped shaft with the dimensions as shown in the figure given below. Take speed = 3000 r.p.m. and feed = 30 mm/min.



(all dimensions are in mm)

(OR)

Name the commercially available GUI based CAPP languages and state their advantages over APT.

C20-M-506

BOARD DIPLOMA EXAMINATION,

Unit Test - 2

COMPUTER AIDED MANUFACTURING SYSTEMS

(M-506)

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) ---------- is used in difficult and hazardous areas to replace humans.

   (b) The systems responsiveness to changing demand patterns is known as---------

   (c) The ease with which the system can be expanded to faster total production volume is known as------------------

   (d) Laminated Object Manufacturing (LOM) is a Rapid Prototyping Technique.(True/False)
2. List any six applications of industrial Robots
3. State any six benefits of CIM.
4. Name various flexibilities defined under FMS.
5. State any six reasons for Reverse Engineering a product or part.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. Describe the functions of the Principal components of a Robot.

   (OR)

   What are the types of AGVS? Describe them with illustrations.
7. Describe the layout of a typical FMS showing the principal components.

   (OR)

   List any four advantages and four limitations of FMS.
8. Explain the process of Reverse Engineering with a flow diagram.

   (OR)

   Explain Rapid Prototyping technique Three Dimensional Printing (3DP)

Course Title : **CAD/CAM LAB PRACTICE**
Course Code : **M–507**
Periods per week : **06**
Period per semester : **90**

TIME SCHEDULE

PART – A - CAD Lab		
Sl No.	**Chapter/Unit Titles**	**No. of periods**
1.	Introduction to CAD	03
2.	Selecting commands & Working with drawing	03
3.	Viewing drawing	03
4.	Working with coordinates	03
5.	Creating simple and complex entities	03
6.	Getting Drawing information	03
7.	Modifying entities	03
8.	Working with text	03
9.	Dimensioning drawing	03
10.	2D Drawing	09
11.	Layers	03
12.	3D Drawings	06
	TOTAL	**45**

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to		
COURSE OBJECTIVES	01	Know CAD screen and various tool bars and menus
	02	Apply dimensioning and hatching on the auto CAD drawings
	03	Draw 2D –drawings
	04	Draw 3D -drawings
COURSE OUTCOMES	CO1	Demonstrate basic concepts of the CAD software
	C02	Apply appropriate command to develop basic drawings
	C03	Use edit and plotting techniques to manipulate drawings through editing and plotting technique
	CO4	Draw 2D drawings for given specifications
	CO5	Draw 3D drawings for given specifications

PO-CO Mapping

Course Code:M-507A	Course Title: CAD Lab Practice No of Cos:7				No. Of periods:45
POs	Mapping with CO No	CO Periods Addressing PO in Col 1		Level (1,2,3)	Remarks
		No	%		
PO1	CO1,CO2,CO3	6	13	1	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2	CO2,CO3	15	33	2	
PO3	CO4,CO5	21	47	3	
PO4					
PO5	CO4,C05	3	7	1	
PO6					
PO7					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1							3	2	1
CO2	1							3	2	1
CO3		2						3	2	1
CO4		2	3		1			3	2	1
CO5	1		3		1			3	2	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes

1.0 Understand about the Computer Aided Drafting and its software

1.1 Define Computer Aided Drafting
1.2 List the Advantages of CAD
1.3 Explain the importance of CAD software
1.4 Explain the evolution of Cad software up to parametric modelling and direct modelling
1.5 Explain the features of Graphic Work station
1.6 Use CAD Environment: Screen, Various tool bars and menus.

2.0 Use appropriate selection commands

2.1 Practice commands using toolbars, menus, command bar
2.2 Practice repeating a command, Nesting a command and modifying a command
2.3 Use prompt history window and scripts
2.4 Practice mouse shortcuts
2.5 Practice the Creating the drawing, Opening existing and damaged Files, saving the drawing
2.6 Practice the setting up a drawing
2.7 Practice the setting and changing the grid and snapping alignment
2.8 Practice the Entity snaps

3.0 Use viewing tools of CAD

3.1 Practice the use of Scroll bar, pan command, and rotating view to move around within drawing
3.2 Practice the changing of magnification of drawing
3.3 Practice the displaying of multiple views
3.4 Practice the use of controlling visual elements like Fill, Text, Blips and Line weight

4.0 Use coordinate systems of the drawing

4.1 Practice how the coordinate system work
4.2 Practice how the coordinate system displayed
4.3 Practice the Find tool to determine the coordinates of a point
4.4 Practice the Two dimensional coordinates such as Absolute Cartesian, Relative Cartesian and Polar coordinates
4.5 Practice the use of right-hand rule
4.6 Practice the how to enter into x, y, z - coordinates
4.7 Practice the Three dimensional coordinates such as Spherical and Cylindrical coordinates
4.8 Practice the use of filters in two and three dimensions
4.9 Practice defining user coordinate system
4.10 Practice the use of present user coordinate system

