

GOVERNMENT OF ANDHRA PRADESH



STATE BOARD OF TECHNICAL EDUCATION AND TRAINING
Andhra Pradesh :: Amaravathi



Globally Competitive
CURRICULUM (C-16)
For Polytechnic Diploma Courses
In Andhra Pradesh



DIPLOMA IN
APPLIED ELECTRONICS &
INSTRUMENTATION ENGINEERING

Objective of the New Curriculum (C-16)

To make the students 'Globally Competitive & Employable' by learning industry relevant subjects & undergoing Industrial training



Suggestions from Industrialists have been incorporated in the Curriculum by organising Industry Institute Interaction Meet.

Highlights of the Curriculum (C-16)



- ❖ 6 months /1 year industrial training in all the Diploma Courses.
- ❖ 1 year industrial training in collaboration with BOAT (Board of Apprenticeship & Training (SR), Chennai).
- ❖ Virtual labs for ECE & Computer Branches & Strengthening of Skill Development Centers to provide industrial training to students.

Fundamentals of 'Internet of Things' (IoT) is included for all the Branches in the Subject "Industrial Management & Smart Technologies".



"Communication Skills" and "Life Skills" have been introduced as practical subjects for all the Branches.





“Computer Fundamentals Laboratory” is introduced for all the Branches in First year. AutoCAD specific to the Branch has been given emphasis in the Curriculum.

C Language, Programmable Logic Controllers (PLC), Microcontrollers, Solar Energy are introduced in Electrical Engineering Branch.



Mobile Communications, Consumer Electronics are introduced in Electronics and Communication Branch

CAD/ CAM, CNC Machines, Power Plant Engineering are introduced in Mechanical Engineering Branch.



OOPS through JAVA, Web Designing, Computer Hardware & Networking are introduced in Computer Engineering Branch.

Automobile Chassis and Body Engineering, Recent Trends In Automobile Engineering, Motor Transport Organization etc are introduced in Automobile Engineering Branch.



Journal (JPAP)

The Department of
Technical Education,
A.P. has a bi- annual
'Journal of Polytechnics
of Andhra Pradesh'
JPAP



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CISCO ACADEMIES IN POLYTECHNICS

- ◆ 70 Government Polytechnics chosen to have Cisco Academies
- ◆ Course Content of CISCO has been incorporated into the ECE and Computer Diploma Courses
- ◆ CISCO to train Staff of Polytechnics in two phases to enable them to run the courses effectively
- ◆ Students to get 'Certificate from CISCO' along with Diploma Certificate.

CURRICULUM-2016
(C-16)

FOR DIPLOMA COURSES IN ANDHRA PRADESH

PREAMBLE

The State Board of Technical Education and Training, Andhra Pradesh under the aegis of the Department of Technical Education, Andhra Pradesh generally reviews the Curricula once in every five years. However, recognizing the needs of the industries and enhancing the employability skills of Polytechnic students, the Government of Andhra Pradesh constituted a committee vide G.O.Rt.No:95 of Higher Education (TE) Dept dated: 29-4-2016 and G.O.Rt.No:98 of Higher Education (TE) Dept dated: 4-5-2016 for updation of polytechnic curriculum under the chairmanship of Sri. S. Balasubrahmanyam, IAS (Retd.,). The committee submitted a report on 31-5-2016 making certain recommendations and suggesting new initiatives to be incorporated in the curriculum. An Industry Institute Interaction Meet was organized with Industry experts and subject experts on 26-12-2016 and the suggestions from Industrialists have also been incorporated in the curriculum. The new Curricula for the different diploma courses have been designed with the active participation of the members of the faculty teaching in the Polytechnics of Andhra Pradesh, besides reviewed by Expert Committee constituted with eminent academicians.

The primary objective of the curricular change is to produce best technicians in the country by correlating growing needs of the industries with the academic input.

The revised New Curriculum i.e., Curriculum–2016 (C-16) is approved by BoG of SBTET for its implementation with effect from 2016-17.

Salient Features:

1. Duration of course is either 3 years / 3½ years duration of Regular Academic Instruction.
2. The Curriculum is prepared in Semester Pattern. However, First Year is maintained as Year-wise pattern.
3. 6 Months/ 1 year Industrial Training is introduced for all the Diploma courses.
4. Fundamentals of Internet of Things (IOT) is introduced for all the Diploma courses in the subject.
5. Modern subjects relevant to the industry are introduced in all the Diploma courses.
6. CISCO course content has been incorporated into the ECE and CME courses to get certification from CISCO along with Diploma.

7. 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.
8. 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 introduced for all the branches.
9. Modern topics relevant to the needs of the industry and global scenario suitable to be taught at Diploma level are also incorporated in the curriculum.
10. AutoCAD specific to the branch has been given more emphasis in the curriculum. Preparing drawings using CAD software has been given more importance.
11. Every student is exposed to the computer lab at the 1st year itself in order to familiarize himself with skills required for keyboard/mouse operation, internet usage and e-mailing.
12. Upon reviewing the existing C-14 curriculum, it is found that the theory content is found to have more weightage than the Practical content. In the revised C-16 curriculum, more emphasis is given to the practical content of Laboratories and Workshops, thus strengthening the practical skills.
13. 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.
14. 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 at the Polytechnics. The experiments /exercises that are chosen for the practical sessions are identified to conform to the field requirements of industry.
15. The Members of the working group are grateful to Sri G.S. Panda Das, I.A.S., Special Commissioner of Technical Education & Chairman of SBTET, AP. and Sri. Adityanath Das, I.A.S., Principal Secretary of Higher Education for their guidance and valuable inputs in revising, modifying and updating the curriculum.
16. The Members acknowledge with thanks the cooperation and guidance provided by Sri. A.Nirmal Kumar Priya, 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

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 BM 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 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 making application to 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.
1). D.H.M.C.T. 2).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 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 cover the syllabus.

6 ELIGIBILITY OF 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 upto 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 next.

7 READMISSION

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

- 1. a) Within 15 days after commencement of class work in any semester (Except Industrial Training).
- b) For Industrial Training: before commencement of the Industrial training.
- 2. Within 30 days after commencement of class works 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, after readmission is granted.

8 SCHEME OF EXAMINATION

a) First Year

THEORY EXAMINATION: Each Subject carries 80% marks with examination of 3 hours duration, along with 20% marks for internal evaluation. (Sessional marks). However, there are no minimum marks prescribed for sessionals.

PRACTICAL EXAMINATION: There shall be 40% Marks for regular practical work done, i.e. sessional marks for each practical subject 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 EXAMINATION: Each subject carries usually 80 marks and 30 marks in respect of specified subjects of 3hours duration, along with 20 marks for internal evaluation (sessional marks) respectively.

PRACTICAL EXAMINATION: Each subject carry 60/30 marks of 3hours duration 40/20 sessional marks.

9 INTERNAL ASSESSMENT SCHEME

- a) Theory Subjects: Theory Subjects carry 20% sessional marks, Internal examinations will be conducted for awarding sessional marks on the dates specified. **Three unit tests will be conducted for I year students and two Unit Tests for semesters.** Average of marks obtained in all the prescribed tests will be considered for awarding the sessional marks.
- b) Practical Subjects: Student's performance in Laboratories / Workshop shall be assessed during the year/ semester of study for 40% marks in each practical subject. Allotment of marks should be discrete taking into consideration of the students' skills, accuracy, recording and performance of the task assigned to him / her. Each student has to write a record / log book for assessment purpose. In the subject of Drawing, which is also considered as a practical paper, the same rules hold good. Drawing exercises are to be filed in seriatum.
- c) Internal assessment in Labs / workshops / Survey field work etc., during the course of study shall be done and sessional marks shall be awarded by the concerned Lecturer / Senior Lecturer / Workshop superintendent as the case may be.

- 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 any local Industry/ nearby Government Polytechnic/ Local Government Organization. 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 all the experiments / exercise prescribed.
- f) Records pertaining to internal assessment marks of both theory and practical subjects are to be maintained for official inspection.
- g) **In case of Diploma courses *having* Industrial Training**, the training assessment shall be done and the marks are to be awarded in the following manner.

Industrial assessment	:	200 marks (in two spells of 100 marks each)
Maintenance of log book	:	30 marks
Record Work	:	30 marks
Seminar / viva-voce	:	40 marks

TOTAL	:	300 marks

The assessment at the institution level (Seminar/Viva-voce) shall be done by three members, viz., Internal Faculty member, External Examiner and Head of Section and be averaged.

10 MINIMUM PASS MARKS

THEORY EXAMINATION:

For passing a theory subject, 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 subject, 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 subjects of D.C.C.P course.

11. PROVISION FOR IMPROVEMENT

1. Improvement is allowed only after he / she has completed all the subjects from First Year to Final semester of the Diploma.
2. Improvement is allowed in any 4 (Four) subjects of the Diploma.
3. 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.
4. No improvement is allowed in Practical / Lab subjects or Project work or Industrial Training assessment. However, improvement in drawing subject(s) is allowed.
5. If improvement is not achieved, the marks obtained in previous Examinations hold good.
6. Improvement is not allowed in respect of the candidates who are punished under Mal-practice in any Examination.
7. Examination fee for improvement shall be paid as per the notification issued by State Board of Technical Education and Training from time to time.
8. 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 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 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 examination if he/she

- i) Puts the required percentage of attendance in the 4th semester
- ii) Should not have failed in more than Four backlog subjects of 1st year

For IVC & ITI Lateral Entry Students:

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 examination if he/she

- i) Puts the required percentage of attendance in the 5th semester
- ii) Should get eligibility to appear for 4th Semester examination.

For IVC& ITI Lateral Entry students:

- i) Puts the required percentage of attendance in the 5th semester
- ii) Should not have failed in more than Four backlog subjects 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 pay 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 Industrial Training assessment (Seminar/Viva-voce)

- i) Puts the required percentage of attendance, ie., 90% in 6th semester Industrial Training
- ii) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

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

ii) 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. 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.

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

1. 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.
2. 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.
3. 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
 - i) Puts the required percentage of attendance in the 4th semester
 - ii) Should not have failed in more than Four backlog subjects of 1st year.

For IVC & ITI Lateral Entry students:

- (i) Puts the required percentage of attendance in the 4th semester
4. 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.
5. 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 i.e.,90 % of attendance and attends for the VIVA-VOCE examination at the end of training.
6. 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.
7. 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

- i) Puts the required percentage of attendance in the 7th semester
- ii) Should get eligibility to appear for 4th semester Examination.

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance in the 7th semester
- ii) Should not have failed more than four backlog subjects of 3rd Semester

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 I 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 I spell of Industrial training.

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.

1. 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.
2. 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.
3. 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

- i) Puts the required percentage of attendance in the 4th semester
- ii) Should not have failed in more than Four backlog subjects of 1st year

For IVC & ITI Lateral Entry Students:

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

4. 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

- i) Puts the required percentage of attendance in the 5th semester
- ii) Should get eligibility to appear for 4th Semester examination.

For IVC & ITI Lateral Entry students:

- iii) Puts the required percentage of attendance in the 5th semester
- iv) Should not have failed in more than Four backlog subjects of 3rd Semester

5. 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

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

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance in 6th semester.
 - ii) should get eligibility to appear for 5th Semester Examination.
6. A candidate shall be promoted to 7th semester provided he/she puts 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

- i) Puts the required percentage of attendance, i.e., 90% in 7th semester Industrial Training
- ii) Should get eligibility to appear for 4th Semester Examination.

For IVC & ITI Lateral Entry students:

- i) Puts the required percentage of attendance, i.e., 90% in 7th semester Industrial Training.
- ii) 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 Industrial training shall commence 10 days after the completion of the last theory examination of 6th Semester.

13. STUDENTS PERFORMANCE EVALUATION

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

1. First Class with Distinction shall be awarded to the candidates who secure an overall aggregate of 75% marks and above.
2. First Class shall be awarded to candidates who secure overall aggregate of 60% marks and above and below 75% marks.
3. Second Class shall be awarded to candidates who secure a pass with an overall aggregate of below 60%.

The Weightage of marks for various year/Semesters which are taken for computing overall aggregate shall be 25% of 1 year marks + 100% of 3rd and subsequent Semesters.

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.

4. 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 from time to time.

15. STRUCTURE OF END EXAMINATION QUESTION PAPER:

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 subject be considered Examination paper is of 3/6/9 hours duration.

- a) Each theory paper consists of Section 'A' and Section 'B'. Section 'A' contains 10 short answer questions. All questions are to be answered and each carries 3 marks Max. Marks: $10 \times 3 = 30$.
Section B contains 8 essay type questions including Numerical questions, out of which 5 questions each carrying 10 marks are to be answered.

Max.Marks: $5 \times 10 = 50$.

Total Maximum Marks: 80.

- b) For Engineering Drawing Subject (107) consist of section 'A' and section 'B'. Section 'A' contains four (4) questions. All questions in section 'A' are to be answered and each carries 5 marks. Max. Marks: $4 \times 5=20$. Section 'B' contains six (6) questions. Out of which four (4) questions to be answered and each question carries 10 Marks. Max. Marks $4 \times 10 = 40$.

- 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 : 60% (of total marks for the subject)

In case of practical examinations with 50 marks, the marks will be worked out basing on the above ratio.

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

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.

17. MAXIMUM PERIOD FOR COMPLETION OF DIPLOMA COURSES:

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 fulfils 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 has completed all the subjects.

Students who fail to fulfill 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 subjects.

Students who fail to fulfill 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

1. A candidate desirous of applying for Photo copy of valued answer script/ scripts should apply within prescribed date from the date of the declaration of the result.
2. Photo copies of valued answer scripts will be issued to all theory subjects and

Drawing subject(s).

3. The Photo copy of valued answer script will be dispatched to the concerned candidate's address as mentioned in the application form by post.
4. No application can be entertained from third parties.

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

1. 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.
2. Re-verification of valued answer script shall be done for all theory subjects and Drawing subject(s).
3. The Re-verification committee constituted by the Secretary, SBTETAP with subject experts shall re-verify the answer scripts.

1) 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).

2) 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 i.e., 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.
4. 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 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. 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 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.

**DIPLOMA IN APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION**

CURRICULUM –16

(FIRST YEAR)

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI-101	English	3	-	90	3	20	80	100
AEI-102	Engineering Mathematics - I	5	-	150	3	20	80	100
AEI-103	Engineering Physics	4	-	120	3	20	80	100
AEI-104	Engineering Chemistry and Environmental Studies	4	-	120	3	20	80	100
AEI-105	Electronic Components and devices	4	-	120	3	20	80	100
AEI-106	Basic Electrical Engineering	4	-	120	3	20	80	100
PRACTICAL:								
AEI-107	Engineering Drawing	-	6	180	3	40	60	100
AEI-108	Electrical Wiring, Electronic Components & Devices Laboratory	-	6	180	3	40	60	100
AEI-109	Physics Laboratory	-	3	90	3	20	30	50
AEI-110	Chemistry Laboratory				3	20	30	50
AEI-111	Computer Fundamentals Laboratory	-	3	90	3	40	60	100
TOTAL		24	18	1260		290	710	1000

AEI-101,102,103,104, 107, 109, 110, 111 Common with all branches.

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

III Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI- 301	Engineering Mathematics – II	5	-	75	3	20	80	100
AEI -302	Electronic circuits	5	-	75	3	20	80	100
AEI -303	Digital Electronics	6	-	90	3	20	80	100
AEI-304	Electronic Measuring Instruments	5	-	75	3	20	80	100
AEI-305	Process Instrumentation	6	-	90	3	20	80	100
PRACTICAL:								
AEI-306	Electronic circuits Lab	-	3	45	3	40	60	100
AEI-307	Digital Electronics Lab	-	3	45	3	40	60	100
AEI- 308	Electronic Measuring Instruments Lab	-	3	45	3	40	60	100
AEI-309	Process Instrumentation Lab	-	6	90	3	40	60	100
TOTAL		27	15	630	-	260	640	900

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

IV Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI -401	Linear IC Applications & Communication Systems	6	-	90	3	20	80	100
AEI -402	Process Control	6	-	90	3	20	80	100
AEI-403	Programming in C	5	-	75	3	20	80	100
AEI-404	Analytical Instrumentation	5	-	75	3	20	80	100
AEI-405	Industrial Electronics & control Systems	5	-	75	3	20	80	100
PRACTICAL:								
AEI-406	Linear IC Applications & e CAD Lab	-	6	90	3	40	60	100
AEI-407	Process control Lab	-	3	45	3	40	60	100
AEI-408	Communication Skills	-	3	45	3	40	60	100
AEI-409	Programming in C lab	-	3	45	3	40	60	100
TOTAL		27	15	630	-	260	640	900

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

V Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI-501	Industrial Management & Smart Technologies	5	-	75	3	20	80	100
AEI-502	Biomedical Instrumentation	6	-	90	3	20	80	100
AEI-503	Micro Controllers & Applications	6	-	90	3	20	80	100
AEI-504	Industrial Automation	5	-	75	3	20	80	100
AEI-505	Instrumentation in Process Industries	5	-	75	3	20	80	100
PRACTICAL:								
AEI-506	PLC & SCADA Lab	-	3	45	3	40	60	100
AEI-507	Micro Controllers Lab	-	6	90	3	40	60	100
AEI-508	Life Skills	-	3	45	3	40	60	100
AEI-509	Analytical and Biomedical Instrumentation Lab	-	3	45	3	40	60	100
	TOTAL	27	15	630	-	260	640	900

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

VI SEMESTER

AEI - 601 INDUSTRIAL TRAINING

S.NO	Subject	Duration	Items	Max Marks	Remarks
1	Practical Training in the Industry	6 Months	1.First Assessment (at the end of 3rd month)	100	
			2. Second Assessment (at the end of 6th month)	100	
			3.Training Report		
			a)Log Book	30	
			b)Record	30	
			4. Seminar	40	
TOTAL			300		

The industrial training shall carry **300** marks and pass marks are **50%**.A candidate failing to secure the minimum marks should complete it at his own expenses. No apprenticeship training stipend is payable in such case

During Industrial training the candidate shall put in a minimum of **90%**attendance.

**DIPLOMA IN APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION**

CURRICULUM –16

(FIRST YEAR)

Subject Code	Name of the Subject	Instruction period / week		Total Period / year	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI-101	English	3	-	90	3	20	80	100
AEI-102	Engineering Mathematics - I	5	-	150	3	20	80	100
AEI-103	Engineering Physics	4	-	120	3	20	80	100
AEI-104	Engineering Chemistry and Environmental Studies	4	-	120	3	20	80	100
AEI-105	Electronic Components and devices	4	-	120	3	20	80	100
AEI-106	Basic Electrical Engineering	4	-	120	3	20	80	100
PRACTICAL:								
AEI-107	Engineering Drawing	-	6	180	3	40	60	100
AEI-108	Electrical Wiring, Electronic Components & Devices Laboratory	-	6	180	3	40	60	100
AEI-109	Physics Laboratory	-	3	90	3	20	30	50
AEI-110	Chemistry Laboratory				3	20	30	50
AEI-111	Computer Fundamentals Laboratory	-	3	90	3	40	60	100
TOTAL		24	18	1260		290	710	1000

AEI-101,102,103,104, 107, 109, 110, 111 Common with all branches.

ENGLISH
(Common to all Branches)

Subject Title : ENGLISH

Subject Code : AEI - 101

Periods per Week : 3

Periods per Year : 90

Time Schedule

Sl No	Major Topics	Titles of the Lessons	No. of Periods	Weightage of Marks	No of Short Answers	No of Long Answers
1	Vocabulary & Need for English	Lessons 1,2 & Regular and essential vocabulary	5	13	1	1
2	Grammar	Lessons 11,12 & 19 to 26	30	31	7	1
3	Reading	Lessons 13 To 18	10	10	-	1
4	Writing	Lessons 27 To 40	30	40	-	4
5	English in Action	Lessons 3 To 10	15	16	2	1
		Total	90	110	10	08

Rationale and Scope

Globalization has ushered in an era of opportunities for those who have the necessary competencies. Effective communication is one among them. This shift demands strengthening of English in polytechnics. In C-16 Curriculum the focus is on the special needs of English for technicians.

. This course aims at integration of the four fold language abilities viz., listening, speaking, reading and writing. The use of English for learning technical subjects and for performing technical functions like, writing reports, giving instructions and interpreting graphics/data is of great

importance. Therefore the curriculum C-16 focuses on improving communicative abilities equipping the students to become industry- ready and employable.

On completion of this course the student will be able to:

- 1.0 Build vocabulary in the direction of future needs
- 2.0 Learn various grammatical structures
- 3.0 Read and comprehend English and understand the details and draw inferences
- 4.0 Learn to be competent in various forms of written communication (writing composition and data interpretation)
- 5.0 Practice spoken communication suited to various situations.

1.0 Extend their vocabulary in the direction of their future needs

- 1.1 Locate words, learn spellings, understand meanings
- 1.2 Pronounce words intelligibly
- 1.3 Find synonyms and antonyms
- 1.4 Use affixation
- 1.5 Comprehend meanings of words by understanding meanings of roots

2.0 Learn various grammatical structures

- 2.1 Identify and use nouns
- 2.2 Identify and use pronouns
- 2.3 Use the present tense
- 2.4 Use the past tense
- 2.5 Use the future tense
- 2.6 Identify and use adjectives
- 2.7 Identify and use adverbs
- 2.8 Use prepositions
- 2.9 Use linkers
- 2.10 State basic sentence structures
- 2.11 Construct different types of sentences
- 2.12 Frame questions to elicit information
- 2.13 Frame questions for confirmation
- 2.14 Use active voice
- 2.15 Use passive voice
- 2.16 Use direct speech
- 2.17 Use indirect speech
- 2.18 Identify and correct errors

3.0 Read and comprehend English

- 3.1 Identify the main ideas
- 3.2 Identify the specific details
- 3.3 Draw inferences
- 3.4 Give contextual meanings of the words
- 3.5 Perceive tone in a text

4.0 Learn to excel in various forms of written communication (writing composition and data interpretation)

- 4.1 Identify components of a good paragraph

- 4.2 Write types of paragraphs
- 4.3 Distinguish between formal and informal letters
- 4.4 Write personal letters
- 4.5 Write leave letters
- 4.6 Write official letters
- 4.7 Write letters of complaints
- 4.8 Prepare a resume
- 4.9 Write a cover letter
- 4.10 Write short messages
- 4.11 Report incidents
- 4.12 Report experiments
- 4.13 Report Industrial visits
- 4.14 Write work done statements
- 4.15 Write maintenance reports
- 4.16 Make notes using Cue method and Mapping method
- 4.17 Summarize Paragraphs
- 4.18 Present and Interpret Data from flow charts, tree diagrams, bar graphs, tables, pie charts

Practice spoken communication suited to various situations.

- 4.19 Use appropriate expressions to greet and take leave
- 4.20 Use proper expressions to make requests
- 4.21 Use apt expressions for asking and giving directions
- 4.22 Use suitable expressions to seek and offer suggestions
- 4.23 Use suitable expressions to state intentions
- 4.24 Use suitable expressions to state feelings
- 4.25 Use appropriate expressions to state agreement and disagreement
- 4.26 Use proper expressions to make complaints
- 4.27 Use suitable expressions to express obligations

Course Material

The textbook prepared by the faculty of English of Polytechnics in AP.

Reference Books

- | | |
|---|--------------------------|
| 1. Essential English Grammar (Intermediate Level) | Raymond Murphy |
| 2. Learn English (A Fun Book of Functional Language, Grammar and Vocabulary) | SantanuSinhaChaudhuri |
| 3. Grammar Builder (Entire Series) | Oxford University Press |
| 4. High School English Grammar (Revised Edition) | Wren and Martin |
| 5. Sentence skills with Readings (fourth Edition, Tata McGraw Hill) | John Langan, Paul Langan |
| 6. Word Power Made Easy | Norman Lewis |
| 7. Spoken English | Shashi Kumar and Dhamija |

:

13	Straight Lines	5	3	6	1	1	0	0	0	0
14	Circle	4	2	5	0	0	0	0	1/2	0
15	Conic Sections	4	3	5	0	0	0	0	1/2	0
	Unit – IV : Differential Calculus									
16	Limits and Continuity	4	2	3	0	1	0	0	0	0
17	Differentiation	18	10	23	1	0	0	1	1	0
S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	Unit - V : Applications of Differentiation	Theory	Practice		R	U	App	R	U	App
18	Geometrical Applications	3	2	5	0	0	0	0	0	1/2
19	Physical Applications	2	2	5	0	0	0	0	0	1/2
20	Maxima and Minima	3	4	5	0	0	0	0	0	1/2
21	Errors and Approximations	2	0	5	0	0	0	0	0	1/2
Total		92	58	110	6	4	0	2	2 1/2	3 1/2
				Marks	18	12	0	20	25	35

R: Remembering type 38 marks
U: Understanding type 37 marks
App: Application type 35 marks

Objectives:

Upon completion of the course the student shall be able to:

UNIT – I

Algebra

1.0 Use Logarithms in engineering calculations

- 1.1 Define logarithm and list its properties.
- 1.2 Distinguish natural logarithms and common logarithms.
- 1.3 Explain the meaning of e and exponential function.
- 1.4 State logarithm as a function and its graphical representation.
- 1.5 Use the logarithms in engineering calculations.