5.0 Create the simple and complex entities

5.1 Draw the lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines
5.2 Practice the Creation of point entities
5.3 Practice the Editing of point entities
5.4 Draw the complex shapes like Rectangles, Polygons, Polylines, Splines, Donuts, and Planes
5.5 Practice the adding of hatch pattern

6.0 Use the drawing information retrieving tools Measure, Divide, Calculate, Display, and Track

6.1 Measure the intervals on entities
6.2 Divide the entities in to segments
6.3 Calculate the areas defined by points, of closed entities, and Combined entities
6.4 Calculate the distance between the entities
6.5 Calculate the angle between the entities
6.6 Display the information about the entities and drawing status
6.7 Track time spent working on a drawing

7.0 Use the modifying tools to modify the properties of entities

7.1 Practice the entity selection and deselect ion methods
7.2 Practice the Deletion of entities
7.3 Practice the Copying of entities within a drawing, between drawings
7.4 Practice the making of parallel copies, Mirroring entities and arraying entities
7.5 Practice the Rearranging of entities by Moving, Rotating and Reordering
7.6 Practice the Resizing of entities by Stretching, Scaling, Extending, Trimming, and Editing the length
7.7 Practice the Braking and joining of entities
7.8 Practice the creating, modifying the groups and ungrouping of Entities
7.9 Practice the Editing of polylines: Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices
7.10 Practice the Exploding of entities
7.11 Practice the Chamfering and Filleting of entities

8.0 Use the Text tool to create and formatting the various types of text fonts and its styles

8.1 Practice the creating, naming and modifying the text fonts
8.2 Practice the Creation of line text, paragraph text
8.3 Practice the Setting of line text style and its alignment
8.4 Practice the Setting of Paragraph text style and its alignment
8.5 Practice the Changing of line text and Paragraph text
8.6 Practice the use of alternate text editor

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimension styles & variables and Adding geometric tolerances

9.1 Practice the creating of linear, Angular, Diametral, Radial, Ordinate dimensions
9.2 Practice the creating leaders and annotations
9.3 Practice making dimensions oblique
9.4 Edit the dimension text
9.5 Practice the Controlling of dimension arrows and format
9.6 Practice the Controlling of line settings and dimension text
9.7 Practice the Controlling of dimension units, and dimension tolerance

10.0 Create 2D Drawing

10.1 Create 2D drawings of Knuckle Joint
10.2 Create 2D drawings of flange Coupling
10.3 Create 2D drawings of Footstep Bearing
10.4 Lathe Tool Post
10.5 Eccentric

11.0 Organize the information on layers

11.1 Practice the setting a current layer, layers color, line type, line weight, print style
11.2 Practice the locking and unlocking of layers
11.3 Practice the layer visibility and layer printing
11.4 Practice the setting of current line type
11.5 Practice the loading of additional line types
11.6 Practice the creating and naming of line type
11.7 Practice the editing of line type

12.0 3D Drawings

12.1 Explain the concept of 3D
12.2 Create 3D solids using solid tool bar options
12.3 Create 3D Drawings of Standard Mechanical Components (Bolt and Nut, Screw jack)
12.4 Practice of Rendering

COURSE CONTENT

1.0 The Computer Aided Drafting and its software

Definition of Computer Aided Drafting, the Advantages and importance of CAD software, the features of parametric modelling and direct modelling, the features of Graphic Work station, CAD Environment: Screen, Various tool bars and menus.

2.0 Selection of commands

Commands using toolbars, menus, command bar. Repeating a command, Nesting a command and modifying a command. Use of prompt history window and scripts, mouse shortcuts. Creating the drawing.Opening existing and damaged files, saving of drawing, setting up a drawing. Setting and changing the grid and snapping alignment, and the Entity snaps.

3.0 Use of viewing tools of CAD

Use of Scroll bar, pan command, and rotating view to move around within drawing, changing of magnification of drawing. Displaying of multiple views, the use of controlling visual elements like Fill, Text, Blips and Line weight.

4.0 Use of coordinate systems of the drawing

Two dimensional coordinates such as Absolute, Cartesian, Relative Cartesian and Polar coordinates. The use of right-hand rule. Three dimensional coordinates such as Spherical and Cylindrical Coordinates, the use of filters in two and three dimensions, defining user Coordinate system.

5.0 Creating simple and complex entities

Drawing of lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines. Creating and editing of point entities. Drawing of complex shapes like rectangles, polygons, polylines, Splines, donuts, planes, and adding of hatch pattern

6.0 Use the drawing information retrieving tools Measure, Divide, Calculate, Display, and Track

Measuring the intervals on entities, dividing the entities into segments. Calculation of areas defined by points, closed entities, and combined entities, calculate the distance and angle between the entities. Displaying the information about the entities and drawing status. Tracking time spent working on a drawing.