2.0 Resolve Rational Fraction into sum of Partial Fractions in engineering problems

2.1 Define the following fractions of polynomials:

1. Rational,
2. Proper and
3. Improper

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

$$\begin{array}{ll} i) \quad \frac{f(x)}{(x+a)(x+b)(x+c)} & ii) \quad \frac{f(x)}{(x+a)^2(x+b)(x+c)} \\ iii) \quad \frac{f(x)}{(x^2+a)(x+b)} & iv) \quad \frac{f(x)}{(x+a)(x^2+b)^2} \end{array}$$

3.0 Use Matrices for solving engineering problems

- 3.1 Define a matrix and order of a matrix.
- 3.2 State various types of matrices with examples (upto 3rd order square matrices).
- 3.3 Compute sum, scalar multiplication and product of matrices.
- 3.4 Illustrate the properties of these operations such as associative, distributive, commutative properties with examples and counter examples.
- 3.5 Define the transpose of a matrix and write its properties.
- 3.6 Define symmetric and skew-symmetric matrices.
- 3.7 Resolve a square matrix into a sum of symmetric and skew- symmetric matrices with examples in all cases.
- 3.8 Define minor, co-factor of an element of 2X2 and 3x3 square matrices with examples.
- 3.9 Expand the determinant of a 3 x 3 matrix using Laplace expansion formula.
- 3.10 Distinguish singular and non-singular matrices.
- 3.11 State properties of determinants with simple examples.
- 3.12 Define multiplicative inverse of a matrix and list properties of adjoint and inverse.
- 3.13 Compute adjoint and multiplicative inverse of a square matrix.
- 3.14 Representation of system of linear equations (2 variables in 2 equations and 3 variables in 3 equations) in matrix form.
- 3.15 Solve system of linear equations using Cramer's rule.
- 3.16 Solve system of linear equations by matrix inversion method
- 3.17 State elementary row operations.
- 3.18 Solve a system of linear equations by Gauss- Jordan method

UNIT – II

Trigonometry :

4.0 Understand Trigonometric Ratios

- 4.1 Define trigonometric ratios of any angle.
- 4.2 List the values of trigonometric ratios at specified values.
- 4.3 Draw graphs of trigonometric functions
- 4.4 Explain periodicity of trigonometric functions.

5.0 Solve simple problems on Compound Angles

- 5.1 Define compound angles and state the formulae of $\sin(A\pm B)$, $\cos(A\pm B)$, $\tan(A\pm B)$ and $\cot(A\pm B)$
- 5.2 Give simple examples on compound angles to derive the values of $\sin 15^\circ$, $\cos 15^\circ$, $\sin 75^\circ$, $\cos 75^\circ$, $\tan 15^\circ$, $\tan 75^\circ$ etc.
- 5.3 Derive identities like $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$ etc.,
- 5.4 Solve simple problems on compound angles.

6.0 Solve problems using the formulae for Multiple and Sub- multiple Angles

- 6.1 Derive the formulae of multiple angles $2A$, $3A$ etc and sub multiple angles $A/2$ in terms of angle A of trigonometric functions.
- 6.2 Derive useful allied formulas like $\sin A = (1 - \cos 2A)/2$ etc.,
- 6.3 Solve simple problems using the above formulae

7.0 Apply Transformations for solving the problems in Trigonometry

- 7.1 Derive the formulae on transforming sum or difference of two trigonometric ratios in to a product and vice versa- examples on these formulae.

8.0 Use Inverse Trigonometric Functions for solving engineering problems

- 8.1 Explain the concept of the inverse of a trigonometric function by selecting an appropriate domain and range.
- 8.2 Define inverses of six trigonometric functions along with their domains and ranges.
- 8.3 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.

8.4 State various properties of inverse trigonometric functions and identities like $\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ etc.

8.5 Derive formulae like $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \left(\frac{x + y}{1 - xy} \right)$, where $x \geq 0, y \geq 0, xy < 1$ etc., and solve simple problems.

9.0 Solve Trigonometric Equations in engineering applications

9.1 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.

9.2 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.

10.0 Appreciate Properties of triangles and their solutions

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

10.2 Explain the formulae for $\sin A/2$, $\cos A/2$, $\tan A/2$ and $\cot A/2$ in terms of semi-perimeter and sides a, b, c .

10.3 List various formulae for the area of a triangle.

10.4 Solve problems using the above formulae.

10.5 Solve a triangle when (i) three sides, (ii) two sides and an included angle, (iii) two sides and an opposite angle-case of two solutions and (iv) one side and two angles are given.

11.0 Represent the Hyperbolic Functions in terms of logarithm functions

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

11.2 Represent inverse hyperbolic functions in terms of logarithms.

12.0 Represent Complex numbers in various forms

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

12.2 Define the operations on complex numbers with examples.

12.3 Define amplitude of a complex number

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

12.5 State DeMoivre's theorem and its applications to complex numbers e.g., finding the roots, powers, simplifications of a complex number with illustrative examples

UNIT - III

Coordinate Geometry

13.0 Solve the problems on Straight lines

- 13.1 Write the different forms of a straight line – point slope form, two point form, intercept form, normal form and general form
- 13.2 Solve simple problems on the above forms
- 13.3 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.

14.0 Solve the problems on Circles

- 14.1 Define locus of a point – circle and its equation.
- 14.2 Find the equation of a circle given
 - (i) Center and radius
 - (ii) Two ends of a diameter
 - (iii) Centre and a point on the circumference
 - (iv) Three non collinear points
- 14.3 Write the general equation of a circle and find the centre and radius.

15.0 Appreciate the properties of Conics in engineering applications

- 15.1 Define a conic section.
- 15.2 Explain the terms focus, directrix, eccentricity, axes and latus rectum of a conic with illustrations.
- 15.3 Find the equation of a conic when focus, directrix and eccentricity are given
- 15.4 Describe the properties of Parabola, Ellipse and Hyperbola in standard form.

UNIT - IV

Differential Calculus

16.0 Use the concepts of Limit and Continuity for solving the problems

- 16.1 Explain the concept of limit and meaning of $\lim_{x \rightarrow a} f(x) = l$ and state the properties of limits.

- 16.2 Mention the Standard limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$, $\lim_{x \rightarrow 0} \frac{\sin x}{x}$, $\lim_{x \rightarrow 0} \frac{\tan x}{x}$, $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$, $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$,

$$\lim_{x \rightarrow 0} (1 + x)^{\frac{1}{x}}, \quad \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x \quad (\text{All without proof}).$$

- 16.3 Solve the problems using the above standard limits

16.4 Evaluate the limits of the type $\lim_{x \rightarrow l} \frac{a x^2 + b x + c}{\alpha x^2 + \beta x + \gamma}$ and $\lim_{x \rightarrow \infty} \frac{f(x)}{g(x)}$

16.5 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.

17.0 Appreciate Differentiation and its meaning in engineering situations

17.1 State the concept of derivative of a function $y = f(x)$ – definition, first principle as

$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ and also provide standard notations to denote the derivative of a

function.

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

17.3 Find the derivatives of elementary functions like x^n , a^x , e^x , $\log x$, $\sin x$, $\cos x$, $\tan x$, $\text{Sec}x$, $\text{Cosec}x$ and $\text{Cot} x$ using the first principles.

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

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

17.6 Explain the method of differentiation of a function of a function (Chain rule) with illustrative examples such as

$$\text{(i)} \sqrt{t^2 + \frac{2}{t}} \quad \text{(ii)} x^2 \sin 2x \quad \text{(iii)} \frac{x}{\sqrt{x^2 + 1}} \quad \text{(iv)} \log(\sin(\cos x)).$$

17.7 Find the derivatives of Inverse Trigonometric functions and examples using the Trigonometric transformations.

17.8 Explain the method of differentiation of a function with respect to another function and also differentiation of parametric functions with examples.

17.9 Find the derivatives of hyperbolic functions.

17.10 Explain the procedures for finding the derivatives of implicit function with examples.

17.11 Explain the need of taking logarithms for differentiating some functions with examples like $[f(x)]^{g(x)}$.

17.12 Explain the concept of finding the higher order derivatives of second and third order with examples.

17.13 Explain the concept of functions of several variables, partial derivatives and difference between the ordinary and partial derivatives with simple examples.

17.14 Explain the definition of Homogenous function of degree n

17.15 Explain Euler's theorem for homogeneous functions with applications to simple problems.

UNIT - V

Applications of the Differentiation

18.0 Understand the Geometrical Applications of Derivatives

- 18.1 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.
- 18.2 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.
- 18.3 Find the lengths of tangent, normal, sub-tangent and sub normal at any point on the curve $y=f(x)$.
- 18.4 Explain the concept of angle between two curves and procedure for finding the angle between two given curves with illustrative examples.

19.0 Understand the Physical Applications of Derivatives

- 19.1 Explain the derivative as a rate of change in distance-time relations to find the velocity and acceleration of a moving particle with examples.
- 19.2 Explain the derivative as a rate measurer in the problems where the quantities like volumes, areas vary with respect to time- illustrative examples.

20.0 Use Derivatives to find extreme values of functions

- 20.1 Define the concept of increasing and decreasing functions.
- 20.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.
- 20.3 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima.
- 20.4 Solve problems on maxima and minima in applications like finding areas, volumes, etc.

21.0 Use Derivatives to find Errors and Approximations

- 21.1 Find the absolute error, approximate error, relative error and percentage error in functions of single variable.

COURSE CONTENT

Unit-I :

Algebra

1. Logarithms :

Definition of logarithm and its properties, natural and common logarithms; the meaning of e and exponential function, logarithm as a function and its graphical representation.

2. Partial Fractions :

Rational, proper and improper fractions of polynomials. Resolving rational fractions into their partial fractions covering the types mentioned below:

$$\begin{array}{ll} i) \quad \frac{f(x)}{(x+a)(x+b)(x+c)} & ii) \quad \frac{f(x)}{(x+a)^2(x+b)(x+c)} \\ iii) \quad \frac{f(x)}{(x^2+a)(x+b)} & iv) \quad \frac{f(x)}{(x+a)(x^2+b)^2} \end{array}$$

Matrices:

3. Definition of 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 2 or 3 variables-Solutions by Cramer's rule, Matrix inversion method-examples-Elementary row operations on matrices -Gauss-Jordan method to solve a system of equations.

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 $\sin(A \pm B)$, $\cos(A \pm B)$, $\tan(A \pm B)$, $\cot(A \pm B)$, and related identities with problems.
6. Multiple and sub multiple angles: trigonometric ratios of multiple angles $2A, 3A$ and submultiple angle $A/2$ 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 :
 $\sin x = k$, $\cos x = k$, $\tan x = k$.
Solutions of simple quadratic equations, equations involving usage of transformations- problems.

10. Properties and solutions of triangles: relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule-area of a triangle- solving 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- Amplitude (polar) form, Exponential form (Euler) form of a complex number- Problems. DeMoivre's Theorem and its applications in complex numbers- Simple problems.

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) center 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 center, radius.
15. Definition of a conic section, equation of a conic when focus directrix and eccentricity are given. Properties of parabola, ellipse and hyperbola, 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. Angle between the curves - 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. Applications of derivative in finding errors and approximations of functions and simple problems.

Reference Books :

1. A text book of matrices by Shanti Narayan,
2. Plane Trigonometry, by S.L Loney
3. Co-ordinate Geometry, by S.L Loney
4. Thomas Calculus, Pearson Addison-Wesley publishers
5. Calculus – I, by Shanti Narayan and Manicavachgam Pillai, S.V Publications

ENGINEERING PHYSICS

Subject Title	:	Engineering Physics
Subject Code	:	AEI -103
Periods per week	:	04
Total periods per year	:	120

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type	Essay Type
1.	Units and Dimensions	08	03	1	-
2.	Elements of Vectors	12	13	1	1
3.	Kinematics	14	13	1	1
4.	Friction	08	10	-	1
5.	Work, Power and Energy	12	10	-	1
6.	Simple Harmonic Motion	12	13	1	1
7.	Heat & Thermodynamics	12	13	1	1
8.	Sound	12	13	1	1
9.	Properties of matter	10	06	2	-
10.	Electricity & magnetism	12	13	1	1
11.	Modern Physics	08	03	1	-
	Total:	120	110	10	8

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Units and dimensions

- 1.1 Explain the concept of Units
- 1.2 Define the terms
 - a) Physical quantity, b) Fundamental physical quantities and
 - c) Derived physical quantities
- 1.3 Define unit
- 1.4 Define fundamental units and derived units
- 1.5 State SI units with symbols
- 1.6 State Multiples and submultiples in SI system
- 1.7 State Rules of writing S.I. units
- 1.8 State advantages of SI units
- 1.9 Define Dimensions
- 1.10 Write Dimensional formulae
- 1.11 Derive dimensional formulae of physical quantities
- 1.12 List dimensional constants and dimensionless quantities
- 1.13 State the principle of Homogeneity of Dimensions
- 1.14 State the applications of Dimensional analysis
- 1.15 State the limitations of dimensional analysis
- 1.16 Solve problems

2.0 Understand the concept of Elements of Vectors

- 2.1 Explain the concept of Vectors
- 2.2 Define Scalar and Vector quantities
- 2.3 Give examples for scalar and vector quantities
- 2.4 Represent vectors graphically
- 2.5 Classify the Vectors

- 2.6 Resolve the vectors
- 2.7 Determine the Resultant of a vector by component method
- 2.8 Represent a vector in space using unit vectors (i, j, k)
- 2.9 State triangle law of addition of vectors
- 2.10 State parallelogram law of addition of vectors
- 2.11 Illustrate parallelogram law of vectors in case of flying bird and sling.
- 2.12 Derive expression for magnitude and direction of resultant of two vectors
- 2.13 State polygon law of addition of vectors
- 2.14 Explain subtraction of vectors
- 2.15 Define Dot product of two vectors with examples (Work done, Power)
- 2.16 Mention the properties of Dot product
- 2.17 Define Cross products of two vectors with examples (Torque, Linear velocity)
- 2.18 Mention the properties of Cross product.
- 2.19 Solve the related numerical problems

3.0 Understand the concept of Kinematics

- 3.1 Write the equations of motion in a straight line
- 3.2 Explain the acceleration due to gravity
- 3.3 Derive expressions for vertical motion
 - a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
- 3.4 Derive height of a tower when a body projected vertically upwards from the top of a tower.
- 3.5 Explain projectile motion with examples
- 3.6 Explain Horizontal projection
- 3.7 Derive an expression for the path of a projectile in horizontal projection
- 3.8 Explain oblique projection
- 3.9 Derive an expression for the path of projectile in oblique projection
- 3.10 Derive formulae for projectile in oblique projection
 - a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
 - e) Horizontal Range, f) Maximum range
- 3.11 Solve the related numerical problems

4.0 Understand the concept of Friction

- 4.1 Define friction
- 4.2 Classify the types of friction and define
- 4.3 Explain the concept of Normal reaction
- 4.4 State the laws of friction
- 4.5 Define coefficients of friction
- 4.6 Explain the Angle of friction
- 4.7 Derive an expression for acceleration of a body on a rough horizontal surface
- 4.8 Derive an expression for the displacement and time taken to come to rest over a rough horizontal surface
- 4.9 Define Angle of repose
- 4.10 Derive expressions for acceleration of a body on a smooth inclined plane (up and down)
- 4.11 Derive expressions for acceleration of a body on a rough inclined plane (up and down)
- 4.12 List the Advantages and Disadvantages of friction
- 4.13 Mention the methods of minimizing friction
- 4.14 Solve the related numerical problems

5.0 Understand the concepts of Work, Power, and Energy

- 5.1 Define the terms 1. Work, 2. Power and Energy

- 5.2 State SI units and dimensional formulae for 1. Work, 2. Power, and Energy
- 5.3 Define potential energy and state examples
- 5.4 Derive the expression for Potential energy
- 5.5 Define kinetic energy and state examples
- 5.6 Derive the expression for kinetic energy
- 5.7 State and derive Work- Energy theorem
- 5.8 Derive the relation between Kinetic energy and momentum
- 5.9 State the law of conservation of energy and mention examples
- 5.10 Verify the law of conservation of energy in the cases of a freely falling body and vertically projected body in the upward direction
- 5.11 Solve the related numerical problems

6.0 Understand the concept of Simple harmonic motion

- 6.1 Define Simple harmonic motion
- 6.2 Give examples for Simple harmonic motion
- 6.3 State the conditions of Simple harmonic motion
- 6.4 Explanation of SHM in terms of projection of circular motion on any one of the diameters of the circular path
- 6.5 Derive expression for displacement
- 6.6 Derive expression for velocity
- 6.7 Derive expression for acceleration
- 6.8 Derive expression for Time period and frequency of S H M
- 6.9 Define phase of S H M and explain from the expression of displacement
- 6.10 Define Ideal simple pendulum and derive expression for Time period of simple pendulum
- 6.11 State the laws of motion of simple pendulum and mention formulae
- 6.12 Solve the related numerical problems

7.0 Understand the concept of Heat and thermodynamics

- 7.1 Explain the concept of expansion of gases
- 7.2 State and explain Boyle's law and also express it in terms of density
- 7.3 Define absolute zero temperature
- 7.4 Explain absolute scale of temperature
- 7.5 State Charles laws in terms of absolute temperature and explain
- 7.6 Define ideal gas and distinguish from real gas
- 7.7 Derive Ideal gas equation
- 7.8 Define Specific gas constant and Universal gas constant
- 7.9 Explain why universal gas constant is same for all gases
- 7.10 State SI unit and dimensional formula of universal gas constant
- 7.11 Calculate the value of universal gas constant
- 7.12 State the gas equation in different forms (as a function of density and mass)
- 7.13 Distinguish between r and R
- 7.14 State and Explain Isothermal process
- 7.15 State and Explain adiabatic process
- 7.16 Distinguish between isothermal and adiabatic processes
- 7.17 State first and second laws of thermodynamics and state applications
- 7.18 Define specific heats & molar specific heats of a gas and differentiate them
- 7.19 Derive the relation $C_p - C_v = R$ (Mayer's Equation)
- 7.20 Solve the related numerical problems

8.0 Understand the concept of Sound

- 8.1 Define the term sound

- 8.2 Explain longitudinal and transverse wave motion and state differences
- 8.3 Distinguish between musical sound and noise
- 8.4 Explain noise pollution and state SI unit for intensity level of sound
- 8.5 Explain causes of noise pollution
- 8.6 Explain effects of noise pollution
- 8.7 Explain methods of minimizing noise pollution
- 8.8 Explain the phenomenon of beats
- 8.9 State the applications of beats
- 8.10 Define Doppler effect
- 8.11 List the Applications of Doppler effect
- 8.12 Define reverberation and reverberation time
- 8.13 Write Sabine's formula and name the parameters contained
- 8.14 Define and Explain echoes and also state its applications
- 8.15 State conditions of good auditorium
- 8.16 Solve the related numerical problems

9.0 Understand the properties of matter

- 9.1 Define the term Elasticity
- 9.2 Define the terms stress and strain and also define different types of stress and strain
- 9.3 State the units and dimensional formulae for stress and strain
- 9.4 State and explain Hooke's law
- 9.5 Define surface tension and state examples
- 9.6 Explain Surface tension with reference to molecular theory
- 9.7 Define angle of contact
- 9.8 Define capillarity
- 9.9 Write the formula for surface tension based on capillarity and name the parameters
- 9.10 Explain the concept of Viscosity
- 9.11 Mention examples of Viscosity
- 9.12 State Newton's formula for viscous force and explain
- 9.13 Define co-efficient of viscosity and write its units and dimensional formula
- 9.14 Explain the effect of temperature on viscosity of liquids and gases
- 9.15 State Poiseulle's equation for Co-efficient of viscosity and name the physical quantities involved
- 9.16 Solve the related numerical problems

10.0 Understand the concept of Electricity and Magnetism

- 10.1 Explain the concept of Electricity
- 10.2 State Ohm's law and write the formula
- 10.3 Explain Ohm's law
- 10.4 Define specific resistance, conductance and state their units
- 10.5 State Kichoff's laws
- 10.6 Explain Kichoff's laws
- 10.7 Describe Wheatstone's bridge with legible sketch
- 10.8 Derive an expression for balancing condition of Wheatstone's bridge
- 10.9 Describe Meter Bridge experiment for the determination of resistivity with a neat circuit diagram
- 10.10 Write the formula in Meter Bridge to determine specific resistance
- 10.11 Explain the concept of magnetism
- 10.12 State the Coulomb's inverse square law of magnetism
- 10.13 Define magnetic field and magnetic lines of force and write the properties of magnetic lines of force
- 10.14 State the Magnetic induction field strength and mention its units and dimensional

formula

10.15 Derive an expression for the moment of couple on a bar magnet placed in a uniform magnetic field

10.16 Derive Magnetic induction field strength at a point on the axial line

10.17 Derive Magnetic induction field strength at a point on the equatorial line

10.18 Solve the related numerical problems

11.0 Understand the concept of Modern physics

11.1 State and Explain Photo-electric effect

11.2 Write Einstein's photoelectric equation and explain

11.3 State laws of photoelectric effect

11.4 Explain the Working of photoelectric cell

11.5 List the Applications of photoelectric effect

11.6 Recapitulate refraction of light and its laws

11.7 Define critical angle

11.8 Explain the Total Internal Reflection

11.9 Explain the principle and working of Optical Fiber

11.10 Mention types of optical fibers

11.11 List the applications of Optical Fiber

11.12 Define super conductor and superconductivity and mention examples for superconductors

11.13 State the properties of superconducting materials

11.14 List the applications of superconductors

COURSE CONTENT

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- - 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. Kinematics

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 - problems

4. Friction:

Introduction to friction- Causes- Types of friction- Laws of friction- Angle of repose-Angle of friction— Motion of a body over a horizontal surface- smooth inclined plane- 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 r and R - Isothermal and adiabatic processes- Laws of thermodynamics- Specific heats - molar specific heats of a gas – Derivation of Mayer's Equation- 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- 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

REFERENCE BOOKS

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

Blue Print for setting question paper at different levels

S.No	Major Topics	No. of Periods	Weightage of Marks	Short answer type			Essay type		
				K	U	A	K	U	A
1.	Units and Dimensions	08	03	1	0	0	0	0	0
2.	Elements of Vectors	12	13	0	0	1	0	1	0
3.	Kinematics	14	13	0	1	0	1	0	0
4.	Friction	08	10	0	0	0	0	1	0
5.	Work, Power and Energy	12	10	0	0	0	0	1	0
6.	Simple Harmonic Motion	12	13	0	0	1	0	1	0
7.	Heat & Thermodynamics	12	13	0	1	0	1	0	0
8.	Sound	12	13	0	1	0	0	0	1
9.	Properties of Matter	10	06	1	1	0	0	0	0
10.	Electricity & magnetism	12	13	0	1	0	0	1	0
11.	Modern Physics	08	03	1	0	0	0	0	0
Total:		120	110	3	5	2	2	5	1

ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES
(Common to all Branches)

Subject Title : Engineering Chemistry & Environmental Studies
Subject Code : AEI-104
Periods per week : 04
Total periods per year : 120

Scheme of instruction and examination Time Schedule

S.No	Major topic	No of Periods	Weight age of marks	Short type (3marks)			Essay type (10 marks)			remarks
				R	U	A	R	U	A	
A. ENGINEERING CHEMISTRY										
1	Fundamentals of Chemistry	18	16	1	0	1	0	1	0	
2	Solutions	10	8	1	0	0	0	0	1/2	5 mark
3	Acids and bases	10	8	0	0	1	0	1/2	0	5 mark
4	Principles of Metallurgy	10	10	0	0	0	1	0	0	
5	Electrochemistry	14	13	0	1	0	0	0	1	
6	Corrosion	8	10	0	0	0	0	1	0	
7	Water Technology	14	13	1	0	0	1	0	0	
8	Polymers	12	13	1	0	0	1	0	0	
9	Fuels	6	3	1	0	0	0	0	0	
B. ENVIRONMENTAL STUDIES		18	16	1	1	0	0	1	0	
total		120	110	6	2	2	3	3 1/2	1 1/2	
				18	6	6	30	35	15	

OBJECTIVES

Upon completion of the course the student shall be able to

A. ENGINEERING CHEMISTRY

1.0 Understand the concept of Atomic structure

- 1.1 Explain the charge and mass of fundamental particles of an atom (electron, proton and neutron)
- 1.2 Explain the concept of atomic number and mass number.
- 1.3 State the Postulates of Bohr's atomic theory and its limitations.
- 1.4 Explain the significance of four Quantum numbers.