7.0 Use the Modifying tools to modify the properties of entities

Entity selection and de selection methods, the Deletion of entities. Copying of entities within a drawing, between drawings, parallel copies, Mirroring entities and Arraying entities. The Rearranging of entities by Moving, Rotating and Reordering. The Resizing of entities by Stretching, Scaling, Extending, Trimming, and Editing the length. The Braking and joining of entities.The creating, modifying the groups and Ungrouping of Entities. Editing of polylines: Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices, The Exploding of entities, the Chamfering and Filleting of entities

8.0 Use the Text tool to create and formatting the various types of text Fonts and its styles

The creating, naming and modifying the text fonts, the Creation of line text, paragraph text, setting of line text style and its alignment.The Setting of Paragraph text style and its alignment, the Changing of line.Text and Paragraph text, the use of alternate text editor.

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimension styles & variables and Adding geometric tolerances

The creating of linear, Angular, Diametral, Radial, Ordinate dimensions. The creating leaders and annotations, making dimensions oblique, Editing the dimension text, controlling of dimension arrows and format. The Controlling of line settings and dimension text, the Controlling of dimension units, and dimension tolerance.

10.0 2D Drawings

Using appropriate commands creation of 2D drawings of standard mechanical components.

11.0 Organize the information on layers

Setting a current layer, layers color, line type, line Weight, print style Locking and unlocking of layers, the layer visibility and layer printing. Setting of current line type.The loading of additional line types, creating and naming of line type, editing of line type.

12.0 3D Drawings

3D drawings of standard components. Rendering of 3D images

REFERENCE BOOKS

4MCAD User Guide- IntelliCAD Technology Consortium (WWW.intellicad.org)
4MCAD Software:
1. 4MCAD Viewer,
2. 4MCAD Classic,
3. 4MCAD Standard,
4. 4MCAD Professional.

TIME SCHEDULE

PART – B – CAM LAB		
S.No	**Chapter/Unit Titles**	**Periods**
1	CNC Introduction	3
2	Study of turning	3
3	G–codes and M-codes	3
4	Simulation software practice	6
5	Structure of program	6
6	Turning exercise–step turning using canned cycle	6
7	Turning exercise–Circular interpolation CW, CCW	6
8	Turning Exercise-Taper turning and Peck drilling	6
9	Turning exercise–Thread cutting and grooving	6
Total		**45**

Course Objectives and Course Outcomes

		Upon completion of the course the student shall be able to
COURSE OBJECTIVES	01	Familiarise with parts and functions of CNC lathe
	02	Familiarise in writing the part programming using M-Codes and G-Codes and execute on CNC Lathe
COURSE OUTCOMES	CO1	Demonstrate the parts and functions of a CNC lathe
	C02	Practice incremental system and absolute system of dimensioning
	C03	Write simple part program using G-Codes and M-Codes.
	C04	Edit and execute a part program using CNC lathe machine simulation package.
	C05	Produce part as per the drawing using CNC lathe machine.

PO-CO Mapping

Course Code:M-507B	**Course Title: COMPUTER AIDED MANUFACTURING SYSTEMS LAB No of Cos:5**				**No. Of periods:45**
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1and C02	07	15.55	1	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2	CO3,CO4 and CO5	05	11.11	1	
PO3	CO3,CO4 and CO5	25	55.55	3	
PO4	CO3,CO4 and CO5	08	17.78	1	
PO5					
PO6					
PO7					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1							3	2	1
CO2	1							3	2	1
CO3		1	3	1				3	2	1
CO4		1	3	1				3	2	1
CO5		1	3	1				3	2	1

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Out Comes:
Upon completion of the course the student shall be able to

1. Demonstrate the parts and functions of CNC lathe
2. Explain incremental system and absolute system on dimensioning.
3. Write simple part program using G-Codes and M-Codes.
4. Edit and execute a part program using CNC lathe machine simulation package.
5. Prepare part program as per the drawing.
6. Produce part as per the drawing using CNC lathe machine.

COURSECONTENT

1. CNC Introduction
2. Study of turning.
3. G–codes and M-codes
4. Simulation soft ware practice.
5. Structure of program.
6. Turning exercise–step turning using canned cycle.
7. Turning exercise–Circular interpolation CW, CCW.
8. Turning exercise-Taper turning and Peck drilling.
9. Turning exercise–Thread cutting and grooving.