- 1.5 Explain 1. Aufbau principle, 2 Pauli's exclusion principle 3 Hund's rule.
- 1.6 Define Orbital in an atom.
- 1.7 Draw the shapes of s, p and d-Orbitals .
- 1.8 Distinguish between Orbit and Orbital
- 1.9 Write the electronic configuration of elements up to atomic number 30
- 1.10 Explain the significance of chemical bonding
- 1.11 Explain the Postulates of Electronic theory of valency
- 1.12 Define the types of Chemical bonding viz., Ionic, Covalent bonds.
- 1.13 Explain the types of Chemical bonding viz., Ionic, Covalent bonds with examples.
- 1.14 Explain bond formation in NaCl and MgO.
- 1.15 List Properties of Ionic compounds
- 1.16 Explain bond formation in Hydrogen molecule, Oxygen molecule, and Nitrogen molecule using Lewis dot method.
- 1.17 List Properties of Covalent compounds
- 1.18 Distinguish between properties of ionic compounds and covalent compounds.
- 1.19 Structures of ionic solids-define a) Unit cell b) co-ordination number.
- 1.20 Structures of Unit cells of NaCl and CsCl.
- 1.21 Define the term. Oxidation number.
- 1.22 Calculate the Oxidation Number of underlined atoms in the following examples
a) $\underline{K}\underline{Mn}O_4$ b) $K_2\underline{Cr}_2O_7$ c) $H\underline{N}O_3$ d) $H_2\underline{S}O_4$ e) $\underline{C}lO_4^-$ f) $\underline{N}H_4^+$
- 1.23 Differentiate between Oxidation Number and Valency

2.0 Calculate Molarity and Normality of given Solution

- 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
- 2.4 Problems on 'Mole concept'
- 2.5 Define the terms 1. Atomic weight, 2. Molecular weight and 3. Equivalent weight
- 2.6 Calculate Molecular weight and Equivalent weight of given Acids, (HCl, H_2SO_4, HNO_3) Bases ($NaOH, KOH, Ca(OH)_2$) and Salts ($NaCl, Na_2CO_3, CaCO_3$)
- 2.7 Define 1. Molarity, 2. Normality of solutions
- 2.8 Solve 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 Understand the concepts of Acids and bases

- 3.1 Explain Arrhenius theory of Acids and Bases
- 3.2 State the limitations of Arrhenius theory of Acids and Bases
- 3.3 Explain Bronsted–Lowry theory of acids bases
- 3.4 State the limitations of Bronsted–Lowry theory of acids bases
- 3.5 Explain Lewis theory of acids and bases
- 3.6 State the limitations of Lewis theory of acids and bases
- 3.7 Explain the Ionic product of water
- 3.8 Define Ph and explain Sorenson scale
- 3.9 Solve the Numerical problems on Ph (Strong Acids and Bases)
- 3.10 Define Buffer solution
- 3.11 Give atleast three examples for Buffer solutions
- 3.12 State the applications of Buffer solution

4.0 Understand the Principles of Metallurgy

- 4.1 List at least eight Characteristics of Metals
- 4.2 Distinguish between Metals and Non Metals
- 4.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Fluxand 5.Slag
- 4.4 Describe the methods of concentration of Ore; 1.Handpicking,2.Levigation, and3. Froth Floation
- 4.5 Describe the methods involved in extraction of crude metal- Roasting, Calcination and Smelting.
- 4.6 Explain the purification of Metals by Electrolytic Refining
- 4.7 Define an Alloy
- 4.8 Write the Composition of the following alloys:1.Brass, 2. Germansilver, 3 Nichrome
- 4.9 List the uses of the following Alloys: 1. Brass, 2.Germansilver, 3.Nichrome

5.0 Understand the concepts of Electrochemistry

- 5.1 Define the terms1. Conductor, 2. Insulator, 3.Electrolyte 4.Non–electrolyte
- 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. Electrochemical equivalent (e) and their relation.
- 5.6 Solve the Numerical problems based on Faraday's laws of electrolysis
- 5.7 Define Galvanic cell
- 5.8 Explain the construction and working of Galvanic cell
- 5.9 Distinguish between electrolytic cell and galvanic cell

- 5.10 Explain the electrode potentials and standard electrode potentials
- 5.11 Explain the electrochemical series and its significance
- 5.12 Explain the emf of a cell.
- 5.13 Solve the numerical problems on emf of the cell based on standard electrode potentials.

6.0 Understand the concept of 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 Understand the concept of Water Technology

- 7.1 State the various Sources of water like Surface water and sub-surface water.
- 7.2 Define the terms soft water and hard water with respect to soap consumption.
- 7.3 Define the term hardness of water
- 7.4 Types of hardness of water 1. Temporary hardness 2. Permanent hardness
- 7.5 List the salts that causing hardness of water (with Formulae)
- 7.6 State the disadvantages of using hard water in industries
- 7.7 Define Degree of hardness, units of hardness (mg/L) or ppm.
- 7.8 Explain the methods of softening of hard water :a) Ion-Exchange process, b) Permutit process or zeolite process
- 7.9 Concept of Osmosis and Reverse Osmosis with examples .
- 7.10 State the applications of Reverse Osmosis.
- 7.11 State essential qualities of drinking water.

8.0 Understand the concepts of Polymers

- 8.1 Explain the concept of polymerisation
- 8.2 Describe the methods of polymerization a) addition polymerization of Ethylene b) condensation polymerization of phenol and formaldehyde (Only flow chart i.e. without chemical equations)
- 8.3 Define the term plastic
- 8.4 Classify the plastics with examples

- 8.5 Distinguish between thermo and thermosetting plastics
- 8.6 List the Characteristics of plastics
- 8.7 State the advantages of plastics over traditional materials
- 8.8 State the disadvantages of using plastics.
- 8.9 Explain the methods of preparation of the following plastics:
1.Polythene, 2. PVC, 3.Teflon, 4. Polystyrene and 5. Urea formaldehyde
- 8.10 Explain the uses of the following plastics:
1.Polythene, 2. PVC, 3.Teflon, 4.Polystyrene and 5. Urea formaldehyde
- 8.11 Define the term natural rubber
- 8.12 write the structural formula of Natural rubber
- 8.13 Explain the processing of Natural rubber from latex
- 8.14 List the Characteristics of natural rubber
- 8.15 Explain the process of Vulcanization
- 8.16 List the Characteristics of Vulcanized rubber
- 8.17 Define the term Elastomer
- 8.18 Describe the preparation of the following synthetic rubbers a) Buna-s and b) Neoprene rubber
- 8.19 List the uses of the following synthetic rubbers a) Buna-s and b) Neoprene rubber

9.0 Understand the concepts of Fuels

- 9.1 Define the term fuel
- 9.2 Classify the fuels based on physical state—solid, liquid and gaseous fuels,
- 9.3 Classify the fuels based on occurrence-primary and secondary fuels
- 9.4 List the characteristics of good fuel
- 9.5 State the composition and uses of gaseous fuels:
a) water gas, b) producer gas, c) natural gas, d) coal gas, e) Biogas and f) acetylene

B. ENVIRONMENTAL STUDIES

- 1.1 Define the term environment
- 1.2 Explain the scope and importance of environmental studies
- 1.3 Segments of environment 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere,
- 1.4 Define the following terms 1)Pollutant, 2).Pollution, 3).Contaminant, 4)receptor, 5)sink, 6) particulates, 7)dissolved oxygen, 8)Threshold limitvalue, 9).BOD, and 10).COD 11) eco system .
- 1.5 State the renewable and non renewable energy sources with examples.
- 1.6 Define the terms:
1). Producers, 2). Consumer sand 3). Decomposers with examples.
- 1.7 Explain biodiversity and threatsto biodiversity
- 1.8 Define air pollution
- 1.9 Classify the air pollutants-based on origin and physical state of matter.

- 1.10 Explain the causes of Air pollution.
- 1.11 Explain the effects of air pollution on human beings, plants and animals.
- 1.12 State the uses of forest resources.
- 1.13 State the deforestation and its causes and effects.
- 1.14 Explain the 1.) Green house effect , 2) Ozone layer depletion and 3) Acid rain.
- 1.15 Explain the methods of control of Air pollution
- 1.16 Define Water pollution
- 1.17 Explain the causes of Water pollution
- 1.18 Explain the effects of Water pollution on living and Non-living things.
- 1.19 Explain the methods of control of Water pollution.

COURSE CONTENT

A. ENGINEERING CHEMISTRY

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, CsCl.

, **Oxidation Number**- calculations, differences between Oxidation Number and Valency.

2. Solutions

Introduction-concentration methods – Mole concept, Molarity, Normality, Equivalent weights, 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 and related numerical problems–Buffer solutions–Applications.

4. Principles of Metallurgy

Characteristics of Metals and distinction between Metals and Non Metals, Metallurgy, ore, Gangue, Flux, 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, insulators, electrolytes– electrolysis – Faraday's laws of electrolysis-numerical problems – Galvanic cell – standard electrode potential – electrochemical series– emf and numerical problems on emf of a cell

6. Water technology

Introduction–soft and hard water–causes of hardness–types of hardness –disadvantages of hard water – degree of hardness (ppm) – softening methods – permutit process – ion exchange process– drinking water –Osmosis, Reverse Osmosis –Applications of Reverse osmosis

- 7. Introduction - factors influencing corrosion - composition, stress and concentration cells–

rusting of iron and its mechanism – prevention of corrosion by coating methods, cathodic protection

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: 1. Polythene 2. PVC 3. Teflon 4. Polystyrene 5. Urea formaldehyde – Rubber – Natural rubber – processing from latex – Vulcanization – Elastomers, Buna-s, Neoprene rubber and their uses.

9. **Fuels**

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

B. **ENVIRONMENTAL STUDIES**

Introduction – environment – scope and importance of environmental studies important terms – renewable and non-renewable energy sources – Concept of ecosystem, producers, consumers and decomposers – Biodiversity, definition and threats to Biodiversity.

Air pollution – causes – Effects – forest sources: uses and over exploitation, deforestation, acid rain, greenhouse effect – ozone depletion – control of air pollution – Water pollution – causes – effects – control measures,

REFERENCE BOOKS

- | | | |
|----|--------------------------------|--|
| 1. | Intermediate chemistry Vol 1&2 | Telugu Academy |
| 2. | Intermediate chemistry Vol 1&2 | Vikram Publishers |
| 3. | Intermediate chemistry Vol 1&2 | Vignan Publishers & Deepthi Publishers |
| 4. | Engineering Chemistry | Jain & Jain |
| 5. | Engineering Chemistry | O.P. Agarwal, Hi-Tech. |
| 6. | Engineering Chemistry | Sharma |
| 7. | Engineering Chemistry | A.K. De |

ELECTRONIC COMPONENTS AND DEVICES

Subject Title : **Electronic Components and Devices**
Subject Code : **AEI-105**
Periods/Week : **04**
Periods/Year : **120**

TIME SCHEDULE

S. No	Major Topics	No. of period	Weightage of marks	Short Answer Questions	Essay Questions
1	Resistors	15	13	1	1
2	Capacitors	12	13	1	1
3	Inductors	12	13	1	1
4	Switches and Relays	13	13	1	1
5	Microphones and Loud speakers	13	08	1	½
6	Semiconductor Diode and Its applications	17	16	2	1
7	Transistors	14	13	1	1
8	Power supplies and batteries	16	13	1	1
9	PCBs	08	08	1	½
Total		120	110	10	8

OBJECTIVES: Up on completion of the subject the student shall be able to:

1.0 Understand the working and constructional details of different types of Resistors.

- 1.1 Define the term resistance.
- 1.2 Classify types of resistors.
- 1.3 Derive the relation $R = \rho l/a$
- 1.4 List the specifications of a resistor, and state their importance.
- 1.5 Explain the Colour Code of a Resistor.
- 1.6 Find the value of Resistance by using colour code.
- 1.7 Find the equivalent resistance when two resistors are connected in series.
- 1.8 Find the equivalent resistance when two resistors are connected in parallel.
- 1.9 Simple problems on series and parallel connected resistors.
- 1.10 Explain the effect of temperature on resistance.
- 1.11 Define temperature co-efficient of resistance and derive the relation $R_t = R_o(1 + \alpha_o t)$
- 1.12 Compare the features of carbon film metal film and wire wound resistors with respect to size, power rating, tolerance, temperature coefficient and applications
- 1.13 Describe constructional details and working of carbon and wire wound potentiometers.
- 1.14 Compare the features of carbon and wire wound potentiometers
- 1.15 Mention the need for tapering in potentiometers.
- 1.16 Describe constructional details and working of rheostat and list its applications.
- 1.17 List the common faults in resistors'

2.0 Familiarise with different types of capacitors used in electronic circuits and their applications

- 2.1 Define the term capacitance.
- 2.2 Classify the types of capacitors.
- 2.3 List the specifications of a capacitor and state their importance
- 2.4 State the factors affecting the capacitance of a capacitor.
- 2.5 Define Di-electric constant and Di-electric strength of a material.
- 2.6 State the properties, range of values and applications of paper, mica, glass, ceramic and electrolytic capacitors.
- 2.7 List types of variable capacitors and mention their applications.
- 2.8 List losses in capacitors.
- 2.9 Find equivalent capacitance of Capacitors connected in i) series, and ii) parallel.
- 2.10 Simple problems on series and parallel connected capacitors.
- 2.11 List the common faults in capacitors.

3.0 Familiarise with different types of inductors used in electronic circuits and their applications

- 3.1 Define self-inductance, mutual inductance and coefficient of coupling.
- 3.2 Draw the symbols of iron core, air core, and ferrite core inductors.
- 3.3 Simple problems on self inductance, mutual inductance and coefficient of coupling
- 3.4 Classify inductors.
- 3.5 List the specifications of inductors.
- 3.6 List the various core materials used in the construction of inductors.
- 3.7 Find equivalent inductance when they are connected in series aiding and opposing.
- 3.8 Write the expressions of inductance when they are connected in parallel aiding and opposing (No derivation).
- 3.9 Describe the constructional features of A.F. and R.F chokes.
- 3.10 List applications of A.F. and R.F chokes.

4.0 Familiarise with different types of switches, Connectors and Relays.

- 4.1 Define a switch.
- 4.2 Classify switches according to poles and throws (SPST, SPDT, DPST, DPDT, Multi-pole multi-throw).
- 4.3 Sketch the I.S.I symbols of SPST, SPDT, DPST, DPDP, Multi-pole multi throw switches.
- 4.4 List different types of switches.
- 4.5 Explain the working of toggle, rotary, slider switches and mention their applications.
- 4.6 State the need of fuse in electronic equipment.
- 4.7 Mention different types of fuses.
- 4.8 Mention the ratings of fuse.
- 4.9 State the necessity of connectors in electronic circuits.
- 4.10 List different types of connectors.
- 4.11 Mention the use of MCB.
- 4.12 Define a relay.
- 4.13 Classify different relays based on principle of operation, polarization and application.
- 4.14 Mention specifications and applications of relays.
- 4.15 Explain the construction & working of general-purpose electromagnetic relay.
- 4.16 List the contact materials used in relays and list their characteristics.

5.0 Understand the different types of microphones and loud speakers.

- 5.1 Define Microphone.
- 5.2 List the different types of microphones based on impedance, polar characteristics and principle of working.
- 5.3 Explain the working of carbon, Crystal and dynamic microphones.
- 5.4 Mention the specifications of microphones.
- 5.5 Define Loudspeaker.
- 5.6 Explain the constructional features and principle of operation of PMMC Loudspeaker.
- 5.7 Mention the necessity of Baffle for a Loudspeaker and list the types of Baffles (like open, infinite, bass reflex, acoustic labyrinth).
- 5.8 Mention the use of woofers and tweeters.
- 5.9 Give the need for a Horn loud speaker.
- 5.10 Explain the principle of magnetic and crystal headphones and list their uses.
- 5.11 Mention the specifications of Loudspeaker.

6.0 Understand different types of Diodes and its applications.

- 6.1 State the electrical properties of solid Semiconductor materials.
- 6.2 Sketch energy level diagrams for conductors, Semiconductors, Insulators.
- 6.3 Define Intrinsic and extrinsic Semiconductors.
- 6.4 Distinguish between Intrinsic and extrinsic Semiconductors.
- 6.5 Describe the formation of P- type and N-type materials and sketch the energy band diagrams.
- 6.6 Identify Majority and Minority carriers in P and N Type materials.
- 6.7 Distinguish between Drift and Diffusion current.
- 6.8 Explain the formation of PN junction diode.
- 6.9 Describe the working of PN junction Diode with various biasing voltages.
- 6.10 Sketch the forward/Reverse Bias Voltage characteristics of diode.
- 6.11 List the specifications of a diode.
- 6.12 List the applications of a diode.
- 6.13 Draw and explain the working of clipper and clamper circuits using diodes.
- 6.14 Describe the formation and working of Zener diode.
- 6.15 Sketch the characteristics of Zener breakdown and Avalanche breakdown.
- 6.16 Distinguish between Zener breakdown and Avalanche breakdown.
- 6.17 Explain working principle and applications of following
 - a) Varactor diode
 - b) Tunnel diode
- 6.18 Draw the symbols of PN junction diode, Zener diode, Varactor diode, and Tunnel diode.

7.0 Understand the working of Transistor

- 7.1 State the formation of a transistor.
- 7.2 Draw the symbols and explain the working of PNP and NPN Transistors.
- 7.3 List transistor configurations.
- 7.4 Describe working of transistor as amplifier (CE configuration)
- 7.5 Draw and explain the different transistor configurations (CB, CC).
- 7.6 Define cut off, saturation and active regions.
- 7.7 Sketch the input/output characteristics of CB, CC and CE configurations.
- 7.8 Define alpha, beta and gamma Factors.

- 7.9 Obtain relation between alpha, beta and gamma Factors.
- 7.10 Write collector current expression in CB and CE modes of transistors in terms of α, β, I_B, I_C and I_{CBO}, I_{CEO} .
- 7.11 Compare the performance characteristics of transistor in CB, CE and CC configurations.

8.0 Understand the working of power supply Circuits and Batteries.

- 8.1 State the necessity of D.C. power supply for Electronic circuits.
- 8.2 Define cycle, Frequency, Time Period, Maximum Value, Average value, RMS value, Form Factor, peak factor for sinusoidal AC quantities.
- 8.3 Describe the working of HW, FW and Bridge Rectifier circuits with wave forms.
- 8.4 Define PIV, Ripple factor and Efficiency and write their expressions for the above circuits.
- 8.5 Compare HW, FW and Bridge Rectifiers
- 8.6 Define Voltage Regulation.
- 8.7 Define a filter circuit.
- 8.8 State the need for a filter circuit in power supplies.
- 8.9 List the types of filter circuits.
- 8.10 Explain the operation of C, LC, CLC filters.
- 8.11 State the need for a regulated power supply and list its specifications.
- 8.12 Explain the operation of simple Zener regulator.
- 8.13 List the types of storage batteries.
- 8.14 List the uses of storage batteries.
- 8.15 Compare lead acid and Nickel – iron cells.
- 8.16 Explain about maintenance free battery and list its applications.

9.0 Understand PCB materials and their fabrication

- 9.1 State the need of PCB in electronic equipment.
- 9.2 Classify PCBs.
- 9.3 List types of laminates used in PCBs.
- 9.4 Explain the following in PCB Layout planning.
 - a) Layout Scale
 - b) Grid system.
 - c) Spacing specifications for component holes and conductor widths.
- 9.5 List the methods of transferring layout on the copper clad sheet.
- 9.6 List the steps involved in screen-printing for making PCBs.
- 9.7 List the materials used in screen-printing.
- 9.8 Describe the photo processing technique for PCB preparation.
- 9.9 Explain the methods of etching, cleaning and drilling of PCB.
- 9.10 List the steps involved in making double-sided PCB.
- 9.11 List the materials used in soldering.
- 9.12 List the soldering methods of PCBs.
- 9.13 State the standard PCB specification.

COURSE CONTENTS

1. **Resistors:** Classification of resistors, colour code, Specifications, Carbon film metal film wire wound resistors. Constructional details of carbon and wire wound Potentiometers - tapering. Effect of temperature on resistance. Faults in resistors.
2. **Capacitors:** Classification, specifications of capacitors, dielectric constant, dielectric strength, properties and applications of paper, mica, ceramic, glass and electrolytic capacitors. Variable capacitors and applications, capacitor connected in series and parallel.
3. **Inductors:** Self Inductance, mutual inductance, coefficient of coupling, A.F. and R.F. chokes.
4. **Switches, connectors and Relays:** Different types of switches and connectors used in Electronic circuits and their specifications. Fuses. Types of relays-Relay contacts - Electromagnetic Relay.
5. **Microphones and Loudspeakers:** Types of microphones – carbon, dynamic and crystal. Constructional features, principle of working, characteristics, construction of PMMC Loudspeakers, Baffles, need for horn loud speaker- head phones.
6. **Semiconductor Diode:** Electrical properties of semiconductor materials, Energy level diagrams of conductors, semiconductors and Insulators, Formation of P-type and N-type materials, PN junction diode with characteristics, Drift and Diffusion current, Diode clippers and clampers. Zener diode - Zener break down and Avalanche breakdown, Varactor diode, tunnel diode.
7. **Transistors:** Working of PNP and NPN transistors. Transistor configurations- CB, CE and CC, Input and Output characteristics, α , β , and γ factors, Relation between α , β , and γ , Comparisons of CB, CE and CC configurations
8. **Power supplies and Batteries:** Need of DC power supply, Rectifiers- Half wave rectifier, full wave rectifier, bridge rectifier, RMS value, DC value, Ripple factor and Efficiency, voltage regulation. Filters - C, LC, and CLC filters. Simple Zener regulator, Batteries- storage batteries.
9. **PCBs:** Classification of PCBs, screen-printing of PCBs, photo processing, double sided PCBs, soldering methods of PCBs, standard PCB specifications.

Reference Books

1. Electronic devices and applications by B. Soma Nathan Nair, PHI.
2. Principles of Electronic Communications by Anok Singh (For speakers & Microphones)
3. Electronic components by Dr.K.Padmanabham.
4. Principles of Electronics by V.K.Mehatha, S Chand & Company Ltd.
5. Printed Circuit Boards Design and Technology by Walter C. Bosshart, TMH
6. Basic Electronics by Grob., TMH
7. Electronic devices & Circuits by Millman & Halkias, TMH
8. Electronic Components by F.J. Waters.

BASIC ELECTRICAL ENGINEERING

Subject Title : Basic Electrical Engineering

Subject code : AEI-106

Periods/Week : 04

Periods/Year : 120

TIME SCHEDULE

S.No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1	D.C Circuits and Network Theorems	25	26	2	2
2	Single phase A.C. circuits	30	29	3	2
3	Heating Effects of Electrical Current	21	16	2	1
4	Transformers	25	26	2	2
5	DC & AC Machines	19	13	1	1
	Total	120	110	10	08

OBJECTIVES: Upon completion of the subject the student shall be able to:

1.0 Understand the DC Circuits and Network Theorems.

- 1.1 Differentiate between active and passive circuits.
- 1.2 Define junction, branch and loop in a circuit.
- 1.3 State Kirchhoff's current law and voltage law.
- 1.4 Solve simple circuit problems by nodal method and loop current method based on Kirchhoff's laws.
- 1.5 Explain star and delta circuits.
- 1.6 Give the formulae for star- delta and delta – star transformations.
- 1.7 Solve simple problems on star- delta and delta– star transformations.
- 1.8 Define ideal voltage source & ideal current source.
- 1.9 Convert ideal voltage source to ideal current source.
- 1.10 Convert ideal current source to voltage source.
- 1.11 State super position, Thevenin's ,Norton's, maximum power transfer theorems (D.C circuits only & No Problems)

2.0 Comprehend the single phase A.C. circuits

- 2.1 Define the term phase and phase difference.
- 2.2 Derive the relationship between voltage and current in pure resistive, Inductive and capacitive circuits.
- 2.3 Calculate the impedance, current, phase angle, power and power factor in R-L, R-C, & R-L-C. Series circuits.
- 2.4 Solve simple Problems on Series Circuits.
- 2.5 Solve simple problems on parallel circuits by
 - a) Vector method and
 - b) Admittance method
 - c) 'J' notation method
- 2.6 Define resonance in series and parallel electric circuits.
- 2.7 Differentiate series resonance and parallel resonance.
- 2.8 Calculate the resonance frequency for both series and parallel resonant circuits.
- 2.9 Define 'Q' factor. Mention the importance of Q factor.

3.0 Understand the Heating effects of Electric Current

- 3.1 Explain the Mechanical equivalent of heat.
- 3.2 State the heat produced due to flow of current.
- 3.3 List the practical applications of heat produced due to Electric current in metal.
- 3.4 Explain the following practical applications of heat produced due to Electric current in metal:
 - a) Filament lamps
 - b) Electric kettle
 - c) Electric cooker
 - d) Electric Iron
 - e) Space heaters
 - f) Geyser
 - g) Infrared lamp.
- 3.5 Define Thermal efficiency.
- 3.6 Solve simple problems on Thermal efficiency.

4.0 Understand working of Transformers

- 4.1 Explain the working principle of a Transformer
- 4.2 Explain the construction of transformers (core type, shell type).
- 4.3 Give reasons for using laminations in transformer core
- 4.4 Derive the EMF equation of transformer.
- 4.5 Solve simple problems on EMF equation of transformer.
- 4.6 State the relationship between voltage, current ratios and turns ratio.
- 4.7 Define efficiency and regulation of transformer.
- 4.8 State the losses in a transformer.
- 4.9 Explain the working principle of Auto transformer and list their advantages.
- 4.10 Explain the use of transformer as a:
 - a) Potential transformer
 - b) Current transformer

- c) Impedance matching transformer
- d) Isolation transformer
- 4.11 State the need for cooling of a transformer.
- 4.12 List the cooling methods of a transformer.
- 4.13 List important specifications of a transformer.

5.0 Understand DC machines & AC Machines

- 5.1 Explain the construction of D.C. Machine.
- 5.2 Write the expression for E.M.F. equation of a D.C. generator (no derivation).
- 5.3 Classify D.C. Machines with reference to excitation.
- 5.4 Define armature reaction and state their effects.
- 5.5 Define commutation and state the methods to improve commutation.
- 5.6 List different losses in D.C. Machines.
- 5.7 Define efficiency.
- 5.8 Solve simple problems on efficiency of DC machines.
- 5.9 Explain the working principle of D.C. Motors.
- 5.10 Define back e.m.f. and give formula in terms of supply voltage, Armature current and Resistance, and also in terms of ϕ , Z, N, P, A.
- 5.11 Write the expression for Torque Equation (No derivation)
- 5.12 Explain the principle of alternator.
- 5.13 Explain the constructional features of alternator. i) Salient pole ii) Non salient pole.
- 5.14 Write the expression for EMF equation of alternator (No – Derivation).

COURSE CONTENT:

- 1. DC Circuits and Network Theorems:** Junction, branch and loop in circuits- Kirchoff's laws - Star - Delta configurations, Concept of transformation - Ideal Voltage , Ideal current source & Convention - Super position theorem, Thevenin's Theorem -Norton's Theorem, Maximum power transfer theorem with reference to D.C.-Problems on the above.
- 2. Single phase A.C. Circuits:** Derivation of voltage , current, power relations including phase relationships, wave forms and phasor diagrams - R-L, R-C , R-L-C series circuits - Derivation of relation between voltage, current, impedance, power including wave forms - Problems on series circuits - Parallel circuits - solution by vector method, admittance method and by 'J' notation – problems - Resonant circuit - Definition of resonance – Series and parallel resonant circuit - Variation of reactance and current with frequency - Resonant frequency - problems - power factor of series and parallel resonant circuits - Voltage and current magnification, 'Q' factor of coil - applications.
- 3. Heating Effects of Electrical Current:** Mechanical Equivalent of Heat - Heat produced due to flow of current in metal: Filament lamps, Electric kettle, Electric cooker, Electric Iron, Space heaters, Geyser, Infrared lamp.
- 4. Transformers:** Principle of Transformer - Types and Constructional features of transformer- Auto Transformer - Use of transformer as Potential Transformer, Current transformer, Impedance matching transformer, Isolation transformer.

5. DC & AC Machines:

DC machines-Construction of D.C generators, E.M.F equation, classification of D.C machines on the basis of excitation, Losses and efficiency, principles of D.C. motors back E.M.F., speed torque equations.

AC Machines: Principle and construction of alternator, types of alternator, e.m.f. equation of alternator.

REFERENCE BOOKS

1. Electrical Technology - Vol - I by B.L. Theraja
2. Introduction to Electrical Engg. By V.K.Mehtha
3. Electrical Technology by Hughes.
4. Problems in Electrical Engg. By Parker Smith

ENGINEERING DRAWING

Subject Title	:	Engineering Drawing
Subject Code	:	107 (Common to all Branches)
Periods/Week	:	06
Periods Per Year	:	180

Time Schedule

Sno	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	01	-	-	-
2	Engineering Drawing Instruments	05	-	-	-
3	Free hand lettering & Numbering	06	5	1	-
4	Dimensioning Practice	09	5	1	-
5	Geometrical Constructions	21	15	1	1
6	Projection of points, Lines, Planes & Solids	21	10	-	1
7	Auxiliary views	06	5	1	-
8	Sectional views	27	10	-	1
9	Orthographic Projection	33	10	-	1
10	Pictorial drawing	30	10	-	1
11	Development of surfaces	21	10	-	1
	Total	180	80	04	06

The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation

OBJECTIVES

Upon completion of the subject the student shall be able to

1) Understand the basic concepts of Engineering Drawing

- a) State the importance of drawing as an engineering communication medium
- b) State the necessity of B.I.S. Code of practice for Engineering Drawing
- c) Explain the linkages between Engineering drawing and other subjects of study in diploma course

2) Use of Engineering Drawing Instruments

- a) Select the correct instruments and draw lines of different orientation
- b) Select the correct instruments and draw small and large Circles
- c) Select the correct instruments for measuring distances on the drawing
- d) Use correct grade of pencil for different types of lines, thickness and given function
- e) Select and use appropriate scales for a given application
- f) Identify different drawing sheet sizes as per I.S. and Standard Layouts
- g) Prepare Title block as per B.I.S. Specifications
- h) Identify the steps to be taken to keep the drawing clean and tidy

3) Write Free Hand Lettering and Numbers

- a) Write titles using slanting letters and numerals of 7mm, 10mm and 14mm height
- b) Write titles using vertical letters and numerals of 7mm, 10mm and 14mm height
- c) Select suitable sizes of lettering for different layouts and applications

4) Understand Dimensioning Practice

- a) Define "Dimensioning"
- b) State the need of dimensioning the drawing according to accepted standards
- c) Identify notations of Dimensioning used in dimensioned drawing
- d) Identify the system of placement of dimensions in the given dimensioned drawing
- e) Dimension a given drawing using standard notations and desired system of dimensioning
- f) Dimension standard features applying necessary rules
- g) Arrange dimensions in a desired method for a given drawing
- h) Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly

5) Apply Principles of Geometric Constructions

- a) Divide a given line into desired number of equal parts internally
- b) Draw tangent lines and arcs
- c) Use General method to construct any polygon
- d) Explain the importance of conics
- e) Construct ellipse by concentric circles method
- f) Construct parabola by rectangle method
- g) Construct rectangular hyperbola from the given data
- h) Construct involute from the given data
- i) Construct cycloid and helix from the given data
- j) State the applications of the above constructions in engineering practice

6) Apply Principles of Projection of points, lines, planes & solids

- a) Visualize the objects
- b) Explain the I-angle and III-angle projections
- c) Practice the I-angle projections
- d) Draw the projection of a point with respect to reference planes (HP&VP)

- e) Draw the projections of straight lines with respect to two reference planes (cases of lines parallel to one plane and inclined to other plane only)
- f) Draw the projections of planes (cases of planes perpendicular to one plane and inclined to other plane only)
- g) Draw the projections of solids (cases of axis perpendicular to one plane and inclined to other plane only)

7) Understand the need of auxiliary views

- a) State the need of Auxiliary views for a given engineering drawing
- b) Draw the auxiliary views of a given engineering component
- c) Differentiate between auxiliary view and apparent view

8) Appreciate the need of Sectional Views

- a) Explain the need to draw sectional views
- b) Select the section plane for a given component to reveal maximum information
- c) Explain the positions of section plane with respect to reference planes
- d) Differentiate between true shape and apparent shape of section
- e) Draw sectional views and true sections of regular solids discussed in chapter-6 above
- f) Apply principles of hatching

9) Apply principles of orthographic projection

- a) Explain the principles of orthographic projection with simple sketches
- b) Draw the orthographic view of an object from its pictorial drawing
- c) Draw the minimum number of views needed to represent a given object fully

10) Prepare pictorial drawings

- a) State the need of pictorial drawings
- b) Differentiate between isometric scale and true scale
- c) Prepare Isometric views for the given orthographic drawings

11) Interpret Development of surfaces of different solids

- a) State the need for preparing development drawing
- b) Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramids) using parallel line and radial line methods
- c) Prepare development of surface of engineering components like trays, funnels, 90° elbows & rectangular ducts

COURSE CONTENT

NOTE

- 1) B.I.S Specifications should invariably be followed in all the topics.**
- 2) A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.**
- 3) First Angle Projection is to be followed for all Orthographic projection exercises**

1) 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) Engineering drawing Instruments

Classification: Basic tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mention the names under each classification and their brief description -Scales: Recommended scales reduced & enlarged scales-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

Drawing Plate 1: Consisting of two exercises on use of drawing instruments

3) Free hand lettering & numbering

Importance of lettering – Types of lettering -Guide Lines for Lettering- Practicing letters & numbers of given sizes (7mm, 10mm and 14mm) Advantages of single stroke or simple style of lettering

Drawing plate 2: Consisting of five to six exercises on freehand Lettering & Numbering

4) Dimensioning practice

Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape description of an Engineering object - Dimensioning size, Location 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 dimensioning of narrow spaces

Drawing Plate 3: Consisting of 8 exercises on Dimensioning methods and rules

5) Geometric Constructions

Division of a line: to divide a straight line into given number of equal parts internally and it's examples in engineering applications. Construction of tangent lines: to draw tangent lines touching circles internally and externally. 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 of given side using general method. Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and loci of a moving point, Eccentricity of above curves – Their Engg. applications viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process - Construction of ellipse by concentric circles method - Construction of parabola by rectangle method - Construction of rectangular hyperbola - General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering applications, viz, Gear tooth profile, screw threads, springs etc. - their construction.

Drawing Plate 4: Consisting of eight exercises on construction of polygons

Drawing Plate 5: Consisting of eight exercises on construction of conics

Drawing Plate 6: Consisting of eight exercises on involute, cycloid and helix

6) Projection of points, lines, planes & solids

Projecting a point on two planes of projection -Projecting a point on three planes of projection - Projection of straight line i) Parallel to both the planes ii) Perpendicular to one of the planes iii) Inclined to one plane and parallel to other plane - Projection of regular planes- i) Plane perpendicular to HP and parallel to VP and vice versa ii) Plane perpendicular to HP and inclined to VP and vice versa - Projection of regular solids with i) Axis perpendicular to one of the planes ii) Axis parallel to VP and inclined to HP and vice versa

Drawing Plate 7: Consisting of eight exercises on projection of points and Lines

Drawing Plate 8: Consisting of eight exercises on projection of planes

Drawing Plate 9: Consisting of eight exercises on projection of solids

7) Auxiliary views

Need for drawing auxiliary views - Explanation of the basic principles of drawing auxiliary views, explanation of reference plane and auxiliary plane - Partial auxiliary view.

Drawing plate 10: Consisting of four exercises on auxiliary views

8) Sectional views

Need for drawing sectional views – what is a sectional view - Location of cutting plane – Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) - Hatching – Section of regular solids inclined to one plane and parallel to other plane

Drawing Plate 11: Consisting of six exercises on sections of solids

9) Orthographic Projections

Meaning of orthographic projection -Using a viewing box 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 number of engineering 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 mitre 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

Drawing Plate 12: Consisting of 12 exercises on orthographic projections of engineering objects

10) Pictorial Drawings

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Iso axis, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and ordinary 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 - Use of box and offset methods

Drawing plate 13: Consisting of 12 exercises on Isometric views of engineering objects

11) 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 plane and parallel to the other -Development of simple solids like cubes, prisms, cylinders, cones, pyramids -Types of development: Parallel line and radial line development -Procedure of drawing development - drawings of trays, funnels, 90⁰ elbow pipes and rectangular ducts.

Drawing plate 14: Consisting of 5 exercises on development problems

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.

ELECTRICAL WIRING, ELECTRONIC COMPONENTS & DEVICES LABORATORY

Subject Title : Electrical Wiring, Electronic Components & Devices
Laboratory
Subject Code : AEI-108
Periods/Week : 06
Periods/Year : 180

TIME SCHEDULE

S. No.	Major Topic	No. of Periods
1	Wiring practice	35
2	Identification of components	30
3	Soldering Practice	40
4	Study and use of Electronic equipment	35
5	Testing of Electronic components, Devices and Rectifiers	40
Total		180

OBJECTIVES: Upon completion of the subject the student shall be able to

1.0. Wiring Practice.

1.1. Familiarisation of various tools used in electrical wiring.

1. Wire stripper, 2. Insulation remover 3. Pocket knife 4. Electrical Tester 5. Phillips Head Screwdrivers 6. Mallet 6. Rawl plug jumper 7. Standard wire Gauge

1.2. Identifying and working with Pliers

a) Identify the various functions of cutting pliers, Nose pliers, Pipe pliers, Flush cutter, top cutting pliers, Electronics pliers, Insulated cutting pliers

b) Perform the following operations:

1. Holding 2. Wire cutting 3. Component bending 4. Twisting the wire.

1.3. Identification of different wires and cables:

- a) Hookup wires a. PVC wire b. Teflon wires c. single strand d. multi strand.
 - b) Wires used for electrical wiring: i) Service wire ii) TRS wires /PVC Wires (Al & Cu), iii) .single strand iv) Multi strand v) twisted Flexible pair wires vi) Enameled copper wire, Power cord.
 - c) Cables: UTP cable , Co axial cables, Flat ribbon cable for antennas, Telephone cable, Ethernet cable, Ribbon cables, Optical fiber.
- 1.4. Wire joints practice: Perform the following wire joint operations: Twisting, Splicing, Insulating, Western union joint, Married joint, Britania (straight Joint), Tee joint, Joining running cables, Pigtail or rat tail joint.
 - 1.5. Identifying the Electrical accessories:
 - a) SPST Switch , SPDT switch ,
 - b) Two pin and Three pin Sockets and plugs,
 - c) Power Socket and Power plugs, Lamp holders, Ceiling rose,
 - d) Mains Switch, MCB, Kitkat Fuse – Fuse wire ratings.
 - 1.6. Identifying the mains supply Phase , Neutral , Ground:
 - a) Identification of Phase and Neutral, Terminals in mains supply,
 - b) Understand the purpose of earthing, 2pin and 3pin Plug connections.
 - 1.7. Make simple switch connections using low voltage transformer
 - a) Connecting a 6V lamp to a switch (toggle).
 - b) 2 way switch connections.
 - c) Series and parallel connection of lamps.
 - 1.8. Simple staircase wiring – one lamp control with two switches.
 - 1.9. Connection of tube light with function of choke, tube and starter.
 - 1.10. Connection of ceiling fan and reversing the direction of ceiling fan.

2.0 Identification of components

- 2.1 Identify different types resistors with different wattage.
- 2.2 Identify different types of Inductors.
- 2.3 Identify colour coding of different resistors.
- 2.4 Find the value of a given Resistor using colour code.
- 2.5 Identify different types of switches and relays
- 2.6 Identify microphones and loudspeaker connections.

3.0 Soldering

- 3.1 Familiarisation of various soldering tools, Components & different cables.
- 3.2 Assemble and disassemble components using soldering irons.
- 3.3 Use different types of soldering irons.
- 3.4 Use solder squeezer on electronic PCBs.
- 3.5 Use instant soldering gun.
- 3.6 Solder on printed circuit boards using passive and active components.

4.0 Study and use of electronic equipment

- 4.1 Familiarise with the symbols of electronic circuit components by drawing.
- 4.2 Measurement of AC/DC Voltages and currents using voltmeters and current Meters.
- 4.3 Measurement of voltage, current and resistance using analog and digital Multimeters.
- 4.4 Perform the continuity test for different components and devices using analog and Digital multimeters.
- 4.5 Study and use of AF / RF signal generators.
- 4.6 Study and use of C.R.O. (single trace & Dual trace) for measuring frequency and amplitude.
- 4.7 Study and use of single channel and dual channel regulated power supply units.

5.0 Testing of electronic components, Devices and Rectifiers

- 5.1 Measure the value of resistor using ohmmeter / multimeter and compare with the colour code value.
- 5.2 Test and measure the value of capacitor using R.L.C. meter and compare with the marked / colour code value.
- 5.3 Test the given loud speaker and measure the voice coil resistance-using multimeter.
- 5.4 Test the working of different types of switches, relays.
- 5.5 Identify leads and testing of different diodes (PN Junction Diode, Zener Diode) and transistors using Multimeter..
- 5.6 Study of data manuals/ application manuals for diodes and transistors.
- 5.7 Arrange the Public Address system and test the performance.
- 5.8 Draw forward and reverse bias characteristics of semiconductor diode and calculate forward and reverse resistance of diode.
- 5.9 Draw reverse bias characteristics of Zener diode and find out the zener voltage.
- 5.10 Draw input and output characteristics of transistor in CB mode and determine R_i , R_o , and α .
- 5.11 Draw input and output characteristics of transistor in CE mode and determine R_i , R_o , and β ..
- 5.12 To implement Half wave rectifier with and without filter
- 5.13 To implement Full wave rectifier with and without filter
- 5.14 To implement Bridge rectifier with and without filter

Reference Lab Manual:

- 1. Electronic Devices and Circuits by David A Bell 4 Edition PHI
- 2. Hand soldering and circuit board repair by H.(Ted)Smith, Thomas Delmar.
- 3. Electronic instruments and systems – principles, maintenance and troubleshooting. by R.G. Gupta.

PHYSICS LABORATORY

Subject Title	:	Physics Laboratory
Subject Code	:	Common -109
Periods per week	:	03
Total periods per year	:	45

TIME SCHEDULE

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)	03
7.	Refractive index of solid using traveling microscope	03
8.	Surface tension of liquid using traveling microscope	03
9.	Coefficient of viscosity by capillary method	03
10.	Boyle's law verification	03
11.	Meter bridge	03
12.	Mapping of magnet lines of force	03
	Revision	06
	Test	03
	Total:	45

Objectives:

Upon completion of the course the student shall be able to

- 1.0 Practise with Vernier calipers to determine the volumes and areas of a cylinder and sphere and their comparison etc .
- 2.0 Practise 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 Determine the surface tension of a liquid using travelling microscope

- 9.0 Determine the viscosity of a liquid using capillary method
 10.0 Verify the Boyle's law employing a Quill tube
 11.0 Determine the specific resistance of material of a wire using Meter Bridge
 12.0 Drawing magnetic lines of force under N-S and N-N methods and locate null points

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	Competencies	Key competencies
1. Hands on practice on Vernier Calipers(03)	<ul style="list-style-type: none"> • Find the Least count • Fix the specimen in posit • Read the scales • Calculate the physical quantities of given object 	<ul style="list-style-type: none"> • Read the scales • Calculate the requisite physical quantities of given objects
2. Hands on practice on Screw gauge(03)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length
4. Simple pendulum(03)	<ul style="list-style-type: none"> • 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 I-T and I-T² graph 	<ul style="list-style-type: none"> • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw I-T and I-T² graph

5. Velocity of sound in air –Resonance method (03)	<ul style="list-style-type: none"> • Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonating lengths • Calculate velocity of sound 	<ul style="list-style-type: none"> • Adjust the reservoir level • Find the first and second resonating lengths • Calculate velocity of sound at room temperature • Calculate velocity of sound at 0° C
Name of the Experiment(Periods)	Competencies	Key competencies
6. Focal length and Focal power of convex lens (Separate & Combination) (03)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab 	<ul style="list-style-type: none"> • Read the scale • Calculate the refractive index of glass slab
8. Surface tension of liquid using traveling microscope(03)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water

9. Coefficient of viscosity by capillary method(03)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water
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Name of the Experiment	Competencies	Key competencies
10. Boyle's law verification (03)	<ul style="list-style-type: none"> • 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 $P \times l$ 	<ul style="list-style-type: none"> • Find the length of air column • Find the pressure of enclosed air • Find the value $P \times l$
11. Meter bridge(03)	<ul style="list-style-type: none"> • Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance 	<ul style="list-style-type: none"> • Find the balancing length • Calculate unknown resistance • Calculate the specific resistance

<p>12. Mapping of magnet lines of force(03)</p>	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Draw magnetic lines of force• Locate the neutral points along equatorial and axial lines
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CHEMISTRY LABORATORY

Subject Title	:	Chemistry Laboratory
Subject Code	:	Common -110
Periods per week	:	03
Total periods per year	:	45

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Familiarization of methods for Volumetric analysis	03
2.	Preparation of Std Na_2CO_3 and making solutions of different dilution	03
3.	Estimation of HCl solution using Std. Na_2CO_3 solution	03
4.	Estimation of NaOH using Std. HCl solution	03
5.	Estimation of H_2SO_4 using Std. NaOH solution	03
6.	Estimation of Mohr's Salt using Std. KMnO_4	03
7.	Determination of acidity of water sample	03
8.	Determination of alkalinity of water sample	03
9.	Determination of total hardness of water using Std. EDTA solution	03
10.	Estimation of Chlorides present in water sample	03
11.	Estimation of Dissolved Oxygen (D.O) in water sample	03
12.	Determination of pH using pH meter	03
13.	Determination of conductivity of water and adjusting ionic strength	03
14.	Determination of turbidity of water	03
15.	Estimation of total solids present in water sample	03
	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.
- 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_3 solution for 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 Conduct titrations adopting standard procedures 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 (03)	--	--
Preparation of Std Na_2CO_3 and making solutions of different dilution (03)	<ul style="list-style-type: none"> ▪ 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 	<ul style="list-style-type: none"> ▪ 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

Name of the Experiment (No of Periods)	Competencies	Key competencies
Estimation of HCl solution using Std. Na_2CO_3 solution (03)	<ul style="list-style-type: none"> ▪ 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 ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results 	<ul style="list-style-type: none"> ▪ 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)		
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)		
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method) (03)	<ul style="list-style-type: none"> ▪ 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 	<ul style="list-style-type: none"> ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately
Determination of pH using pH meter (03)		
Determination of conductivity of water and adjusting ionic strength to required level (03)		
Determination of turbidity of water (03)		

Name of the Experiment (No of Periods)	Competencies	Key competencies
Estimation of total solids present in water sample (03)	<ul style="list-style-type: none"> ▪ 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 	<ul style="list-style-type: none"> ▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate

COMPUTER FUNDAMENTALS LABORATORY

Subject Title : Computer Fundamentals Laboratory
Subject Code : AEI-111
Periods/Week : 03
Periods/Year : 90

Time Schedule

S. No.	Major Topics	No. of sessions each of 3 periods duration	No. of Periods
I.	Computer hardware Basics	02	06
II.	Windows Operating System	02	06
III.	MS Word	08	24
IV.	MS Excel	09	27
V.	MS PowerPoint	09	27
Total		30	90

Rationale: The knowledge of Computer usage has become a must for everyone, due to wide spread computer usage and related applications in all fields. This laboratory is designed to give the students hands on practice of Windows Operating System and MS Office to enable the students to use these skills in future courses.

I. Computer Hardware Basics (Not for end examination)

1. a) To familiarize with a Computer System and its hardware connections.
b) To start and Shutdown a Computer correctly.
c) To check the software details of the computer
d) To practice Internal and External DOS commands
2. To check the hardware present in your computer.