Life Skills Lab Practice

Course Code	Course Title	No. of Periods/Week	Total No. of Periods	Marks for FA	Marks for SA
C-508	Life Skills Lab Practice	3	45	40	60

S. No.	Unit Title	No of Periods	COs Mapped
1	**Attitude**	**4**	CO1
2	**Adaptability**	**4**	CO1, CO2
3	**Goal Setting**	**4**	CO1, CO2, CO3
4	**Motivation**	**4**	CO1, CO2, CO3
5	**Time Management**	**4**	CO2
6	**Critical thinking**	**4**	CO3
7	**Creativity**	**4**	CO3
8	**Problem Solving**	**5**	CO3
9	**Team Work**	**4**	CO4
10	**Leadership**	**4**	CO4
11	**Stress Management**	**4**	CO4
Total Periods		**45**	

Course Objectives	To understand the importance of Life skills for acceptable, sustainable and ethical behaviour in academic, professional and social settings
	To exhibit language competence appropriate to acceptable social and professional behaviour.
	To demonstrate time management, stress management, team skills, problem solving ability to manage oneself in academic, professional and social settings.

CO No.	Course Outcomes
CO1	Demonstrates positive attitude and be able to adapt to people and events
CO2	Fixes personal and professional goals and manages time to meet targets
CO3	Exhibits critical and lateral thinking skills for problem solving.
CO4	Shows aptitude for working in teams in a stress free manner and sometimes/ very often/ mostly display leadership traits.

CO-PO Matrix

Course Code C-508	**Course Title: English Number of Course Outcomes: 4**				**No. of Periods: 45**
POs	Mapped with CO No.	CO Periods Addressing PO in Column 1		Level of Mapping (1,2,3)	Remarks
		Number	Percentage %		
PO1		Not directly applicable for Life Skills Course. However activities that use content and situations from academic, professional and social settings relevant to the Programme shall be exploited for triggering thought and interaction in the Course.			
PO2					
PO3					
PO4					
PO5	CO1, CO2, CO3, CO 4	11	25%		>60%: Level 3 16 -59%: Level 2 Up to 15%: Level 1
PO6	CO1, CO2, CO3, CO4	27	45%		
PO7	CO1, CO2, CO3, CO4	7	30%		

Level 3 – Strongly Mapped
Level 2- Moderately Mapped
Level 1- Slightly Mapped

Mapping Course Outcomes with Program Outcomes:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO 1					✓	✓	✓
CO 2					✓	✓	✓
CO3					✓	✓	✓
CO4					✓	✓	✓

Blue Print for evaluation based on Course Outcomes for SA:

Note: Every Activity based Question that focuses on COs and responses as exhibited through communication has to be given marks for the following parameters

- Clarity of Thinking as Exhibited through Content
- Features of Etiquette

***Rubric Descriptors 'Outstanding/ Very Good/ Good/ Satisfactory/ Poor' levels of Competence**

Level of Competence	Parameters of Assessment	
	Clarity of thinking as exhibited through content	**Features of etiquette**
Outstanding 10	**Thinking** is **extremely logical** and suggested course of action is **feasibile** Shows **creativity and uniqueness** Exhibits **expert use of expression** (organizational devices and discourse markers) that denote clarity in thought.	Exhibits **courtesy to all most appropriately** with **confidence**
Very Good 8/9	**Thinking** is **clear and logical** Suggested **course of action is feasible** Shows **traces of creativity** Exhibits **good expression** (organizational devices and discourse markers) that denote clarity in thought.	Exhibits **courtesy to all to a considerable level.**
Good 6/7	**Thinking is clear and logical most of the time**. Lacks creativity or out of the box thinking as expressed through content.	Exhibits **courtesy / politeness to an acceptable level.**
Satisfactory 4/5	**Thinking is logical**; However **expressing content is disjointed and disorganized.**	Has courtesy but often fumbles with language.
Poor 3 or less than 3	**Thoughts** as expressed through content are **incoherent. Language skills are very limited.**	Fails to show courtesy to others.

Blue Print for evaluation based on Course Outcomes for SA of each student:
Note: Marks are awarded for each student as per the Rubric descriptors.

S No.	Questions based on Course Outcomes	Periods Allocated for practical work	Max Marks	Poor >3	Satisfactory 4 /5	Good 6/7	Very Good 8/9	Outstanding 10
1	Short presentation on GOALS with Timeline and Action Plan	12	10					
2	State what you will do in the given situation (Assesses adaptability and critical thinking skills, leadership, team skills)	12	10					
3	In how many different and creative way can you use ______ (Object) other than its primary use	8	10					
4	What solutions can you think of for ______ problem.	13	10					
	Total	**45**	**60**					

Note: The marks that are awarded for the student for 40 to be increased proportionally for 60.