II. Windows's operating system (Not for end examination)

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 practice Excel Graphs and Charts
20. To format a Worksheet in Excel, Page Setup and Print

V. Practice with MS-POWERPOINT

21. To familiarize with Ribbon layout features of PowerPoint 2007.
22. To create a simple PowerPoint Presentation
23. To set up a Master Slide in PowerPoint
24. To insert Text and Objects
25. To insert a Flow Charts
26. To insert a Table
27. To insert a Charts/Graphs
28. To insert video and audio
29. To practice Animating text and objects
30. To Review presentation

Competencies and Key Competencies to be achieved by the students

Exp No.	Name of the Experiment	Competencies	Key Competencies
1 (a).	To familiarize with Computer system and hardware connections	<ul style="list-style-type: none"> a. Identify the Parts of a Computer system a). CPU b) Monitor c) CD/DVD Drive d) Power Switch e) Start Button f) 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	<ul style="list-style-type: none"> a. Log in using the password b. Start and shut down the computer c. Use Mouse and Keyboard 	<ul style="list-style-type: none"> a. Login and logout as per the standard procedure b. Operate mouse & Keyboard
1 (c).	To explore Windows Desktop	<ul style="list-style-type: none"> a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support 	<ul style="list-style-type: none"> a. Access application programs using Start menu b. Use taskbar and Task manager
1(d).	To practice Internal and External DOS commands	<ul style="list-style-type: none"> a. Practice Internal commands b. Practice External commands 	Familiarize with MS-DOS Commands
2.	To check the software details of the computer	<ul style="list-style-type: none"> c. Find the details of Operating System being used d. 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	<ul style="list-style-type: none"> 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 Disk Drives and partitions e. Use the Taskbar 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> a. Create folders and organizing files in different folders b. Use copy / paste or move commands to organize files and folders 	<ul style="list-style-type: none"> a. Create files and folders rename , arrange and search for the required folder/file

Exp No.	Name of the Experiment	Competencies	Key Competencies
	Working with Files and Folders Continued....	<ul style="list-style-type: none"> c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut for files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin 	<ul style="list-style-type: none"> b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> a. Use windows accessories and select correct text editor based on the situation. b. Use MS Paint 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	<ul style="list-style-type: none"> a. Create/Open a document b. Use Save and Save as features c. Work on two documents simultaneously d. Choose correct Paper size and Printing options 	<ul style="list-style-type: none"> a. Create a Document and name appropriately and save b. Set paper size and print options
7.	To practice Word Processing Basics	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> a. Use keyboard 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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

Exp No.	Name of the Experiment	Competencies	Key Competencies
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9.	To insert a table of required number of rows and columns	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	<ul style="list-style-type: none"> a. Create a 2-page document. &Insert hyperlinks and Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table. 	<ul style="list-style-type: none"> a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	<ul style="list-style-type: none"> a. Move around a Worksheet- Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> a. Sort and filter data in a worksheet b. Perform Mathematical 	Use built in functions in Excel

		Calculations verify -AutoSum c. Perform Automatic Calculations- Align Cell Entries	
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 Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce an Excel Column Chart c. Practice creating any Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
20.	To format a Worksheet in Excel, page setup and print	a. Shade alternate rows of data b. Add currency and percent 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
21.	To familiarize with Ribbon layout & features of PowerPoint 2007.	Use various options in Home, insert, design, animation , slideshow, Review & View in the PowerPoint	Access required options in the tool bar

Exp No.	Name of the Experiment	Competencies	Key Competencies
22.	To create a simple PowerPoint Presentation	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes b. Use bullets option
23.	To Set up a Master Slide in PowerPoint and add notes	<ul style="list-style-type: none"> 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 f. Add Notes to a PowerPoint Presentation 	<ul style="list-style-type: none"> a. Setup Masterslide and format b. Add notes
24.	To Insert Text and Objects	<ul style="list-style-type: none"> a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and WordArt f. Use 3d features g. Arrange objects 	<ul style="list-style-type: none"> Inset Text and Objects Use 3d features
25.	To insert a Flow Chart / Organizational Charts	<ul style="list-style-type: none"> a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art 	<ul style="list-style-type: none"> Create organizational charts and flow charts using smart art
26.	To insert a Table	<ul style="list-style-type: none"> a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend 	<ul style="list-style-type: none"> Insert tables and format
27.	To insert a Charts/Graphs	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Create charts and Bar graphs, Pie Charts and format.

Exp No.	Name of the Experiment	Competencies	Key Competencies
28.	To Insert audio & video, Hyperlinks in a slide Add narration to the slide	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
29.	To Practice Animation effects	<ul style="list-style-type: none"> a. Apply transitions to slides b. To explore and practice special animation effects like <i>Entrance, Emphasis, Motion Paths & Exit</i> 	Add animation effects
30.	Reviewing presentation	<ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> (a) Slides (b) Handout 	<ul style="list-style-type: none"> a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

III Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical /Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI- 301	Engineering Mathematics – II	5	-	75	3	20	80	100
AEI -302	Electronic circuits	5	-	75	3	20	80	100
AEI -303	Digital Electronics	6	-	90	3	20	80	100
AEI-304	Electronic Measuring Instruments	5	-	75	3	20	80	100
AEI-305	Process Instrumentation	6	-	90	3	20	80	100
PRACTICAL:								
AEI-306	Electronic circuitsLab	-	3	45	3	40	60	100
AEI-307	Digital Electronics Lab	-	3	45	3	40	60	100
AEI- 308	Electronic Measuring Instruments Lab	-	3	45	3	40	60	100
AEI-309	Process Instrumentation Lab	-	6	90	3	40	60	100
TOTAL		27	15	630	-	260	640	900

ENGINEERING MATHEMATICS – II**(Common to all Branches)**

Subject Title	:	Engineering Mathematics-II
Subject Code	:	AEI-301
Periods per week	:	05
Periods per Semester	:	75

Blue print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
				R	U	App	R	U	App
	Unit - I								
1	Indefinite Integration	15	21	1	1	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
	Unit - II								
2	Definite Integration and its applications	35	60	1	1	3	1	1	$2\frac{1}{2}$
	Unit - III								
3	Differential Equations	25	29	2	1	0	1	1	0
	Total	75	110	4	3	3	$2\frac{1}{2}$	$2\frac{1}{2}$	30
			Marks:	12	9	9	25	25	30

R: Remembering type	37 marks
U: Understanding type	34 marks
App: Application type	39 marks

Upon completion of the subject the student shall be able to

OBJECTIVES**Unit-I****1.0 Indefinite Integration**

- 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 $\int \sin^m \theta \cos^n \theta. d\theta$ where m and n are positive integers.
- 1.7 Evaluate integrals of 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

$$\int \frac{1}{a \pm b \sin \theta} d\theta, \int \frac{1}{a \pm b \cos \theta} d\theta \text{ and } \int \frac{1}{a \cos \theta \pm b \sin \theta \pm c} d\theta .$$

- 1.10 Evaluate integrals using decomposition method.
- 1.11 Evaluate integrals using integration by parts with examples.
- 1.12 State the Bernoulli's rule for evaluating the integrals of the form $\int u.v dx$.
- 1.13 Evaluate the integrals of the form $\int e^x [f(x) + f'(x)] dx$.

Unit-II

(a) Understand definite integral and its properties

- 2.1 State the fundamental theorem of integral calculus
- 2.2 Explain the concept of definite integral.
- 2.3 Calculate the definite integral over an interval.
- 2.4 State various properties of definite integrals.
- 2.5 Evaluate simple problems on definite integrals using the above properties.

(b) Real life applications of definite integrals

- 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 volumes of solids of revolution.
- 2.9 Obtain the mean value and root mean square value of the functions in any given interval.
- 2.10 Explain the Trapezoidal rule, Simpson's 1/3 rules for approximation of integrals and provide some examples.

(c) Certain special integrals: Laplace Transforms

- 2.11 Write the definition of Laplace Transform and explain sufficient conditions for its existence.
- 2.12 Provide formulae for Laplace transforms of standard functions.

- 2.13 State Linear property, First shifting property, Change of Scale property for Laplace transforms. Solve simple problems using these properties.
- 2.14 Write formulae for Laplace transform of $t^n f(t)$, $\frac{f(t)}{t}$, $f^{(n)}(t)$, $\int_0^t f(u) du$ in terms of Laplace transform of $f(t)$. Provide simple examples on these functions.
- 2.15 Define unit step function and write the Laplace Transform of unit step function. State second shifting property.
- 2.16 Define inverse Laplace Transform and write inverse Laplace Transform of standard functions. Solve simple problems.
- 2.17 Write first shifting property of inverse Laplace Transform with examples
- 2.18 Define convolution of two functions and state convolution theorem with few examples for understanding only.

(d) Understand the Fourier series expansion of functions

- 2.19 Define Fourier series of a function on the interval $(c, c + 2l)$ and state sufficient conditions for its existence. Write the Euler's formulae for determining the Fourier coefficients.
- 2.20 Find Fourier series of simple functions in the range $(0, 2l)$, $(0, 2\pi)$, $(-l, l)$ and $(-\pi, \pi)$.
- 2.21 Find Fourier coefficients for even and odd functions in the interval $(-l, l)$ and $(-\pi, \pi)$ in simple examples.
- 2.22 Define half range Fourier sine and cosine series of a function over the interval $(0, l)$ with examples.

3.0 Introduction to Differential Equations

- 3.1 Define a Differential equation, its order, degree
- 3.2 Form a differential equation by eliminating arbitrary constants.
- 3.3 Solve the first order first degree differential equations by the following methods:
- i. Variables Separable.
 - ii. Homogeneous Equations.
 - iii. Exact Differential Equations
 - iv. Linear differential equation of the form $dy/dx + Py = Q$, where P and Q are functions of x or constants.
 - iv. Bernoulli's Equation (Reducible to linear form.)
- 3.4 Solve Differential equations of the type $(aD^2 + bD + c)y = 0$ when the roots of the auxiliary equation are real and different, real and repeated, Complex conjugates.
- 3.5 Solve the higher order homogeneous differential equations with constant coefficients.

- 3.6 Explain the concept of complementary function, particular Integral and general solution of a differential equation.
- 3.7 Solve n^{th} order differential equation of the type $f(D) y = X$ where $f(D)$ is a polynomial of n^{th} order and X is a function of the form $k, e^{ax}, \text{Sin}ax, \text{Cos}ax, x^n$.
- 3.8 Solve simple problems leading to engineering applications

COURSE CONTENT

Unit-I

Indefinite Integration:

1. Integration regarded as anti-derivative – Indefinite integral of standard functions. Properties of indefinite integral. Integration by substitution or change of variable. Integrals of the form

$\sin^m \theta, \cos^n \theta$. where m and n are positive integers. Integrals of $\tan x, \cot x, \sec x, \text{cosec} x$ and powers of $\tan x, \sec x$ 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.

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. Volumes of solids of revolution. Mean and RMS values of a function on a given interval. Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a definite integral.

. Definition, sufficient conditions for existence of Laplace Transform (LT), LT of elementary functions, linearity property, scale change property, first shifting property, multiplication by t^n , division by t , LT of derivatives and integrals, unit step function, LT of unit step function, second shifting theorem, inverse Laplace transforms- shifting theorems and change of scale property, multiplication by s^n and division by s – examples of inverse LT using partial fractions – convolution theorem (no proof).

Representation of a function in Fourier series over the interval $(c, c + 2l)$, Give sufficient conditions for existence of Fourier series. Euler's formulae for Fourier coefficients, Finding Fourier coefficients for simple functions, elementary even and odd functions. Define half range Fourier series.

Unit -III

Differential Equations:

Definition of a differential equation-order and degree of a differential equation- formation of differential equations-solution of differential equation of first order, first degree: variable-separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.

Non-homogenous linear differential equations with constant coefficients of the form $f(D)y = X$, where X is in the form k , e^{ax} , $\sin ax$, $\cos ax$, x^n , ($n= 1,2$) – complimentary function, particular integral and general solution.

Reference Books:

1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan
2. Thomas' Calculus, Pearson Addison –Wesley Publishers
3. A Text book of Engg. Mathematics by B.S.Grawel
4. A Text book of Engg. Mathematics by B.V.Ramana- T.Mc Graw Hill Publishers

ELECTRONIC CIRCUITS

Subject Title : Electronic Circuits

Subject Code : AEI-302

Periods/Week : 05

Periods/Semester : 75

TIME SCHEDULE

S. No.	Major topics	No of periods	Weight age of marks	Short Answer Questions	Essay Questions
1	FET, UJT and SCR	10	16	2	1
2	Transistor Biasing & Stabilization	10	16	2	1
2	Small signal amplifiers	9	13	1	1
3	Feedback Amplifiers & Power Amplifiers	16	21	2	1½
4	Oscillators	18	26	2	2
5	Sweep circuits & Multivibrators	12	18	1	1 ½
	TOTAL	75	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Understand the construction and working of FET, UJT and SCR.

- 1.1 Classify FETs.
- 1.2 List the advantages of JFET over BJT.
- 1.3 Draw the symbols of P-channel and N-channel JFET.
- 1.4 Explain the construction and working of N-channel JFET.
- 1.5 Draw the drain and transfer characteristics of N-channel JFET.
- 1.6 List the applications of FET.
- 1.7 List the types of MOSFETs.
- 1.8 Explain the construction and principle of operation of N- channel depletion and enhancement type MOSFETs.
- 1.9 Explain the construction and principle of operation of CMOS FET.
- 1.10 Explain the construction and working principle of UJT, with its characteristics.
- 1.11 Give the expression for intrinsic stand-off ratio (η).
- 1.12 List the applications of UJT.
- 1.13 List different thyristor family devices.
- 1.14 Explain the construction of SCR.
- 1.15 Explain the working of SCR with its characteristics.

1.16 List the applications of SCR.

2.0 Understand the concepts of transistor biasing and Stabilization

- 2.1 Explain the transistor as an amplifier in CB, CE and CC modes.
- 2.2 State, why CE Mode is widely used in amplifier circuits.
- 2.3 Define DC load line and AC load line.
- 2.4 Determine the Q- point (operating point) on the DC load line.
- 2.5 Define transistor biasing.
- 2.6 State the need for proper biasing in amplifier circuits.
- 2.7 List the types of biasing circuits.
- 2.8 Explain potential divider method of biasing.
- 2.9 Define the term stabilization.
- 2.10 State the need for stabilization in amplifier circuits.
- 2.11 Define stability factors S , S_V and S_{β} .
- 2.12 List the stabilization techniques.
- 2.13 Explain Diode and Thermistor stabilization techniques.

3.0 Understand the working of small signal amplifier circuits

- 3.1 Classify the amplifiers based on frequency, period of conduction, and coupling.
- 3.2 State the need of multistage amplifier (Cascading of amplifiers).
- 3.3 List the types of couplings used in amplifiers.
- 3.4 Explain the principle of operation of two-stage RC coupled amplifier with circuit diagram and draw its frequency response.
- 3.5 Explain the principle of operation of two-stage transformer coupled amplifier with circuit diagram and draw its frequency response.
- 3.6 Draw and explain the circuit of Direct Coupled Amplifiers.
- 3.7 Compare RC coupling, transformer coupling and Direct Coupling schemes used in amplifiers.

4.0 Understand the working of feedback amplifiers and power amplifiers

- 4.1 Compare Negative and Positive feedback.
- 4.2 Explain the principle of negative feedback in amplifiers.
- 4.3 Classify negative feedback amplifiers
- 4.4 Draw and explain the following block diagram arrangements, of negative feedback amplifiers.
(a) Voltage –Series (b) Voltage –Shunt (c) Current- Series (d) Current - Shunt
- 4.5 Explain the working of Darlington amplifier circuit.
- 4.6 Explain the emitter follower circuit and mention its advantages.
- 4.7 Distinguish between voltage amplifiers and power amplifiers.
- 4.8 Classify power amplifier circuits on the basis of frequency, period of conduction, and configurations.
- 4.9 Draw and explain the circuit of Push-Pull Power amplifier.
- 4.10 List the advantages of push-pull amplifiers.
- 4.11 List the applications of power amplifier.
- 4.12 State the necessity of Heat sink for a power transistor and power I.C. device.
- 4.13 List the different types of heat sinks.

5.0 Understand oscillators

- 5.1 List the Barkhausen Criterion conditions for an amplifier to work as an oscillator.
- 5.2 List the essentials of an oscillator.
- 5.3 Classify oscillator circuits.
- 5.4 Draw and explain the working of an RC phase shift and Wein bridge oscillator circuits.
- 5.5 State the conditions of sustained oscillations and give the expression for the frequency of oscillations of RC phase shift oscillator and Wein bridge oscillator circuits.
- 5.6 Draw and explain the working of Hartley, Colpitts, and Crystal oscillator circuits.
- 5.7 Write the expressions for frequency of oscillation and mention the conditions for sustained oscillations of Hartley, Colpitts, and Crystal oscillator circuits.
- 5.8 List the advantages of crystal oscillators over other types.
- 5.9 State the reasons for instability in oscillator circuits.
- 5.10 Suggest the remedies for instability in oscillator.
- 5.11 List the applications of oscillators.

6.0 Understand the working of Sweep circuits and Multivibrators

- 6.1 Define Sweep Voltage.
- 6.2 State the fundamental consideration of sweep waveform.
- 6.3 Distinguish between voltage and current time-base generators.
- 6.4 Draw and explain the Bootstrap sweep circuit.
- 6.5 Draw and explain Miller's sweep circuit using transistor.
- 6.6 Draw current sweep circuit using transistor and explain its working with waveform.
- 6.7 Explain how transistor works as a switch, in CE mode.
- 6.8 Classify Multivibrators.
- 6.9 Draw and explain the working of Transistorised Astable, Bistable and Mono stable multivibrators with waveforms.
- 6.10 Draw and explain the working of Schmitt trigger circuit using transistor with waveforms.

COURSE CONTENTS

- 1.0 FET, UJT and SCR:** FET- construction and working, characteristics, applications. MOSFET – types, construction and working, applications. UJT- construction and working, characteristics, applications. SCR- construction and operation, Characteristics and applications.
- 2.0 Transistor Biasing & Stabilization:** Transistor as an amplifier, operating point, DC load line, Biasing- types of biasing, potential divider biasing, Stabilization- stability factors, Bias stabilisation techniques.
- 3.0 Small Signal Amplifiers:** Classification of amplifiers, working and frequency response of two- stage RC coupled and transformer coupled amplifiers.
- 4.0 Feedback Amplifiers & Power Amplifiers:** Feedback Amplifiers- negative and positive feedback. Classification of negative feedback amplifiers, Darlington

amplifier, Emitter follower. Power Amplifiers- push-pull Amplifier, Comparison of voltage and power amplifiers, Applications of power amplifiers. Heat sink – types and its importance.

5.0 Oscillators: Barkhausen criterion conditions, Classification of oscillators, RC oscillators - RC phase shift oscillator and Wein bridge oscillator. LC Oscillators - Hartley and Colpitts oscillators. Crystal Oscillator working, advantages of crystal oscillator. Reasons and remedies for instability in oscillator circuits. Applications of oscillators.

6.0 Sweep circuits & Multivibrators: Sweep circuits - Time base generators, Bootstrap sweep circuit, Miller sweep circuit, Current sweep circuit. Multivibrators - Classification of multivibrators, Transistorised Astable, monostable and bistable multivibrators with waveforms. Schmitt trigger using transistor - operation and waveforms.

REFERENCE BOOKS:

1. Electronic devices and circuits by David A Bell, PHI
2. Electronic Devices & Circuits by Millman & Halkias, TMH
3. Principles of Electronics by V.K. Mehta, S.Chand
4. Foundations of Electronic circuits and devices by Meade Thomson Delmar.
5. Electronic Devices and Circuits by Salivahana TMH
6. Basic Electronics by B.L.Theraja.
7. Basic Electronic Principles by Malvino, TMH

DIGITAL ELECTRONICS

Subject Title : Digital Electronics

Subject Code : AEI-303

Periods/Week : 06

Periods/Semester : 90

TIME SCHEDULE

S. No.	Major topics	No. of periods	Weight age of marks	Short Answer Questions	Essay Questions
1	Basics of Digital Electronics	18	26	2	2
2	Combinational Logic circuits	18	26	2	2
3	Sequential Logic Circuits	24	29	3	2
4	Registers and Memories	15	16	2	1
5	A/D and D/A converters	15	13	1	1
Total		90	110	10	8

OBJECTIVES

On completion of the study of the subject a student should be able to:

1.0 Understand the basics of Digital Electronics

- 1.1 Explain Binary, Octal, Hexadecimal number systems and compare with decimal system.
- 1.2 Convert one number system to another of the above systems.
- 1.3 Perform binary addition, subtraction, Multiplication and Division.
- 1.4 Write 1's complement and 2's complement numbers for a given binary number.
- 1.5 Perform subtraction of binary numbers in 2's complement method.
- 1.6 Compare weighted and Un-weighted codes.
- 1.7 Write Binary equivalent number for number in 8421, Excess-3 and Gray code and vice-versa.

- 1.8 State the use of alphanumeric codes (ASCII & EBCDIC)
- 1.9 State the importance of parity Bit.
- 1.10 List the types of parity bits.
- 1.11 State different postulates in Boolean algebra.
- 1.12 Write Boolean expressions for the given statement of the problem (Limited 3 variables only).
- 1.13 State De-Morgan's theorems.
- 1.14 Apply De-Morgan's theorems and other postulates to simple Boolean expressions.
- 1.15 Write Boolean expressions from the given truth table.
- 1.16 Use Karnaugh map to simplify Boolean Expression (up to 3 variables only).
- 1.17 Explain AND, OR, NOT operators with truth table.
- 1.18 Explain the working of an exclusive – OR gate with truth table.
- 1.19 Explain the working of NAND, NOR gates using truth tables.
- 1.20 Develop AND, OR, NOT operations using NAND, NOR gates.
- 1.21 List the numbers of two input Digital IC Logic gates.

2.0 Understand the working of combinational logic circuits

- 2.1 Define combinational logic circuit.
- 2.2 State the function of the Half-adder.
- 2.3 Draw Half adder circuit using Exclusive OR gate and an AND gate.
- 2.4 Realise a Half-adder using NAND gates only and NOR gates only.
- 2.5 State the function of the full-adder.
- 2.6 Draw full adder using basic gates.
- 2.7 Show that two Half-adders and an OR – gate constitutes a full-adder.
- 2.8 Draw a 4 Bit parallel adder using full – adders.
- 2.9 Explain the working of the above circuit.
- 2.10 Draw and Explain 2's compliment parallel adder/ subtractor circuit.
- 2.11 Explain the working of a serial adder with a Block diagram.
- 2.12 Distinguish between serial and parallel adder.
- 2.13 Draw and explain the operation 4 X 1 Multiplexer
- 2.14 Draw and explain the operation 1 X 4 Demultiplexer
- 2.15 Draw and explain 2 X 4 and 3 X 8 decoders.
- 2.16 List the applications of Multiplexer and decoder.
- 2.17 Explain the working of 4 X 2 encoder.
- 2.18 Draw and explain one-bit digital comparator.

3.0 Understand the working of Sequential logic circuits

- 3.1 Define Sequential logic circuit.
- 3.2 Distinguish between synchronous and asynchronous sequential logic circuits.
- 3.3 Construct SR flip flop using NAND gates and explain its operation.
- 3.4 Explain JK flip flop with the help of truth table
- 3.5 State the need for preset and clear inputs
- 3.6 State the race around condition.
- 3.7 List the conditions for eliminating the race around condition.
- 3.8 Explain JK Master Slave flip flop with truth table
- 3.9 Explain the D flip flop and T flip-flop with the help of truth table and diagram.
- 3.10 Define counter.
- 3.11 Differentiate between synchronous and asynchronous counters.
- 3.12 Define Modulus of the Counter.
- 3.13 Explain asynchronous ripple counter (MOD-16) with the help of flip-flops and timing diagrams.