Learning Outcomes

1. **Attitude Matters :**
   - 1.1 Understand the importance of positive attitude and the consequences of negative attitude.
   - 1.2 Demonstrate positive attitude in dealing with work-related issues and in personal life.
2. **Adaptability….makes life easy :**
   - 2.1 Understand the significance of adaptability.
   - 2.2 Show adaptability whenever needed, both at place of work and on personal front.
3. **Goal Setting … life without a Goal is a rudderless boat!**
   - 3.2 Understand the SMART features of goal-setting.
   - **3.3** State one's short-term and long-term goals and spell out plans to achieve them.
4. **Motivation … triggers success!**
   - 4.2 Comprehend the need for motivation in order to achieve success in life.
   - 4.3 State how one is motivated in life.
   - 4.4 Show the impact of motivation on one's life

5. **Time Management… the need of the Hour!**

    5.2 Understand the value of time management and prioritizing in life

    5.3 Demonstrate the effect of time management on one's professional work.

6. **Critical Thinking … logic is the key!**

    6.1 Distinguish between facts and assumptions

    6.2 Use logical thinking in dealing with professional matters

7. **Creativity … the essential you!**

    7.2 Understand the importance of thinking out of the box in dealing with critical issues

    7.3 Solve problems using creativity / imagination

8. **Problem Solving … there is always a way out!**

    8.2 Understand the need for and importance of problem solving.

    8.3 Use logic or creativity to solve a problem at workplace or home.

9. **Team Work… together we are better!**

    9.1 Understand the need for team skills / team building

    9.2 Demonstrate one's skills as a team player

10. **Leadership… the meaning of a leading!**

    10.1 Understand the need for team skills / team building

    10.2 Demonstrate one's skills as a team player

11. **Stress Management… live life to the full!**

    11.1 Understand what causes stress and how to cope with stress at workplace.

    11.2 Demonstrate how stress can be overcome in a healthy way.

Course Title	Course Code	Periods per Week	Periods per Semester
Refrigeration and Air Conditioning Lab Practice	M – 509	03	03

TIME SCHEDULE

S.No	Chapter/Unit Title	Periods
1	Perform basic fabrication operations viz., flaring, swaging, bending and brazing on soft copper tubes	9
2	Evaluate the C.O.P of a given Vapour Compression cycle test rig	3
3	Evaluate the C.O.P of a Domestic Refrigerator	3
4	Evaluate the C.O.P of a water cooler	3
5	Evaluate the C.O.P of Ice Plant	3
6	Perform various types of leak detection methods of a refrigeration system	9
7	Evaluate the C.O.P. of given air-conditioning system	3
8	Apply the method of vacuumization and refrigerant charging for a given vapour compression system.	6
9	Study of Window Air Conditioning System & Summer Air Conditioning system	6
	Total	**45**

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to			
COURSE OBJECTIVES	01		Familiarisation with R & AC tools and perform the basic operations on soft copper tube
	02		Conduct performance test on Vapour Compression Refrigeration test rig, Domestic Refrigerator, Water Cooler, Ice Plant and Air condition Test Rig
	03		Detect the Leakage of Refrigerant and vacuumization and refrigerant charging for a given vapour compression system.
COURSE OUT COMES	CO1	M-509.1	Explain various tools used in Refrigeration & Air Conditioning
	C02	M-509.2	Conduct the performance test and evaluate the COP of Vapour Compression Refrigeration test rig, Domestic Refrigerator, Water Cooler, Ice Plant.
	C03	M-509.3	Calculate the COP of a given Air condition Test Rig.
	C04	M-509.4	Conduct the vacuumization and refrigerant charging for a given vapour compression system.
	C05	M-509.5	Describe Window Air Conditioning System

Course Code: M-509	Course Title: Refrigeration & Air Conditioning Lab No of Cos:6				No. Of periods:45
POs	**Mapped with CO No**	**CO Periods Addressing PO in Col 1**		**Level (1,2,3)**	**Remarks**
		No	**%**		
PO1	CO1, CO5	07	15.56	1	>40% Level 3 (Highly Addressed) 25% to 40% Level 2 (Moderately Addressed) 5% to 25% Level 1 (Low Addressed) <5% Not Addressed
PO2					
PO3	CO2 ,CO3, CO4,	10	2.22	1	
PO4	CO1, CO2,CO3, CO4	28	62.22	3	
PO5					
PO6					
PO7					

PO-CO Mapping

CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**
CO1	2			2				3		
CO2		2	3	2				3		
CO3			2	2						
CO4			2	3				3		
CO5	2								2	

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be achieved by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Objectives:
Upon completion of the course the student shall be able to

1.0. Perform basic fabrication operations viz., flaring, swaging, bending and brazing on soft copper tubes

1.1. Identify various tools used in Refrigeration & Air Conditioning
2.2. Perform flaring, swaging, bending and brazing operations by using Refrigeration & Air conditioning tools.

2.0. Evaluate the C.O.P of a given Vapour Compression cycle test rig

2.1. Identify the components of vapour compression system

2.2. Record the values of pressure and temperature when the pressure gauges are stabilized

2.3. Record the energy meter reading

2.4. Read the values from Pressure Vs Enthalpy diagram of the given refrigerant

2.5. Evaluate actual, theoretical and relative C.O.P

3.0. Evaluate the C.O.P of a Domestic Refrigerator

3.1 Identify the components

3.2 Record the values of pressure and temperature when the Pressure gauges are stabilized

3.3 Record the energy meter reading

3.4 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

3..5 Evaluate actual, theoretical and relative C.O.P

4.0. Evaluate the C.O.P of a water cooler

4.1 Identify the components

4.2 Record the values of pressure and temperature when the Pressure gauges are stabilized

4.3 Record the energy meter reading

4.4 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

4..5 Evaluate actual, theoretical and relative C.O.P

5.0. Evaluate the C.O.P of Ice Plant

5.1 Identify the components

5.2 Record the values of pressure and temperature when the Pressure gauges are stabilized

5.3 Record the energy meter reading

5.4 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

5..5 Evaluate actual, theoretical and relative C.O.P

6.0. Identify various types leak detection methods of a refrigeration system

6.1 Detect the leakages of given vapour compression refrigeration system by using soap solution method.

6.2 Apply the methods of arresting leakages

6.3 Arrest the leakages if any by soldering

7.0. Evaluate the C.O.P. of given air-conditioning system

7.1 Identify the components of given vapour compression air-conditioning test rig.

7.2 Insert thermometers in suction line and discharge line

7.3 Run the given V.C. A.C. system for some time

7.4 Record the pressure and temperature readings when the pressure gauges are stabilized.

7.5 Record the energy meter reading

7.6 Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant

7.7 Evaluate C.O.P

8.0. Apply the method of vaccumization and refrigerant charging for a given vapour compression system.

8.1 Evacuate the given V.C.R. system using a vacuum pump

8.2 Charge the given V.C.R. system by using suitable refrigerant gas

8.3 Run the system for at least 15 min. and check for the build up of pressure in the pressure gauge.

9.0. Study of Window Air Conditioning System

9.1 Identify the components of given window A/C

9.2 Understand the functions of the components

9.3 Understand the maintenance procedure and remedies to the common problems encountered.

Course Title	Course Code	Periods per Week	Periods per Semester
PROJECT WORK	M – 510	03	45

Upon completion of the course the student shall be able to		
Course Objectives		• Enhance the knowledge by field visits • Provide with the opportunity to synthesize knowledge from various areas of learning • Critically and creatively apply it to real life situations
COURSE OUT COMES	CO1	To demonstrate team work, sprit and self-confidence
	CO2	To work independently.
	CO3	To Apply theory to practical work situations.
	CO4	To prepare technical reports.

PO-CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1						2				
CO2							2			
CO3			3							
CO4						2				

3: High, 2: Moderate,1: Low

Note:
The gaps in CO and PO mapping will be met by one or more appropriate activities from the following:

(i) Assignments (ii) Tutorials (iii) Seminars (iv) Guest Lectures (v) Group Discussions (vi) Quiz (vii) Industry Visits (viii) Tech Fest (ix) Mini Projects (x) Library Visits.

Learning Outcomes
Upon completion of the course the student shall be able to
1.0 Problem solving and Critical Thinking

1.15. Generate Ideas from mechanical courses.
1.16. Develop these Ideas.
1.17. Gather relevant Information.
1.18. Evaluate Ideas.
1.19. Apply these ideas to a specific task.
1.20. Execute appropriate Laboratory skills
1.21. Draw Appropriate Conclusions

2.0 Communication
. 2.1 Communicate effectively.
2.2 Present Ideas Clearly.
2.3 Present Ideas Coherently.
2.4 Report writing

3.0 Collaboration

3.1. Discuss the ideas.
3.2 Coordinate with team members
3.3. Team work in accomplishing the task.

4.0 Independent Learning

4.1. Involves in the group task.

4.3. Analyze the appropriate actions.

4.4. Compares merits and demerits
4.5. Analyze the activities for sustainability.
4.6 Analyze the activities to ensure ethics

5.0 Ethics

5.1 Give respect and value to all classmates, educators, colleagues, and others

5.2 Understand the health, safety, and environmental impacts of their work

5.3 Recognize the constraints of limited resources

5.4 Develop sustainable products and processes that protect the health, safety, and prosperity of future generations

5.5 Maintain integrity in all conduct and publications and give due credit to the contributions of others

COURSE CONTENT

1.0 Design/Fabrication/Analysis/ Case Study Projects in the areas of Mechanical Engineering and other related areas

Weightage of marks for Assessment of Learning Outcomes of Project work

S.No	Item	Marks
1	**Internal Marks** Demonstration of Assigned task in the group to complete the project	**40**
	End Exam Marks: **Demonstration of skill relevant to the project (30)** **Project Report(20)** **Viva Voce(10)**	**60**
Total marks		**100**

- End Examination assessment shall be done by both internal, external examiners and faculty members who guided the students during project work.