- 3.14 Explain asynchronous ripple counter (MOD-10 or Decade counter) with the help of flip-flops and gates.
- 3.15 Explain synchronous ripple counter (MOD-16) with the help of flip-flops and gates.
- 3.16 Explain the working of Ring counter and list its applications

4.0 Understand working of Registers and memory

- 4.1 Define the term Register.
- 4.2 State the need for a Register.
- 4.3 Explain the working of serial in Serial out, serial in Parallel out, Parallel in serial out and Parallel in parallel out Registers.
- 4.4 Explain the working of shift left and shift right Registers.
- 4.5 Explain the working of Universal shift register (74194 or equivalent)
- 4.6 List the applications of Register.
- 4.7 List various types of memories
- 4.8 Differentiate between ROM and RAM
- 4.9 Explain basic principle of working of ROM
- 4.10 State different types of ROM
- 4.11 Explain basic principle of working of RAM
- 4.12 Compare static RAM and dynamic RAM
- 4.13 List different ROM and RAM ICs

5.0 Understand the need for A/D and D/A converters

- 5.1 State the need for A/D converters.
- 5.2 State the need for D/A conversion.
- 5.3 Explain the basic principle of D/A conversion.
- 5.4 Define the terms resolution, Accuracy, Monotonicity and settling time of D/A converter.
- 5.5 Explain D/A conversion using weighted resistors.
- 5.6 Explain D/A conversion using R-2R ladder network.
- 5.7 Explain A/D conversion using counter method.
- 5.8 Explain A/D conversion using successive approximate method.

COURSE CONTENTS

1.0 Basics of Digital Electronics

Binary, Octal, Hexadecimal numbering systems. Conversion from one system to another number system. Binary codes, excess-3 and gray codes. Logic gates: AND, OR, NOT, NAND, NOR, Exclusive-OR. Boolean algebra, Boolean expressions. Demorgan's Theorems. Karnaugh map.

2.0 Combinational logic circuits

Half adder, Full adder, Serial and parallel Binary adder. Parallel adder, Multiplexer, Demultiplexer, decoder, encoder, Digital comparator

3.0 Sequential logic circuits

Principle of flip-flops operation, RS, D, JK, T, JK Master Slave flip-flops. Binary counter, asynchronous ripple counter, decade counter., synchronous counter, Ring Counter.

4.0 Registers and memories

Shift Registers- serial in Serial out, serial in Parallel out, Parallel in serial out and Parallel in parallel out Registers. Universal shift registers-Applications.RAM, ROM, static RAM, dynamic RAM.

5.0 A/D and D/A Converters

Necessity of A/D and D/A converters.Weighted resistors and R-2R ladder method of D/A converters.Counter and SAR method of A/D converters.

Reference Books

1. Modern Digital Electronics By RP JAIN TMH
2. Digital Electronics Tokhem TMH
3. Digital Electronics Puri TMH
4. Digital Computer Fundamentals by Barty
5. Digital Electronics and logic design by B. Somanathan Nair, PHI
6. Digital Computer Electronics by Malvino., TMH
7. Digital logic and computer design by M. Morris Mano.

ELECTRONIC MEASURING INSTRUMENTS

Subject Title : **Electronic Measuring Instruments**
Subject Code : **AEI-304**
Periods/Week : **05**
Periods/Semester : **75**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	Weight age of Marks	Short Answer Questions	Essay Questions
1	Analog instruments	17	29	3	2
2	Digital instruments	16	26	2	2
3	CRO	20	29	3	2
4	Signal generators	11	13	1	1
5	Test instruments	11	13	1	1
	Total	75	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Understand the working Analog instruments

1. 1 Classify the analog measuring instruments.
1. 2 List the different torques needed for driving analog instruments.
1. 3 Explain the construction and principle of operation of PMMC instrument.
1. 4 Explain the principle of operation of extending the range of DC ammeter
1. 5 Explain the principle of operation of extending the range of DC voltmeter.
1. 6 Explain the construction and principle of operation of Moving Iron instrument.
1. 7 Explain the principle and working of rectifier type voltmeters.
1. 8 Explain the construction and principle of operation of series and shunt type ohmmeters.
1. 9 State the need for high input impedance for a voltmeter.
1. 10 Explain the working of FET input voltmeter with necessary circuit (DC/AC) and emitter follower voltmeter.
1. 11 Explain the working of differential voltmeters.
1. 12 Define sensitivity of voltmeter and explain loading effect.
1. 13 State the use of Meggar for insulation measurements.
1. 14 Give the classification of bridge circuits.
1. 15 Mention the balancing conditions of bridges (AC and DC).
1. 16 Explain the resistance measurement using Wheatstone bridge.
1. 17 Explain the inductance measurement using Maxwell's Bridge.
1. 18 Explain the capacitance measurement using Schering Bridge.

2.0 Understand working of Digital instruments

- 2.1 List the advantages of digital instruments over analog instruments.

- 2.2 Explain the working of digital voltmeters (Ramp type, successive approximation type) with block diagrams.
- 2.3 List the specifications of digital voltmeters.
- 2.4 Explain the working of Digital Multimeter with block diagram.
- 2.5 List the specifications of Digital Multimeter.
- 2.6 Explain the working of digital frequency meter with block diagram.
- 2.7 List the specifications of digital frequency meter.
- 2.8 Explain the working of digital LCR meter with block diagram.
- 2.9 List the specifications of digital LCR meter.

3.0 Understand the working of CRO

- 3.1 Draw the block diagram of general purpose CRO and describe the function of each block.
- 3.2 Sketch CRT and describe the function of each part.
- 3.3 State the necessity of time base generator.
- 3.4 Write the expression for deflection sensitivity.
- 3.5 List the conditions for stationary and flicker free waveforms.
- 3.6 Explain triggered sweep with necessary circuit, and mention its advantages.
- 3.7 List the front panel controls of CRO and state their function.
- 3.8 List its specifications of CRO.
- 3.9 List the applications of CRO.
- 3.10 Explain the procedure for measurement of voltage (DC & AC), frequency, and phase using CRO.
- 3.11 Explain the Dual trace oscilloscope with a block diagram.
- 3.12 Explain the principle of operation of Storage oscilloscope with a block diagram.
- 3.13 Explain the principle of operation of Digital oscilloscope with a block diagram.

4.0 Understand the working of AF and RF signal generators.

4. 1 Explain the working of AF Oscillator (sine & square) with block diagram.
4. 2 List the front panel controls of AF Oscillator and state their function.
4. 3 List specifications of AF Oscillator.
4. 4 Explain the working of function generator with block diagram.
4. 5 List the applications of AF oscillators and function generators.
4. 6 Explain the working of RF signal generator.
4. 7 List the specifications and applications of RF signal generator.
4. 8 State the importance of shielding in RF generators.

5.0 Understand the working of test instruments

5. 1 Define Q meter.
5. 2 Explain the working of Q meter with diagram.
5. 3 Explain the working of digital IC tester with block diagram.
5. 4 Explain the working of logic analyser with block diagram.
5. 5 State the necessity of plotter and recorders.
5. 6 List the different recorders.
5. 7 Explain the working of XY recorders.
5. 8 Explain the working of plotter.

COURSE CONTENTS

- 1.0 **Analog instruments:**
PMMC Instrument, extending the range of instruments, series and shunt type

ohmmeter, moving iron type instrument, Rectifier type voltmeter, FET input voltmeter, differential voltmeter, Wheatstone, Maxwell, Schering Bridge.

2.0 Digital Instruments:

Digital voltmeter, Digital Multimeter, Digital frequency meter, Digital LCR Meter.

3.0 Cathode Ray Oscilloscope:

Block diagram of general purpose CRO, sweep circuits, triggered sweep circuit, controls, specifications, applications, dual trace CRO, Storage CRO, Digital CRO.

4.0 AF and RF signal generators

AF oscillator- specifications, function generator, RF signal generator - specifications,

5.0 Test instruments:

Q meter, Plotter and Recorders. Digital IC tester, Logic analyser.

Reference Books

1. Electronic instrumentation and measurements by David A Bell, PHI
2. Electronic Instrumentation by H S Khalsi, TMH
3. Electronic Measurements & Instruments by Cooper PHI
4. Modern Electronic Equipment by Khandpur
5. Electrical, Electronic Measurements and Instruments by Sahney

PROCESS INSTRUMENTATION

Subject Title : Process Instrumentation
Subject Code : AEI - 305
Periods per Week : 06
Periods per semester : 90

TIME SCHEDULE

Sl.No.	Major Topics	No. of Periods	Weight age of marks	Short Answer Questions	Essay Questions
1	Fundamentals of Instrumentation	11	16	02	01
2	Displacement and position measurement	13	13	01	01
3	Temperature measurement	10	13	01	01
4	Pressure measurement	10	13	01	01
5	Flow measurement	16	16	02	01
6	Level Measurement	10	13	01	01
7	Density and Viscosity measurements	10	13	01	01
8	Weight and Humidity measurements	10	13	01	01
	Total	90	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Fundamentals of Instrumentation

1.1 Define the following terms:

- i. Accuracy
- ii. Precision
- iii. Error
 - a) Intrinsic, Absolute and Relative errors
 - b) Uncertainty and Random error
 - c) Systematic and instrumental errors
 - d) Interference errors
 - e) Installation errors
 - f) Operational errors (Human errors)
- iv. Linearity
- v. Hysteresis

- vi. Resolution and scale readability
- vii. Threshold
- viii. Repeatability
- ix. Reliability and maintainability
- x. Range and Span

- 1.2 Define calibration and state the need of calibration.
- 1.3 Define Sensor and Transducer.
- 1.4 Classify the transducers and mention few transducers under each category.
- 1.5 List the basic requirements of Transducer.

2.0 Understand the principles of displacement and position measurements

2.1 Explain the principle of operation of the following

- I. Linear potentiometers
- II. Linear variable differential transformers (LVDT)
- III. Linear variable Reluctance transducers (LVRT)

2.2 Explain the principles of Inductive and Capacitive proximity sensors for position measurement.

2.3 Explain the principle of Resistance strain gauge and give the expression for gauge factor.

2.4 Explain the principle of operation of Rotary variable differential transformer (RVDT).

2.5 State the importance of vibration monitoring.

2.6 Explain the principle of operation of the following for linear velocity transducers.

- a. Moving coil type velocity transducer
- b. Moving iron type velocity transducer

2.7 Explain the principle of operation of the following for angular velocity measurement.

- a. AC Tacho generators
- b. Photo electric Tachometer
- c. Toothed rotor variable reluctance Tachometer.

3.0 Understand the principles of Temperature measurement

3.1 Define the term temperature

3.2 Classify Temperature transducers

3.3 Explain the principle of operation of the following.

- a. Bi-metallic strip
- b. Liquid filled thermometers.
- c. Resistance Temperature Detector
- d. Thermocouple
- e. Thermistor
- f. Total radiation pyrometer
- g. Solid state sensors

3.3 List the applications of the above temperature transducers and give their range.

4.0 Understand the principles of pressure measurement.

4.1 Explain with a diagram the principle of operation of the following Elastic elements for pressure measurement

- a. Diaphragm : Membrane diaphragm, Thin plate diaphragm, corrugated diaphragm
- b. Capsule : Single capsule & Double capsule
- c. Bellows
- d. Bourdon tube: C-shaped bourdon tube, Twisted bourdon tube & Helical bourdon tube

4.2 Explain the principle of operation of the following electrical pressure transducers.

- a. Potentiometric transducer
- b. Strain gauge transducer
- c. Variable reluctance transducer
- d. LVDT type transducer
- e. Variable capacitance transducer
- f. Thin film pressure transducer
- g. Force -Balance Transducer
- h. Piezoelectric pressure transducer

4.3 State the necessity and explain the principle of pressure multiplexer

4.4 Explain the pressure calibration using Dead Weight tester.

5.0 Understand the principles of flow measurement.

5.1 Explain the principle of operation and list the applications of the following Head – type flow meters based on differential pressure measurement

- a. Orifice plate
- b. Venturi tube
- c. Pitot tube

5.2 Explain the principle of operation of the Rotameter (variable – area meter) and also list its applications

5.3 Explain the principle of operation of Turbine flow meter and list its applications

5.4 Explain the principle of operation of the following Anemometers and list their applications.

- a. Cup type Anemometer
- b. Hot wire/hot film type Anemometer

5.5 Explain the principle of operation of the following flow meters and list their applications

- a. Electromagnetic flow meter
- b. Ultrasonic flow meter
- c. Laser anemometer.

6.0 Understand the principles of Level measurement.

6.1 Explain the principle of operation of the following and list their applications.

- a. Liquid level sight glass
- b. Float Actuated level indicators
- c. Resistive type level indicator.
- d. Capacitance type level indicators
- e. Nucleonic level gauge.
- f. Ultrasonic level gauge
- g. Level switches

7.0 Understand the principles of density and Viscosity measurement

- 7.1 Define density
- 7.2 State the necessity of density measurement.
- 7.3 Explain the principle of operation of the following for density measurement.
 - a. Displacement type
 - b. Fluid dynamic type
 - c. Capacitance type
- 7.4 Define Viscosity
- 7.5 State the necessity of viscosity measurement
- 7.6 Explain the principle of operation of the following viscometers
 - a. Capillary viscometers
 - b. Falling ball viscometers
 - c. Rotating viscometers

8.0 Understand the principles of Weight and humidity Measurements.

- 8.1 Explain the principle of operation of the following for weight measurement and list their applications.
 - a. Hydraulic load cells
 - b. Pneumatic load cells
 - c. Strain gauge load cells
- 8.2 Define relative humidity.
- 8.3 Explain the principle of operation of following hygrometers
 - a) Condensation type hygrometer.
 - b) Electrolytic hygrometer.

COURSE CONTENTS

1.0 Fundamentals of Instrumentation

Accuracy, Precision, Error- Intrinsic, Absolute and Relative errors, Uncertainty and Random error, Systematic and instrumental errors, Interference errors, Installation errors, Operational errors (Human errors)- Linearity, Hysteresis, Resolution, Threshold, Repeatability, Reliability, Maintainability, Span, Calibration, Transducer – Classification.

2.0 Displacement and Position Measurements

Linear potentiometers, L.V.D.T, linear variable Reluctance Transducers, RVDT, linear velocity measurement, moving coil type velocity transducers, moving iron type velocity transducers, Angular velocity measurements - AC Tachogenerators, Photo electric tachometer, Toothed rotor variable reluctance tachometer.

3.0 Temperature measurement

Bimetallic strip, Liquid filled thermometer, RTD, Thermocouple, Thermistor, Total radiation pyrometer and solid state sensor

4.0 Pressure measurements :

Elastic elements used for pressure measurements-Diaphragms, Capsules, Bellows, Bourdon tubes, principle of operations of pressure transducers- Potentiometer, Strain gauge transducer, Variable reluctance transducer, LVDT type transducer, Variable capacitance transducer, Thin film pressure transducer, Force -Balance

Transducer, Piezoelectric pressure transducer. Principle of pressure multiplexer, pressure calibration using dead weight tester.

5.0 Flow measurements:

Head type of flow meters, Rota meters. turbine flow meter, Anemometers- cup type and hot wire type. Ultra sonic flow meters, thermal flow meters, laser anemometers, Electromagnetic flow meters

6.0 Level measurements:

Liquid level sight glass, float actuated level indicator, resistance, inductance, capacitance type level indicators, nucleonic, Ultrasonic level gauges. Level switch.

7.0 Density measurements and viscosity measurements:

Displacement type, Fluid dynamic type, Capacitance type density measurement. Capillary viscometers, falling ball viscometers, Rotating viscometers.

8.0 Weight and Humidity Measurements :

Hydraulic load cells, Pneumatic load cells, Strain gauge load cells, Relative humidity, condensation type and electrolytic hygrometers.

REFERENCE BOOKS:

1. Principles of Industrial Instrumentation By Patranabis.
2. Industrial Instruments and Control by S.K.Singh
3. Mechanical Measurements and Control by DS. Kumar
4. Instrument Engineer Hand Book by Liptak.
5. Instrumentation Measurement, Devices and systems by Rangan , Mani and Sharma.
6. Instrument Technology Vol-I BY E.B. Jones.
7. Electrical and Electronics Measurement and Instrumentation by A.K. Sahwney
8. Electronic Measurement and Instrumentation by Nakra & Chowdary.
9. ransducers Technology BY DVS Murthy.

ELECTRONIC CIRCUITS LAB

Subject Title : **Electronic Circuits Lab**
Subject Code : **AEI-306**
Periods/Week : **03**
Periods/Semester : **45**

LIST OF EXPERIMENTS

1. Construct and draw the drain characteristics of FET & MOSFET.
2. Construct and draw the characteristics of UJT.
3. Construct and draw the characteristics of SCR.
4. Perform an experiment on CE transistor amplifier, and Measure the values A_v , A_i , Z_i , Z_o from it.
5. Perform an experiment on RC coupled amplifier and Draw its frequency response
6. Perform an experiment on transformer coupled amplifier and Draw its response characteristics.
7. Perform an experiment and draw the response characteristics of Push-pull power amplifier.
8. Construct and test the function of Negative feedback voltage amplifier
9. Construct and find the frequency of RC-phase shift oscillator.
10. Construct and find the frequency of Wein-bridge oscillator.
11. Construct and find the frequency of Colpitts oscillator.
12. Construct and find the frequency of Hartley oscillator.
13. Construct and find the frequency of Crystal oscillator.
14. Construct transistorised Bistable multivibrator and draw its waveforms.
15. Construct transistorised Monostable multivibrator and draw its waveforms.
16. Construct transistorised Astable multivibrator and draw its waveforms.
17. Construct Schmitt trigger circuit using transistor and draw its waveforms.

Digital Electronics Lab

Subject Title : **Digital Electronics Lab**
Subject Code : **AEI-307**
Periods/Week : **03**
Periods/Semester : **45**

List of Experiments

1. Logic gates – I - AND, OR, NOT (Using IC's).
2. Logic gates – II - NAND, NOR, Exclusive OR (using IC's).
3. Half-adder using IC logic gates.
4. Full-adder using IC logic gates.
5. Verification of truth tables for RS, D, T, and JK and Master - Slave JK Flip-flops.
6. Verify function of counter (ICs like 7490, 7492, 7493, 74 C 93, 74160).
7. Verify function of shift register (ICs like 74104, 74185, 74 C 164, 7495, 74194 etc.)
8. Construct a comparator circuit for 7485 and verify the truth table.
9. Construct and verify the working SA type A/D converter.
10. Construct and verify the working of R-2R D/A converter.
11. Verify the working of Multiplexer
12. Verify the working of Demultiplexers
13. Implement any given Boolean function using logic gates.

ELECTRONIC MEASURING INSTRUMENTS LAB

Subject title : **Electronic Measuring Instruments lab**
Subject Code : **AEI-308**
Periods/week : **03**
Periods/semester : **45**

List of experiments

1. Conduct an experiment to Calibrate Ammeter and Voltmeter.
2. Conduct an experiment to extend the range of Ammeter and Voltmeter.
3. Conduct an experiment to convert an Ammeter to Voltmeter.
4. Conduct an experiment to construct series and shunt Ohmmeter.
5. Study the use of Meggar.
6. Study the front panel of a digital multimeter.
7. Conduct an experiment to measure voltage, current and resistance using digital multimeter.
8. Study the front panel of a Digital LCR meter.
9. Conduct an experiment to measure R, L, C parameters using digital LCR meter.
10. Study the front panel of a signal generator.
11. Conduct an experiment to test the signals generated by signal generator using multimeter and CRO.
12. Study the front panel of Digital IC tester.
13. Conduct an experiment to test an IC using Digital IC tester.
14. Study the front panel of CRO.
15. Study the use of different types of probes used for CRO.
16. Conduct an experiment to measure voltage, frequency and phase using CRO.
17. Conduct an experiment to measure frequency using lissajous patterns in CRO.

PROCESS INSTRUMENTATION LAB

Sub. Title : **Process instrumentation Lab**

Sub. Code : **AEI-309**

Periods/week : **06**

Periods/Semester : **90**

List of Experiments

1. Conduct an experiment to measure Linear Displacement using LVDT and plot a graph between voltage and displacement.
2. Conduct an experiment to measure Linear Displacement using Resistive Transducer and plot a graph between resistance and displacement
3. Conduct an experiment to measure angular velocity using Tachometer.
4. Conduct an experiment to measure Temperature using RTD and plot graph between temperature and resistance.
5. Conduct an experiment to measure Temperature using Thermister and plot the following graphs
 - (a) Between temperature and resistance
 - (b) Between voltage and temperature
6. Conduct an experiment to measure Temperature using Thermocouple and plot a graph between temperature and voltage.
7. Conduct an experiment to measure Pressure using Strain gauge Load cell and plot a graph between pressure and voltage.
8. Conduct an experiment to measure Flow rate using
 - a. Orifice Plate
 - b. Venturi Tube
 - c. Rota meter
9. Conduct an experiment to measure Level using
 - i. Float type level indicator
 - ii. Resistive type level indicator
 - iii. Bubbler type level measurement
10. Conduct an experiment to measure the Density of given sample.
11. Conduct an experiment to measure viscosity of given sample using viscometer.
12. Conduct an experiment to measure Weight using Strain gauge Load cell.
13. Conduct an experiment to measure relative humidity using hygrometer

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

IV Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI -401	Linear IC Applications & Communication Systems	6	-	90	3	20	80	100
AEI -402	Process Control	6	-	90	3	20	80	100
AEI-403	Programming in C	5	-	75	3	20	80	100
AEI-404	Analytical Instrumentation	5	-	75	3	20	80	100
AEI-405	Industrial Electronics & control Systems	5	-	75	3	20	80	100
PRACTICAL:								
AEI-406	Linear IC Applications & e CAD Lab	-	6	90	3	40	60	100
AEI-407	Process control Lab	-	3	45	3	40	60	100
AEI-408	Communication Skills	-	3	45	3	40	60	100
AEI-409	Programming in C lab	-	3	45	3	40	60	100
TOTAL		27	15	630	-	260	640	900

LINEAR IC APPLICATIONS AND COMMUNICATION SYSTEMS

SUBJECT NAME : Linear IC Applications and Communication Systems

SUBJECT CODE : AEI- 401

PERIODS/WEEK : 06

PERIODS/SEMESTER : 90

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	Weight age of marks	Short Answer Questions	Essay Questions
1	Introduction to Operational amplifiers	12	16	2	1
2	Applications of Operational amplifiers	13	16	2	1
3	Active filters	10	13	1	1
4	555 Timer IC	10	13	1	1
5	Analog communication	12	13	1	1
6	AM and FM detectors, receivers	13	13	1	1
7	Pulse modulation	10	13	1	1
8	Modern communication	10	13	1	1
	Total	90	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Introduction to operational amplifiers

- 1.1 State the requirement of an operational amplifier.
- 1.2 Draw the circuit of differential amplifier.
- 1.3 Explain the operation of differential amplifier.
- 1.4 List the limitations of differential amplifier using discrete components.
- 1.5 Draw and explain the block diagram of a typical integrated circuit operational amplifier.
- 1.6 List and sketch different package styles of analog ICs.
- 1.7 Draw the pin diagrams of metal can package and dual-in-line package for a typical IC 741 or equivalent.
- 1.8 Draw the schematic symbol of operational amplifier.
- 1.9 List the basic specifications of ideal operational amplifier.
- 1.10 Define Voltage gain A_v , output impedance Z_o , input impedance Z_i , Bandwidth BW, input offset voltage, input offset current, input bias current, input resistance and also give the typical values for an ideal operational amplifier.

- 1.11 Define C.M.R.R.
- 1.12 State the need for high C.M.R.R.
- 1.13 Define slew rate with reference to operational amplifier.

2.0 Understand the applications of operational amplifiers

- 2.1 Explain the open loop operation of an operational amplifier.
- 2.2 Mention the effects of negative feedback on an amplifier.
- 2.3 Draw and explain the operation of non inverting, inverting amplifiers, and voltage follower circuits.
- 2.4 Draw and explain the operation of summing amplifier, difference amplifier.
- 2.5 Draw and explain the operation of ideal and practical integrator and differentiator circuits.
- 2.6 Draw and explain the operation of current to voltage converter
- 2.7 Draw and explain the operation of voltage to current converter.
- 2.8 Draw and explain the operation of Instrumentation amplifier and Isolation amplifier.
- 2.9 Explain the operating principle of phase locked loop (PLL) with the help of block diagram.
- 2.10 List the applications of PLL.

3.0 Understand the active filters (No mathematical treatment)

- 3.1 Define Filter.
- 3.2 Define Pass band and Stop band.
- 3.3 Draw the ideal and practical frequency response plots for a first order LPF, HPF, BPF, and BSF.
- 3.4 List the limitations/disadvantages of passive filters.
- 3.5 State how active filters overcome the above limitations.
- 3.6 Draw and explain the operations of LPF, HPF, BPF and BSF using operational amplifiers.
- 3.7 List the disadvantages of active filters.

4.0 Understand the operation and application of 555 Timer IC

- 4.1 Draw the block diagram of 555 timer IC.
- 4.2 Explain the operation of various blocks of a 555 timer IC.
- 4.3 Draw the pin diagram of 555 IC and Mention the function of each pin.
- 4.4 Draw and explain the operations of mono stable Multivibrator using 555 IC.
- 4.5 Draw and explain the operation of Astable multivibrator using IC 555 timer.
- 4.6 Mention the applications of 555 Timer IC.