VI SEMESTER

INDUSTRIAL TRAINING

Course Title : **Industrial Training**
Course Code : **M-601**
Duration : **6 months**

Time schedule

S.NO	Code	TOPICS	Duration
1	M-601	• Practical training in Industry • Training Report Preparation Report Preparation: Title Page, Certificate, Acknowledgements, Abstract, Contents(introduction of Industry, Plant Layout, Organization Chart, List of Major Equipments, List of Processes: Skills Acquired; Conclusions; References	Six Months

Course Objectives and Course Outcomes

Upon completion of the course the student shall be able to		
Course Objectives		1.Expose to real time working environment 2. Enhance knowledge and skill already learnt in the institution. 3. Acquire the required skills of manufacturing processes, assembling, servicing, supervising in the engineering fields. 4. Install the good qualities of integrity, responsibility and self confidence.
COURSE OUT COMES	CO1	Apply theory to practical work situations
	CO2	Cultivate sense of responsibility and good work habits
	CO3	Exhibit the strength, teamwork spirit and self-confidence
	CO4	Write report in technical projects

PO-CO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2				2		1	3		2
CO2						3		3		2
CO3						3		3		2
CO4						3		3		2

3: High, 2: Moderate,1: Low

Learning Outcomes

The student shall be able to display the following skill sets

1) Technical Skills *(*Manufacturing/Service/Drafting/Maintenance etc)
2) Reading drawings and analysing Specifications
3) Recognize and Practice safety Measures
4) Handling Tools/Instruments/Materials/Machines
5) Assess and Control of quality parameters
6) Planning, Organizing and recording Skills

Scheme of evaluation

<table>
<tr><th rowspan="2">SI. No.</th><th rowspan="2">Course</th><th rowspan="2">Duration</th><th colspan="3">Scheme of evaluation</th></tr>
<tr><th>Assessment</th><th>Nature</th><th>Max. Marks</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Industrial Training</td><td rowspan="5">6 months</td><td>1.First Assessment at Industry (After 12 Weeks)</td><td>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</td><td>120</td></tr>
<tr><td>2.Second Assessment at the Industry (After 22 weeks)</td><td>Assessment of Learning outcomes by both the faculty and training Mentor of the industry</td><td>120</td></tr>
<tr><td rowspan="3">Final Summative assessment at institution level</td><td>Training Report</td><td>20</td></tr>
<tr><td>Demonstration of any one of the skills listed in learning outcomes</td><td>30</td></tr>
<tr><td>Viva Voce</td><td>10</td></tr>
<tr><td colspan="5">TOTAL MARKS</td><td>300</td></tr>
</table>

Weightage of marks for Assessment of Skill sets during first and second assessment.

Skill Set Sl.No	***SKILL SET***	***Max Marks Allotted For each parameter***
1	***Technical Skills***	*15*
2	***Reading Drawings and Analysing Specifications***	*20*
3	***Handling Tools / Instruments / Safety Practices***	*15*
4	***Trouble Shooting / Dismantling & Assembling of the Unit***	*30*
5	***Quality Assessment and Control***	*15*
6	***Soft skills and Recording skills***	*25*
	Total	*120*

During assessment the performance of the students shall be assessed in those skills in which the student has been trained and be awarded the marks as per the weightage assigned as above. In case the student has undergone training in a few skill sets then the total marks obtained shall be raised to 120 marks for the given assessment i.e. either assessment 1 or 2. However the performance of the student shall be assessed at the most skill sets listed above but not less than three skill sets.

Illustration

If the student has undergone training in only 4 skill sets (namely serial number 1, 3, 4, 5 of above skill sets) and marks awarded during assessment is 50 out of 80 marks, then the marks of 50 shall be enhanced to 120 proportionately as (50/80)*120=75.

GUIDELINES FOR INDUSTRIAL TRAINING

1. Duration of the training: 6 months.
2. Eligibility: The As per SBTET norms
3. Training Area: Students may be trained in the fields Fabrication/Foundry/Manufacturing/Service/Drafting/Maintenance etc.
4. The candidate shall put a minimum of 90% attendance during Industrial Training.
5. If the student fails to secure 90% attendance during industrial training, the student shall reappear for 6 months industrial training.
6. Formative assessment at industry level shall be carried out by the Mentor from of the industry, where the student is undergoing training and the faculty in charge (Guide) from the concerned section in the institution.
7. The Industrial training shall carry 300 marks and pass marks is 50% in assessments at industry (first and second assessment) and final summative assessment at institution level put together i.e. 150 marks out of 300 marks.
8. If the student fails to secure 50% marks in final summative assessment at institution level, the student should reappear for final summative assessment in the subsequent board examination.
9. Final summative assessment at institution level is done by a committee including 1. Head of the section (**of concerned discipline ONLY**), 2. External examiner from an industry and 3. Faculty member who assessed the student during Industrial Training as members.