5.0 Introduction to Analog communication

- 5.1 State the need for Modulation in communication system.
- 5.2 Name the different types of Analog modulation methods.
- 5.3 Explain AM, FM and PM with waveforms and give their expressions.
- 5.4 Explain SSB, DSBSC and VSB.
- 5.5 List the merits and demerits of AM and FM.
- 5.6 Distinguish between FM and PM.
- 5.7 Explain AM generation using base circuits and collector circuits.
- 5.8 Draw the block diagram and explain AM transmitter.

- 5.9 Explain the following methods of FM generation by using Reactance tube and Varactor diode
- 1.10 Draw the block diagram and explain FM transmitter.

6.0 Understand the AM and FM detectors / Receivers.

- 6.1 Explain the principle of TRF receiver.
- 6.2 State the need for heterodyning in radio receiver.
- 6.3 Draw and explain the block diagram of super heterodyne receiver.
- 6.4 Define the terms selectivity, sensitivity, fidelity and Image Frequency Rejection.
- 6.5 Explain the basic principle of operation of AM & FM detector.
- 6.6 Draw and explain single diode detector circuit.
- 6.7 List FM demodulator circuits.
- 6.8 Draw and explain Fosters – Seely demodulator.
- 6.9 Draw and explain FM receiver.

7.0 Understand the principle of pulse modulation

- 7.1 State the principle of pulse modulation.
- 7.2 List different types of pulse modulation methods.
- 7.3 Sketch the waveforms of PAM, PPM, PWM
- 7.4 Explain PCM with Block Diagram.
- 7.5 List the merits of PCM.
- 7.6 List the applications of the above four types of modulation.
- 7.7 List different types of multiplexing methods and explain them with neat diagrams

8.0 Introduction to Modern Communication Systems

- 8.1 State the basic principle of Radar with a block diagram.
- 8.2 Explain the principle of fibre optic communication with a block diagram.
- 8.3 List the Transmitters and receivers used in fibre optic communication.
- 8.4 Explain the principle of Satellite communication system.
- 8.5 Explain uplink and downlink and the frequencies used in satellite communication system.
- 8.6 Explain the principle of cellular communication.
- 8.7 Explain FDMA, TDMA and CDMA.
- 8.8 List the features of GSM Mobile Technology.
- 8.9 List the features of CDMA Technology.
- 8.10 Compare CDMA & GSM.

COURSE CONTENTS

- 1.0 Introduction to Operational amplifiers:** Block diagram of typical operational amplifier; IC package, pin identification, **Definitions:** Input offset voltage, input offset current, input bias current, input resistance, slew rate, CMRR, with reference to operational amplifier, specifications of ideal op-amp.
- 2.0 Applications of Operational amplifiers:** Open loop op-amp configuration, inverting and non-inverting amplifier. Op-amp with feedback: summing amplifier, differential amplifier, integrator, differentiator, Instrumentation amplifier, and isolation amplifier voltage to current converter and current to voltage converter, PLL.

- 3.0 Active Filters (No mathematical treatment):** Low pass, high pass, Band pass and Band elimination filters, frequency response.
- 4.0 555 Timer IC:** Block diagram and operation of 555 timer IC, Monostable, Astable multivibrator operations using 555 timer IC.
- 5.0 Analog Communication**
Modulation, AM, FM, PM, SSB, DSB and VSB, Generation of AM and FM, AM Transmitter, FM Transmitter.
- 6.0 AM and FM Detectors / Receivers**
Crystal Receiver, TRF Receiver, Super heterodyne Receiver, Selectivity, Sensitivity and Fidelity, FM Receiver, Diode detector, Foster-Seely Demodulator.
- 7.0 Pulse Modulation**
Principle of pulse modulation, PAM, PWM, PPM, PCM and Applications, Multiplexing methods.
- 8.0 Modern communication systems**
Radar, Fibre optic communication, Satellite communication, computer GSM Mobile, Transmission Reception, CDMA, and GSM

REFERENCE BOOKS

1. Op Amps & Linear Integrated Circuits -- Ramakanth A Gaykwad
2. linear Integrated Circuits -- Roy Chowdary
3. Integrated Circuits -- Botkar
4. Mobile Cellular Telecommunications - by William C.Y. Lee
5. Satellite Communication - by Martin
6. Communication systems - by Simon Hawkins
7. Electronic Communication Systems - by Blake
8. Wireless communication Systems - by William shallings

PROCESS CONTROL

Subject Title : Process Control

Subject Code : AEI- 402

Periods/Week : 06

Periods/Semester : 90

TIME SCHEDULE

Sl. No.	Major Topics	No. of Periods	Weight age of marks	Short Questions	Essay Questions
1	Introduction to process control	10	13	1	1
2	Controller principles	28	29	3	2
3	Introduction to final control operation	22	29	3	2
4	Advanced process Control systems	20	26	2	2
5	Process instrument diagrams and standards	10	13	1	1
	Total	90	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Introduction to process control

- 1.1 Define process and process control.
- 1.2 Explain the development of automatic process control with an example.
- 1.3 Draw the block diagram of a process control loop.
- 1.4 Describe each element in a process control loop.
- 1.5 Explain batch process and continuous process.
- 1.6 Define controlled variable and manipulated variable.
- 1.7 Explain controlled variable and manipulated variable with an example.
- 1.8 Explain a physical control system and draw its block diagram.

2.0 Introduction to Controller principles

- 2.1 Define process load, process lag and self-regulation.
- 2.2 Define error, control lag, dead time, and cycling.
- 2.3 List the Discontinuous control modes.
- 2.4 Describe two positions, multi position and floating control modes.
- 2.5 List the continuous control modes.
- 2.6 Define proportional control mode.
- 2.7 Describe proportional control mode.
- 2.8 Define proportional band and offset.
- 2.9 List the characteristics of proportional control mode.

- 2.10 Define integral control mode.
- 2.11 Describe integral control mode.
- 2.12 List the characteristics of integral control mode.
- 2.13 Define derivative control mode.
- 2.14 Describe the derivative control mode.
- 2.15 List the characteristics of derivative control mode.
- 2.16 List the composite control modes.
- 2.17 Describe the Proportional-Integral Control modes.
- 2.18 List the characteristics of Proportional-Integral Control modes.
- 2.19 Describe PD and PID control modes.
- 2.20 List advantages and disadvantages of PI, PD & PID controllers.
- 2.21 State the need for tuning of PID controllers.
- 2.22 Describe the following methods of tuning of PID controllers
 - a) Ultimate gain method
 - b) Process reaction curve method.

3.0 Introduction to Final control Operation

- 3.1 Explain the Principle of final control operation.
- 3.2 Draw the block diagram of final control operation and explain its each block.
- 3.3 State the need for electric to pressure and pressure to electric converters.
- 3.4 Explain the basic principle of Nozzle-Flapper system with a diagram.
- 3.5 Explain the principle of operation of Electric to Pressure converter.
- 3.6 Explain the principle of operation of Pressure to Electric converter.
- 3.7 List the different types of Actuators.
- 3.8 Explain the principle of Pneumatic Actuator with diagram.
- 3.9 Explain the principle of Hydraulic Actuator with diagram.
- 3.10 Explain the principle of Electro Pneumatic Actuator with diagram.
- 3.11 Explain the following Electrical actuators
 - a) Solenoid valve actuator
 - b) Stepper motor actuator
- 3.12 Explain the constructional details of control valve.
- 3.13 Classify control valves.
- 3.14 Explain the following different types of control valves.
 - a) Flow – lift characteristics control valves such as Quick opening, Linear, Equal percentage valves,
 - b) Sliding stem Single seat Plug Control valve
 - c) Rotating shaft control valve (Butterfly valve)

4.0 Introduction to Advanced process Control systems

- 4.0 Define the following control system configuration.
 - a) Single variable control system.
 - (i) Independent single variable control system
 - (ii) Interactive single variable control system
 - b) Compound variable control system and
 - c) Multivariable control system
- 4.1 Draw and explain the block diagram of cascade control system.
- 4.2 Justify how the cascade control system is better than single loop control system with an example.
- 4.3 List the applications of cascade control system.
- 4.4 Draw and explain the block diagram of feed forward control system.
- 4.5 Explain the feed forward control system with an example.
- 4.6 Distinguish between feedback and feed forward control systems.
- 4.7 List the applications of feed forward control system.
- 4.8 Explain the operation of Ratio control system with a diagram.
- 4.9 List the applications of Ratio control system.

- 4.10 Define Adaptive control.
- 4.11 Explain programmed adaptive control system with block diagram.
- 4.12 Explain with a diagram of self adaptive control system with model reference adaptive control.
- 4.13 List the applications of adaptive control system.

5.0 To understand the process line diagrams, standards

5.1 Draw the following line diagrams and symbols.

- a) Process line, connection to process or instrument supply
- b) Fluid pressure Line.
- c) Electric signal
- d) Pneumatic signal
- e) Hydraulic signal
- f) Capillary tube.
- g) Electromagnetic or Sonic signal (guided and not guided).
- h) Undefined signal.
- i) Mechanical link
- j) Internal system link (software or data link or computer signal)
- k) Orifice installed line.
- l) Point of measurement

5.2 Draw the symbols for the following controllers and transmitters.

- (a) Pressure transmitter
- (b) Flow Transmitter
- (c) Level Transmitter
- (d) Temperature Transmitter
- (e) Pressure Controller
- (f) Flow Controller
- (g) Level Controller
- (h) Temperature Controller

5.3 Draw the symbols for the following control valves

- (a) Hydraulically operated control valve
- (b) Pneumatically operated control valve
- (c) Electrically operated control valve
- (d) Butterfly valve
- (e) Solenoid Valve
- (f) Gate valve
- (g) Gate valve-hand operated
- (h) Globe Valve
- (i) Globe valve- hand operated

5.4 Draw the following general instruments by Balloon symbols

- (a) Instrument at locally mounted
- (b) Instrument at control centre
- (c) Instrument- bifunctional /two services
- (d) Instrument-transmitting type

5.5 Define piping and instrumentation diagram.

5.6 Explain the use of letter codes for identification of instruments.

5.7 List and explain different standards used in Instrumentation.

- a) ISI
- b) ANSI
- c) BS
- d) ISA

COURSE CONTENTS

1. Introduction to process control:

Process control principle-process control block diagram –typical control variables- controlled variable, manipulated variable- Continuous and Batch process

2. Controller principles: - process characteristics –process load – process lag-self regulation-control system parameters: - error-variable range–control lag-dead time - cycling.

Controller modes–discontinuous-two-position, multi-position, floating, continuous control modes: - proportional, integral, derivative control mode. Composite control modes: - PI, PD and PID-Controller. tuning methods-Ultimate gain method and process reaction curve method.

3. Introduction to final control operation: - Different types of the Actuators: - Pneumatic, Hydraulic, Electrical Actuators-different types of control valves.

4. Advanced process Control systems: - Single variable – compound variable.

Multivariable control systems–cascade control–feed forward control-ratio controls– adaptive control systems..

5. Process instrumentation diagrams and standards:

Line diagrams-Definition of P & I diagrams- Use of letter code of identification of Instruments-Introduction to standards that are widely used in instrumentation Viz., ISI, ANSI, BIS, ISA etc.

REFERENCE BOOKS

1. Automatic process control by Donald.P.Eckmann
2. Instrument Engineers Hand book by Liptak, Volume II
3. Control Valves by Chatwal & Anand
4. Instrument Technology by B.E.Jones, Volume I, II, III
5. Computer based Industrial Control by Krishnakanth
6. Process Control by Peter Harriot
7. Process Analysis & Control by Coughnour.
8. Process control instrumentation technology by Curtis .D.Johnson Seventh edition
9. Process Control by D.Patranabis
10. Chemical Process Control by George stephanopoulous
11. Process Control by K.Krishna swamy

PROGRAMMING IN 'C'

Subject Title	: Programming in C
Subject Code	: AEI- 403
Periods / Week	: 05
Periods / Sem.	: 75

TIME SCHEDULE

S. No.	Major topics	No of periods	Weight age of marks	Short Answer Questions	Essay Questions
1	C Programming Basics	12	16	2	1
2	Decision & Loop Control Statements	16	26	2	2
3	Arrays & Strings	16	26	2	2
4	Functions in C	19	26	2	2
5	Structures, Unions & pointers	12	16	2	1
	Total	75	110	10	08

OBJECTIVES

On completion of the study of this subject a student shall be able to:

1.0 Understand C Programming Basics

- 1.1 Define High level language and low level language
- 1.2 Explain the structure of C language
- 1.3 State the function of preprocessor directives
- 1.4 List preprocessor directives.
- 1.5 Explain the preprocessor directives: #define, #include by taking examples
- 1.6 List the steps involved in executing the C program
- 1.7 Mention the character set of C language.
- 1.8 Define the Keywords and list them
- 1.9 Define the Identifiers and list them.
- 1.10 List the data types used in C and explain them with examples.
- 1.11 Explain constants and variables.
- 1.12 State the declaration of variables.
- 1.13 List the five Arithmetic Operators and give their precedence.
- 1.14 State the assignment statement.
- 1.15 List the shorthand assignment operators and explain with examples.
- 1.16 Define an expression and show how to evaluate an Arithmetic Expression.
- 1.17 Explain the increment and decrement operators.
- 1.18 List the relational operators used in C.
- 1.19 List the logical operators supported by 'C'

- 1.20 Give the operator precedence.
- 1.21 Explain evaluating a logical expression.
- 1.22 List the bitwise logical operators
- 1.23 Explain bitwise logical operators.
- 1.24 Explain printf () and scanf () functions with examples.

2.0 Understand Decision & Loop Control Statements

- 2.1 State the importance of decision making statements in programming
- 2.2 List decision making statements
- 2.3 Write the syntaxes of the following decision making statements and explain
 - a. If
 - b. If.. else.
 - c. Nested if ...else
 - d. If... else ladder ..
- 2.4 Write the syntax of switch statement and explain.
- 2.5 Explain conditional operator.
- 2.6 Write simple programs using decision making statements.
- 2.7 Define a loop in a C and list loop/iterative statements
- 2.8 Write the syntaxes of the following loop control statements and explain
 - a. for
 - b. while
 - c. do... while
- 2.9 Define nested loops.
- 2.10 Compare between while and do .. while loop statements
- 2.11 Compare between for and do .. while loop statements
- 2.12 Write a program to display first n natural numbers using loops.
- 2.13 Write a program to find sum of given numbers using loops.
- 2.14 Write a program to print fibonacci series using loops.
- 2.15 Differentiate between break and continue statements.

3.0 Understand Arrays & Strings

- 3.1 Define an Array.
- 3.2 Explain declaration and initialization of One Dimensional Array.
- 3.3 Explain accessing the elements in the Array.
- 3.4 Write a C program to find largest / smallest number in an array
- 3.5 Write a C program to sorting the numbers in an array.
- 3.6 Explain declaration and initialization of two Dimensional Arrays.
- 3.7 Explain accessing elements of two dimensional arrays with sample program of matrix addition/subtraction.
- 3.8 Define String
- 3.9 State the declaration and initialization of String variables.
- 3.10 List and Explain the functions used for reading and writing strings.
- 3.11 Explain the String handling functions strcat(),strcmp(),strcpy() and strlen() with examples.
- 3.12 Write a c program to check whether the given string is palindrome or not.
- 3.13 Write a c program to reverse the given string.

4.0 Understand Functions in 'C'

- 4.1 Define function.
- 4.2 List various standard built in functions
- 4.3 State the need for user defined functions
- 4.4 Explain function declaration in programs
- 4.5 Define function prototype

- 4.6 Define a function call
- 4.7 Explain return values and their types
- 4.8 Illustrate functions with no arguments and no return values with a program to find sum and average of any 5 numbers.
- 4.9 Illustrate functions with arguments with no return values with a program to find sum and average of any 5 numbers.
- 4.10 Illustrate functions with arguments with return values with a program to find sum and average of any 5 numbers.
- 4.11 Illustrate functions with no arguments with return values with a program to find sum and average of any 5 numbers.
- 4.12 Differentiate between Local and External Variables
- 4.13 List the four storage classes supported by 'C'
- 4.14 Define recursion
- 4.15 Write a C program to find factorial of a given number using recursion
- 4.16 Write a C program to find fibonacci series using recursion.

5.0 Understand Structures, Unions and Pointers

- 5.1 Define a structure
- 5.2 Explain declaring structure variable.
- 5.3 Explain initialization of structure.
- 5.4 Explain the concept of structure assignment
- 5.5 Explain accessing members of a structure with example.
- 5.6 Illustrate structures with a program to read & print a book database consisting of Title of book, author, no. of pages, price as fields.
- 5.7 Define a Union.
- 5.8 Differentiate between structure and union.
- 5.9 Define a pointer.
- 5.10 Declare a pointer ,assign a pointer ,initialize a pointer
- 5.11 Differentiate address and dereferencing operators.
- 5.12 Write a sample programs to declare and initialize the pointers

COURSE CONTENT

1.0 C-Programming Basics

Structure of a C programme, Character Set, Constants, Variables, Data types, Arithmetic, Logical, Relational operators and precedence's – Assignment, Increment, Decrement operators, evaluation of expressions.

2.0 Decision and Loop control Statements

If, If-else, Nested If else, Break, Continue and Switch statements. Loops:- For, While, Do-while, Nesting of Loops.

3.0 Arrays and Strings

1 D Array declaration, Initialization, 2 D Array declaration, Initialization, Accessing of Array elements, Character Arrays declaration and Initialization of Strings, Display of strings with format.

4.0 Functions in C

Function-Definition, Declaration, Return statement, passing parameters to function-Function calls, and Recursion. Storage classes of variables.

5.0 Structures, Unions and Pointers

Structure features, Declaration and Initialization, Accessing of Structure members, Union, Pointer concepts.

REFERENCE BOOKS

1. Programming in ANSI C, Balaguru Swamy.E , 3rd Edition, TMH
2. Programming In C by Samarjit Ghosh-PHI
3. Programming with ANSI and Turbo C by Kamthane, Pearson Education
4. Programming in C by Gottfried (Schaum Series)
5. Programming in C by Reema Thareja, Oxford university press.
6. Let us C, by Yashwant Kanetkar, BPB Publication, New Delhi

ANALYTICAL INSTRUMENTATION

Sub. Title : Analytical Instrumentation

Sub. Code : AEI-404

Periods/week : 05

Periods/Semester : 75

TIME SCHEDULE

S. No	Topics	No. of periods	Weight age of marks	Short Answer Questions	Essay Questions
1	Introduction to analytical instrumentation and spectrophotometer	15	26	2	2
2	Analyzers	15	26	2	2
3	Mass Spectrometry	12	16	2	1
4	Chromatography	13	16	2	1
5	PH & Conductivity Measurement	10	13	1	1
6	Nuclear Instrumentation	10	13	1	1
Total		75	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Introduction to analytical instrumentation and Spectrophotometer

- 1.1 Draw and explain the block diagram of Analytic instrumentation.
- 1.2 Define the term spectroscopy.
- 1.3 Define the terms atomic spectroscopy and molecular spectroscopy.
- 1.4 Draw and explain Electromagnetic spectrum.
- 1.5 State the Beer Lamberts law.
- 1.6 List the components of a monochromator.
- 1.7 List types of monochromators (Prism and Grating).
- 1.8 Explain Prism and Grating Monochromators.
- 1.9 List different types of Visible, UV and IR light sources.
- 1.10 List different types of Visible, UV and IR light detectors.
- 1.11 Explain the principle of operation of the following and list their applications
 - a. U.V Spectrophoto meter
 - b. Visible Spectrophotometer
 - c. IR Spectrophotometer.

2.0 Introduction to Analyzers

- 2.1 Explain the principle of operation of the following and list their applications
 - a) Flame Photometer.
 - b) Spectrofluorometer.
 - c) Refracto meter.
 - d) Interferometer.

e) Polari meter.

2.2 Explain principle of operation of the following and list their applications

- a. Paramagnetic gas analyzer.
- b. Zirconia gas analyzer.
- c. Electro chemical gas analyzer.
- d. Thermal conductivity type analyzer.
- e. Auto analyzer.

3.0 Mass spectrometry

- 3.1 State the principle of Mass spectrometry.
- 3.2 List the advantages of mass spectrometer.
- 3.3 Derive the expression for mass charge ratio (m/e).
- 3.4 Draw and explain the block diagram of mass spectrometer.
- 3.5 Explain the operation of single deflection 180° mass spectrometer with schematic diagram.
- 3.6 Define the resolution of a mass spectrometer.
- 3.7 List the applications of mass spectrometer.

4.0 Chromatography

- 4.1 Define the terms absorption and adsorption.
- 4.2 Differentiate between the terms absorption and adsorption.
- 4.3 Define chromatography.
- 4.4 Classify chromatography.
- 4.5 List the components of a Gas Chromatography.
- 4.6 Explain the principle of operation of the Gas Chromatography.
- 4.7 List the applications of Gas Chromatography.
- 4.8 List the advantages of the Gas Chromatography
- 4.9 Explain the principle of operation of the Liquid Chromatography.
- 4.10 List the applications of Liquid Chromatography.
- 4.11 List the advantages of Liquid Chromatography

5.0 PH and conductivity measurement

- 5.1 Define P^H .
- 5.2 Mention the importance of P^H
- 5.3 State the principle of P^H measurement.
- 5.4 Describe the measuring and reference electrodes used for P^H measurement.
- 5.5 State the effect of temperature on P^H
- 5.6 List the temperature compensating methods in P^H measurement.
- 5.7 Explain the operation of digital P^H -meters.
- 5.8 List the specification of digital type of P^H - meters.
- 5.9 Define conductivity.
- 5.10 State the necessity of conductivity cells.
- 5.11 Describe conductivity cells.
- 5.12 Explain the principle of operation of conductivity meter.

6.0 Nuclear Instrumentation

- 6.1 List the types of Radiations.
- 6.2 List the properties of following ionization radiations:
 - a) Alpha Particles
 - b) Beta particles
 - c) Gamma particles
 - d) Neutrons

- 6.3 List the types of radiation detectors
- 6.4 Explain the working of the following Detection Methods.
- Geiger Muller method
 - Ionization chamber
 - Scintillation counter.
 - Detection of neutrons

COURSE CONTENTS

1. Introduction to analytical instrumentation:

Block diagram of Analytic Instrumentation, Electromagnetic spectrum, Beer Lambert's law, monochromators and lenses, light sources and detectors - UV, IR, and Visible. Spectro photometers,

2. Analyzers: Flame Photometer, Spectro fluorometer, Refractometer, Interferometer. Polarimeter. Paramagnetic, Zirconia type, Electrochemical and thermal conductivity gas analyzers, Auto analyzer.

3. Mass spectrometers: Principle of operation, advantages and applications of Mass spectrometry.

4. Chromatography: absorption and adsorption, Principle of operation, advantages and applications of Gas and Liquid chromatography.

5. Concept of PH and conductivity

PH measurement, Electrodes, Effect of temperature, temperature compensation methods,

Digital type of PH meter, specifications of digital PH meter, Necessity of conductivity cell, principle of conductivity meter

6. Nuclear instrumentation:

Types of Ionization radiation- Alpha, Beta and Gamma Particles, Neutrons, Radiation detectors- Geiger Muller counter, Ionization chamber, Scintillation counter.

REFERENCE BOOKS

- Instrumental Methods of Chemical Analysis by Willard, Merritt, Dean, Settle (CBS Publications & Distributors Pvt. Ltd.)
- Instrumental Methods of Chemical Analysis by Chatwal & Anand (Himalaya Publishing house)
- Hand Book of Analytical Instrumentation by R.S. Khandpur
- Industrial Instrumentation by Donald P. Eckman.
- Industrial Instruments and Control by S.K. Singh.
- Instrument Engineer Hand Book by Liptack.

INDUSTRIAL ELECTRONICS & CONTROL SYSTEMS

Subject Title : Industrial Electronics & Control Systems

Subject Code : AEI- 405

Periods/Week : 05

Periods/ Semester : 75

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	Weight age of marks	Short Answer Questions	Essay Questions
1	Opto Electronic Devices	10	16	2	1
2	Industrial Heating and Welding	18	26	2	2
3	Basic concepts of Control Systems	12	16	2	1
4	Laplace Transforms and Block diagram algebra	20	31	2	2 1/2
5	Time and frequency response and Stability analysis	15	21	2	1 1/2
	Total	75	110	10	8

OBJECTIVES: On completion of the study of this subject a student shall be able to

1.0 Understand Opto Electronic Devices

- 1.1 Explain the working of the following devices and list their applications.
 - a) Photo transistor
 - b) Photo conductive device
 - c) Photo multipliers
 - d) Solar cells
 - e) Opto couplers
 - f) Discrete displays- dot matrix, bar matrix, bar graph and seven segment display.