Guidelines and responsibilities of the faculty members who are assessing the student's performance during industrial training:

- Shall guide the students in all aspects regarding training.
- Shall create awareness regarding safety measures to be followed in the industry during the training period, and shall check it scrupulously.
- Shall check the logbook of the students during the time of their visit for the assessment.
- Shall monitor progress at regular intervals and make appropriate suggestions for improvement.
- Shall visit the industry and make first and second assessments as per stipulated schedules.
- Shall assess the skill sets acquired by the students during their assessment.
- Shall award the marks for each skill set as per the marks allotted for that skill set during 1st and 2nd assessments
- Shall voluntarily supplement students learning through appropriate materials like photographs, articles, videos etc.
- Shall act as co-examiner along with other examiners in the final assessment at institution.
- Shall act as liaison between the student and mentor.
- Shall maintain a diary indicating his observation with respect to the progress of students learning in all three domains (Cognitive, Psychomotor and Affective).

Guidelines to the training mentor in the industry:

- Shall train the students in all the skill sets as far as possible.
- Shall assess and award the marks in both the assessments along with the faculty member .
- Shall check and approve the log books of the students.
- Shall approve the attendance of each student at the end of the training period.
- Shall report to the guide about student's progress, personality development or any misbehavior as the case may be.
- ✓ **Every Teacher (including HoS if not holding any FAC) shall be assigned a batch of students of 10 to 15 for industrial training irrespective of student's placements for training.**

Rubrics for Industrial Training Assessment

Department of Technical Education

Name of the Institution/ College:

PIN: **Name of the student:**

Skill Set Sl.No	***SKILL SET***	**Max Marks Allotted For each parameter**	**Precisely completes the task**	**Completes the task, mistakes are absent, but not Precise**	**Completes the task, Mistakes are a few**	**Makes attempt, Mistakes are many**
1	***Technical Skills (15 M)*** *(i) Analytical Thinking* *(ii) Creativity.* *(iii) Problem-solving.*	 5 5 5	 5 5 5	 *3* *3* *3*	 *2* *2* *2*	 *1* *1* *1*
2	***Reading Drawings and Analysing Specifications (20 M)*** *(i)* 2 D and 3D (Computer Aided Design) CAD. *(ii) Knowledge of specifying the machine member*	*10* *10*	*10* *10*	*7* *7*	*6* *6*	*3* *3*
3	***Handling Tools / Instruments / Safety Practices (15 M)*** *(i) Identification of tools and instruments.* *(ii) Measuring the parameter* *(iii) Aware of safety Management*	 *5* *5* *5*	 *5* *5* *5*	 *3* *3* *3*	 *2* *2* *2*	 *1* *1* *1*

4	***Trouble Shooting / Dismantling & Assembling of the Unit (30 M)*** *(i) Fault-Finding* *(ii) Dismantling the given Machine/ Equipment / Engine* *(iii) Repair or Replacement with spare parts* *(iv) Assembling of the given Machine/ Equipment / Engine after testing for working condition.*	*5* *10* *5* *10*	*5* *10* *5* *10*	*3* *7* *3* *7*	*2* *6* *2* *6*	*1* *3* *1* *3*
5	***Quality Assessment and Control (15 M)*** *(i) Use of various Inspection and Quality Control Tools* *(ii) Identification of Proper Testing Method and Tool for the manufactured Components* *(iii) Analyze Test Results*	*5* *5* *5*	*5* *5* *5*	*4* *4* *4*	*3* *3* *3*	*2* *2* *2*
6	***Soft skills and Recording skills (25 M)*** *(i)Communication Skills (oral/writing skills)* *(ii) Human relations.* *(iii) Supervisory abilities.* *(iv) Recording technical issues* *(v) Proper Maintenance of records in the industry.*	*5* *5* *5* *5* *5*	*5* *5* *5* *5* *5*	*4* *4* *4* *4* *4*	*3* *3* *3* *3* *3*	*2* *2* *2* *2* *2*

*Mistakes are with reference to Technique, Procedure & Precautions, while precision refers to Technique, Procedure, Precautions, Time & Result

Total Marks: 120
Marks Awarded: ___________________
(Marks awarded in words:)

Signature of the Training In-charge (Mentor)
Name
Designation

Signature of the faculty in-charge (Guide)
Name
Designation

E N D