2.0 Understand industrial Heating and welding

- 2.1 List different industrial heating methods.
- 2.2 Explain the principle of Induction Heating.
- 2.3 List the applications of Induction Heating.
- 2.4 Draw and explain the circuit of high frequency power source for Induction Heating.
- 2.5 Explain the principle of Dielectric heating.

- 2.6 List the dielectrics used for dielectric heating.
- 2.7 Explain the methods of coupling, electrodes with RF generator in dielectric heating.
- 2.8 List the applications of Dielectric heating.
- 2.9 Explain the principle of Resistance Welding.
- 2.10 Explain the working of basic A.C resistance welding circuit.
- 2.11 List the types of resistance welding.

3.0 Understand the basic Concepts of Control Systems

- 3.1 Define system and control system.
- 3.2 State the importance of control engineering in day to day life and industry.
- 3.3 Define open loop and closed loop control systems.
- 3.4 Explain open loop and closed loop control systems with examples of water level controller and Temperature controller.
- 3.5 Distinguish between open loop and closed loop control system.
- 3.6 Explain briefly about the following systems:
 - a. Linear and Non-linear control system.
 - b. Time variant and time invariant system.
 - c. Continuous data and discrete data system.
 - d. Digital control systems.
- 3.6 Define Transfer Function.
- 3.7 List the properties and limitations of transfer functions of system.

4.0 Understand the Laplace transforms and block diagram algebra.

- 4.1 Define Laplace Transform of a function.
- 4.2 Obtain the Laplace transforms of unit step, unit ramp, unit impulse, e^{at} , te^{at} , $\sin at$, $\cos at$, $(e^{at} \sin at)$, t^n
- 4.3 State and prove final value theorem and initial value theorem.
- 4.4 Define inverse Laplace transform.
- 4.5 Obtain the inverse Laplace transforms of following functions.
 - i) $F(s) = 1/s$, ii) $F(s) = 1/(s+a)$, iii) $F(s) = a/a(s+a)$, iv) $F(s) = \omega/(s^2 + \omega^2)$,
 - v) $F(s) = s/(s^2 + \omega^2)$, vi) $F(s) = \omega/((s+a)^2 + \omega^2)$,
- 4.6 Derive the transfer functions of RLC series and RLC parallel circuits.
- 4.7 Define block diagram of a system.
- 4.8 List the basic components of a block diagram
- 4.9 Mention the Rules for Block diagram reduction.
- 4.10 Solve simple Problems on block diagram reduction.
- 4.11 Define a signal flow graph of a system.
- 4.12 Write the Mason's Gain formula.

5 Time and frequency response and Stability analysis

- 5.1 Define the term time response of a system.
- 5.2 List and define the test signals in control system.
- 5.3 Obtain the time response of first order system for a unit step and unit impulse input.
- 5.4 Obtain the time response of second order system for a unit step input.

- 5.5 List the specifications of transient response of second order system and define them.
- 5.6 Define Type and order of a control system.
- 5.7 Define type 0, Type 1 and Type 2 control systems.
- 5.8 Obtain static error coefficients K_P , K_V , K_A .
- 5.9 Obtain steady state error for Type 0, Type 1 and Type 2 systems.
- 5.10 Define frequency response a system.
- 5.11 List the frequency response plots.
- 5.12 Define Bode plot.
- 5.13 Define Gain margin and Phase margin.
- 5.14 Obtain bode plots for the following transfer functions
 - i. $G(s) = K$, ii) $G(s) = K/s$, iii) $G(s) = K/(1+sT)$, iv) $G(s) = K/s(1+sT)$
- 5.15 Define absolute and relative stability.
- 5.16 State Routh Hurwitz criterion for stability of a system.
- 5.17 Find the stability of a system using Routh Hurwitz criterion.

COURSE CONTENTS

- 1.0 OPTO ELECTRONIC DEVICES:** Photo transistors, photo conductive device, Photomultipliers. Photo Voltage devices like solar cells. Opto couplers, opto electronic displays like discrete display, dot matrix, bar matrix, bar graph and seven segment display.
- 2.0 INDUSTRIAL HEATING AND WELDING:** Induction heating, Dielectric heating, and Resistance welding.
- 3.0 Basic Concepts of Control Systems:** Definition of system and Control, controlled variable, manipulated variable, controller, Different types of control systems, Definition of transfer function and its properties.
- 4.0 Laplace transforms and block diagram algebra:** Definition of Laplace transform, Laplace transforms of standard time functions, Inverse Laplace transforms–problems on Inverse Laplace transforms - the transfer functions of RLC series and RLC parallel circuits. Block diagram reduction – rules for block diagram reduction, Signal flow graph and Mason’s Gain formula.
- 5.0 Time and frequency Response and stability analysis:** Transient response of first-order system for step input, Impulse input-step response of II order system and specifications Type and order of a system – type 0, Type 1 and Type 2 control systems – error coefficients – Frequency response, bode plot, - relative and absolute stability - Routh Hurwitz criterion.

REFERENCE BOOKS

1. Industrial electronics by Harish .C rai Khanna publications.
2. Industrial Electronics and Control by Biswanath Paul (PHI)
3. Industrial Electronics and Control by S.K.Bhattacharya, S.Chatterjee

4. Control systems Engineering – I.J. Nagrath & M. Gopal, New Age International Publishers.
5. Control Engg.- Bandyopadhyay
6. Control Systems. - A. Nagoor Kani , RBA Publications
7. Control Engg. – B.C.Kuo
8. Control Engg. – Jairath
9. Industrial Electronics & control by Bhattacharya, TTTI Chandigarh.
10. Modern Control Engineering – Katsuhiko Ogata
11. Linear Control Systems– B.S. Manke

LINEAR IC APPLICATIONS AND e-CAD LAB

Subject Name	: Linear IC Applications and e-CAD Lab
Subject Code	: AEI- 406
Periods / Week	: 06
Periods /Semester	: 90

List of Experiments

I. Upon completion of the practice the student shall be able to

1. Construction and Testing of inverting, non inverting amplifier using Operational Amplifier
2. Construction and Testing of summing amplifier Operational Amplifier.
3. Construction and Testing of Instrumentation amplifier Operational Amplifier.
4. Construction and Testing of Digital to Analog converter Operational Amplifier.
5. Construction and Testing of Monostable multivibrator using 555 timer
6. Construction and Testing of Astable multivibrator using 555 timer
7. Construction and Testing of comparator circuit.
8. Construction and Testing of Schmitt trigger using op-amp.
9. Construction and Testing of Wein Bridge Oscillator using op-amp.

II. Circuit simulation using Pspice (e-CAD)

1. Familiarize with the PSPICE modelling using e-CAD software
 - Representation of passive elements
 - Representation of active elements
 - Representation of time Vary signals
 - Representation of nodes
2. To simulate half wave and full wave rectifier circuits with filters and assess the performance
3. To simulate 12v Zener regulator circuit and assess the performance for various loads.
4. To Simulate of CE amplifier and observe the effect of disconnecting bypass capacitor.
5. To simulate Single stage RC coupled Amplifier circuit and observe the effect of change in component values on output waveform
6. To simulate JFET Common source Amplifier circuit and observe the effect of change in gate bias.
7. To simulate Colpitts oscillator circuit and observe the effect of change in component values.
8. To simulate Hartley oscillator circuit and observe the effect of change in component values.
9. To simulate transistor Astable multivibrator circuit and observe the effect of change in component values.
10. Design a PCB for the RC coupled amplifier circuit with built in power supply

PROCESS CONTROL LAB

Subject Name	: Process Control Lab
Subject Code	: AEI-407
Periods / Week	: 03
Periods /Semester	: 45

LIST OF EXPERIMENTS

1. Temperature control using P, PI and PID.
2. Flow control using P,PI and PID
3. Level control using P, PI and PID.
4. Pressure control using P.PI and PID.
5. Study and Demonstration of I / P and P/I converters.
6. Study and demonstration of Pressure control (a) Open loop (b) Closed loop.
7. Study the control valve characteristics for a given valve

**COMMUNICATION SKILLS
(Common to all branches)**

Subject Name : **Communication skills**
Subject code : **AEI – 408**
Periods per week : **3**
Periods per semester : **45**

Introduction:

In the context of globalization, competence in speaking skills is the need of the hour. The gap between the needs of the industry and the curriculum can be bridged by enabling the students to hone their speaking and listening skills. This course aims at providing opportunities for practicing speaking.

Objectives:

On completion of the course the students will be able to

- Strengthen their listening skills
- Strengthen their speaking skills

Time Schedule

S.No.	Topic	Periods	Weightage of marks (End Exam)	Sessional marks	Total
1	Listening I	3	10	10	20
2	Listening II	3			
3	Introducing oneself	3	50	30	80
4	Describing objects	3			
5	Describing events	3			
6	Reporting past incidents	3			
7	Speaking from observation / reading	3			
8	JAM	6			
9	Group discussion	6			
10	Mock interviews	6			
11	Making presentations	6	60	40	100
		45			

Competencies and key competencies to be achieved by the student

Topic	Teacher's input/ methodology	Students competence
Listening I Listening II	Pre- Listening –eliciting, pictures While - Listening Post –Listening –project , writing	Identifying the main idea, Identifying specific details, Identifying parallel and contradictory ideas Drawing inferences, Reasoning
Introducing oneself	Kinds of introduction --official/ personal, dynamic vocabulary, Body language, Model introduction, Use of line ups	Use of simple present tense, Sequencing, Appropriate vocabulary
Reporting incidents	Group work /pair work, Elicit, Use of past tense, Student presentations	Use of past tense, Relevant vocabulary
Describing objects	Vocabulary , Use of adjectives, Games—I spy, Group presentations	Use of adjectives, Dimensions, shapes Compare and contrast, sequence
Describing events	Group work/pair work Use of appropriate tense	Use of appropriate tense, sequencing
Reporting past incidents	Use of past tense, Vocabulary Student presentations	Use of past tense , sequencing
Speaking from observation/reading	Group work/pair work, Reading techniques ,	Use of past tense, Summarising , evaluating, comprehension
JAM	Effective techniques , Good beginning , conclusion, tips, Use of line ups	Vocabulary, Sequencing, Fluency, Thinking spontaneously
Group discussion	Expressing opinion, body language,	Expressing opinion, agree/ disagree, fluency, Persuasive and leadership skills
Mock interview	FAQs , body language	Role play, body language,
Making presentations	Student presentations	Using charts , pictures, interpreting data, sequencing, PPTs

Communicative methodology (CLT) should be used to create an interactive class. Apart from the suggestions given teachers are free to innovate to use any activity to improve the language competence of students . Attention can also be given to improve the accent and intonation of students.

Note:

* This subject is a theory subject.

** The workload should be calculated as theory workload.

***Examinations in the subject will be treated as a practical one.

PROGRAMMING IN C LAB

Subject Name : Programming in C Lab
Subject Code : AEI- 409
Periods/Week : 03
Periods/Semester : 45

LIST OF EXPERIMENTS

At end of this lab practice, the student shall be able to perform

1. Editing, compiling and executing programs
2. Exercises on printf and scanf functions
3. Exercises on decision making statements
4. Exercises on Repetitive Structures
5. Exercises on functions to demonstrate prototyping, parameter passing, function returning values.
6. Exercises on recursion
7. Exercises on arrays and Strings
8. Exercises to demonstrate use of Pointers.
9. Exercise on structures.

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

V Semester

Subject Code	Name of the Subject	Instruction period / week		Total Period / Sem	Scheme of Examination			
		Theory	Practical/ Tutorial		Duration (hours)	Sessional Marks	End Exam Marks	Total Marks
THEORY:								
AEI-501	Industrial Management & Smart Technologies	5	-	75	3	20	80	100
AEI-502	Biomedical Instrumentation	6	-	90	3	20	80	100
AEI-503	Micro Controllers & Applications	6	-	90	3	20	80	100
AEI-504	Industrial Automation	5	-	75	3	20	80	100
AEI-505	Instrumentation in Process Industries	5	-	75	3	20	80	100
PRACTICAL:								
AEI-506	PLC & SCADA Lab	-	3	45	3	40	60	100
AEI-507	Micro Controllers Lab	-	6	90	3	40	60	100
AEI-508	Life Skills	-	3	45	3	40	60	100
AEI-509	Analytical and Biomedical Instrumentation Lab	-	3	45	3	40	60	100
	TOTAL	27	15	630	-	260	640	900

Industrial Management & Smart Technologies

Subject Title	:	Industrial Management & Smart Technologies
Subject Code	:	AEI-501
Periods/Week	:	5
Period/Semester	:	75

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Type Questions
1.	Basics of Industrial Management	06	13	1	1
2.	Organisation structure & Organisational behaviour	10	18	1	1 ^{1/2}
3.	Production Management	10	18	1	1 ^{1/2}
4.	Materials Management	08	13	1	1
5	Maintenance management & Industrial Safety	08	13	1	1
6	Entrepreneurship Development	08	13	1	1
7	Total Quality Management	05	06	2	
8	Smart technologies	20	16	2	1
	Total	75	110	10	08

1. Basics of Industrial Management

On completion of the course the student will be able to

1.0 Understand the principles of management as applied to industry.

- 1.1 Define industry, commerce (Trade) and business.
- 1.2 Know the need for management.
- 1.3 Understand the evolution of management
- 1.4 Understand functions of Management.
- 1.5 Explain the principles of scientific management.
- 1.6 Explain the principles of management.
- 1.7 Differentiate between management and administration.
- 1.8 Understand the nature of management as a profession
- 1.9 Differentiate between supervisory, middle and Top level management
- 1.10 Explain the importance of managerial skills (Technical, Human, Conceptual)

2. Organisation Structure & organisational behaviour

Know types of ownerships, the organisation structure of an industry and the behaviour of an individual in an organisation.

- 2.1 Understand the philosophy and need of organisation structure of an industry.
- 2.2 Understand the line, staff and Functional organisations
- 2.3 Understand the Authority and Responsibility Relationships
- 2.4 Understand the differences between Delegation and decentralization
- 2.5 Explain the factors of effective organisation.
- 2.6 Outline the communication process
- 2.7 State motivation theories.
- 2.8 State Maslow's Hierarchy of needs.

- 2.9 List out different leadership models.
- 2.10 Explain the trait theory of leadership.
- 2.11 Explain behavioural theory of Leadership.
- 2.12 Explain the process of decision making.
- 2.13 Assessing Human resource requirements
- 2.14 Know the concept of Job analysis, Job description and specifications
- 2.15 Understand the process of recruitment, selection, training and development
- 2.16 Understand types of business ownerships
- 2.17 Differentiate between the business ownerships
- 2.18 Know the objectives of Employee participation
- 2.19 Understand the meaning and definition social responsibilities
- 2.20 Corporate social responsibility

3. Production management

Understand the different aspects of production management.

- 3.1 Identify the factors of Plant Location
- 3.2 Know the objectives of plant Layout
- 3.3 Understand the principles of plant Layouts
- 3.4 Explain the types of plant Layouts
- 3.5 Relate the production department with other departments.
- 3.6 State the need for planning and it's advantages.
- 3.7 Explain the stages of Production, planning and control.
- 3.8 Know the basic methods demand forecasting
- 3.9 Explain routing methods.
- 3.10 Explain scheduling methods.
- 3.11 Explain dispatching.
- 3.12 Explain Break Even Analysis
- 3.13 Define supply chain Management, competitive strategy, Supply chain strategy
- 3.14 Draw PERT/CPM networks.
- 3.15 Identify the critical path

4. Materials Management

Understand the role of materials management industries.

- 4.1 Explain the importance of materials management in Industry.
- 4.2 Know Functions of Materials Management
- 4.3 Derive expression for inventory control.
- 4.4 Explain ABC analysis.
- 4.5 Define safety stock.
- 4.6 Define reorder level.
- 4.7 Derive an expression for economic ordering quantity.
- 4.8 Know the functions of Stores Management,
- 4.9 Explain types of store layouts.
- 4.10 List out stores records.
- 4.11 Explain the Bin card.
- 4.12 Describe Cardex method.
- 4.13 Explain general purchasing procedures
- 4.14 Explain tendering, E-tendering and E-procurement procedures
- 4.15 List out purchase records.
- 4.16 Know the applications of RFID (Radio Frequency Identification Device)
- 4.17 Understand the applications of RFID in material management

5. Maintenance Management & Industrial Safety

Comprehend the Importance of Maintenance Management & Safety procedures

- 5.1 Explain the importance of maintenance management in Industry.
- 5.2 Know the Objectives of maintenance management
- 5.3 Know the activities of maintenance management

- 5.4 Understand the importance of Preventive maintenance
- 5.5 Understand the need for scheduled maintenance
- 5.6 Differentiate between scheduled and preventive maintenance
- 5.7 Know the principles of 5 s for good house keeping
- 5.8 Explain the importance of safety at Work place.
- 5.9 List out the important provisions related to safety.
- 5.10 Explain hazard and accident.
- 5.11 List out different hazards in the Industry.
- 5.12 Explain the causes of accidents.
- 5.13 Explain the direct and indirect cost of accidents.
- 5.14 Understand the types of emission from process Industries, their effects on environment and control
- 5.15 Understand the principles of solid waste management

6. Entrepreneurship Development.

Understand the role of entrepreneur in economic development and in improving the quality of life.

- 6.1 Define the word entrepreneur.
- 6.2 Explain the requirements of an entrepreneur.
- 6.3 Determine the role of entrepreneurs in promoting Small Scale Industries.
- 6.4 Describe the details of self-employment schemes.
- 6.5 Characteristic of successful entrepreneurs
- 6.6 Explain the method of site selection.
- 6.7 List the financial assistance programmes.
- 6.8 List out the organisations that help an entrepreneur
- 6.9 Know the use of EDP Programmes
- 6.10 Understand the concept of make in India, Zero defect and zero effect
- 6.11 Understand the importance for startups
- 6.12 Explain the conduct of demand surveys
- 6.13 Explain the conduct of a market survey
- 6.14 Evaluate Economic and Technical factors.
- 6.15 Prepare feasibility report study

7. Total Quality Management:

Understand the concepts adopted in total quality management

- 7.1 Explain the concept of quality.
- 7.2 List the quality systems and elements of quality systems.
- 7.3 State the principles of quality Assurance.
- 7.4 Understand the basic concepts of TQM
- 7.5 Know the Pillars of TQM
- 7.6 List the evolution of ISO standards.
- 7.7 Explain ISO standards and ISO 9000 series of quality systems.
- 7.8 List the beneficiaries of ISO 9000.
- 7.9 Explain the concepts of ISO 14000
- 7.10 Know the overview of PDCA cycle

8. Smart Technologies

8.1 Get an overview of IoT

- 8.1.1 Define the term IoT
- 8.1.2 Know how IoT work
- 8.1.3 List the key features of IoT
- 8.1.4 List the components of IoT : hardware, software, technology and protocols
- 8.1.5 List the advantages and disadvantages of IoT

8.2 IoT Applications

- 8.2.1 Smart Cities
- 8.2.2 Smart Energy and the Smart Grid
- 8.2.3 Smart Transportation and Mobility

- 8.2.4 Smart Home, Smart Buildings and Infrastructure
- 8.2.5 Smart Factory and Smart Manufacturing
- 8.2.6 Smart Health
- 8.2.7 Food and Water Tracking and Security
- 8.2.8 Social Networks and IoT

Course Content

1. Basics of Industrial Management

Introduction: Industry, Commerce and Business; Definition of management; Characteristics of management; Functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making; Principles of scientific management: – F.W.Taylor, Principles of Management: Henry Fayol; Administration and management; Nature of management; levels of management; managerial skills;

2. Organisation Structure & organisational behaviour

Organizing - Process of Organizing; Line/Staff and functional Organizations, Decentralization and Delegation, Effective Organizing; Communication, Motivational Theories; Leadership Models; Human resources development; Forms of Business ownerships: Types – Sole proprietorship, Partnership, Joint Stock Companies, Cooperative types of Organizations; Employee participation in management; Corporate Social responsibility;

3. Production management

Definition and importance; Plant location and layout; Types of production -job, batch and mass; production Planning and Control: Demand forecasting, routing, scheduling, dispatching and follow up; Break even analysis; Supply chain Management (Definition, Competitive strategy Vs Supply chain Strategy, Supply chain drivers); Project scheduling; Application of CPM and PERT techniques; simple numerical problems;

4. 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 RFID (Radio Frequency Identification Device) application in materials management;

5. 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-psychological, physiological and other industrial hazards; Domino sequence; methods of promoting safe practices; Pollution control in process industries; Introductory concepts on Solid waste management (General introduction including definitions of solid waste including municipal, hospital and industrial solid waste, Waste reduction at source – municipal and industrial wastes)

6. 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; Market survey and Demand survey; Preparation of Feasibility study reports

7. Total Quality 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 ISO 9000 series , ISO-14000, Deming's PDCA Cycle (Plan, Do, Check and Action). Japanese Quality Management, culture, Kaizen Strategy (continuous improvement).

8. Smart Technologies :

Overview of IoT - Define IoT, how IoT work, key features of IoT, components of IoT : hardware, software, technology and protocols, advantages and disadvantages of IoT - IoT Applications - Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing, Smart Health, Food and Water Tracking and Security, Participatory Sensing, Social Networks and IoT.

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
7. Supply Chain Management –Sunil Chopra and Meindl, PHI publishers
8. 5 S made easy by David Visco

BIOMEDICAL INSTRUMENTATION

Subject Title : Biomedical Instrumentation

Subject Code : AEI -502

Periods / Week : 06

Periods / Semester : 90

TIME SCHEDULE

Sl. No.	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay Type Questions
1	Introduction to biomedical Engineering.	13	16	2	1
2	Diagnostic Medical Instruments	20	26	2	2
3	Blood pressure and blood flow Measurements	20	26	2	2
4	Therapeutic Instruments	15	16	2	1
5	Modern Imaging Systems	12	13	1	1
6	Patient monitoring system and patient safety	10	13	1	1
	Total	90	110	10	8

OBJECTIVES: Upon completion of the course the student shall be able to:

1.0 Introduction to bio-medical Engineering

- 1.1 Define Bioelectric potentials.
- 1.2 Define resting and action potentials.
- 1.3 Explain resting and Action potentials with waveform.
- 1.4 Explain about Sodium pump and transmission of impulses.
- 1.5 Define an electrode.
- 1.6 List the types of electrodes used for bioelectric potentials measurement.
- 1.7 Explain the different types of electrodes used for ECG, EEG and EMG.

- 1.8 Explain the electrical activity of heart.
- 1.9 Explain the bio-electrical potentials associated with muscle activity.
- 1.10 Explain the electrical activity of Brain.

2.0 Understand the working of Diagnostic medical Instruments.

- 2.1 List the Diagnostic Medical Equipments.
- 2.2 Draw and explain the building Blocks of an electro cardio graph (ECG).
- 2.3 Draw and explain the ECG Lead Configurations (Bipolar & Unipolar).
- 2.4 Compare bipolar and unipolar leads used for ECG measurement.
- 2.5 Draw the electrocardiogram. Indicate its amplitude and duration and state their importance.
- 2.6 List the applications of ECG.
- 2.7 Explain the arrangement of electrodes while monitoring EEG.
- 2.8 Explain with Block diagram, the working principle of an EEG machine.
- 2.9 Classify the EEG frequency bands.
- 2.10 List the applications of EEG.
- 2.11 Draw the block diagram set up for EMG recording.
- 2.12 Mention the frequency and amplitude of EMG.
- 2.13 List the applications of EMG.

3.0 Understand the working of Blood Pressure and blood flow measurements.

- 3.1 List the types of direct blood pressure measurements (catheterization, percutaneous insertion and implantation of transducer in a vessel).
- 3.2 Describe the above three methods with suitable diagrams.
- 3.3 List the types of indirect blood pressure measurements.
- 3.4 Describe indirect blood pressure measurement using sphygmomanometer and Stethoscope.
- 3.5 Explain the working of electromagnetic blood flow meter with diagram
- 3.6 Explain the working of Ultrasonic blood flow meter based on transit time with diagram.
- 3.7 Explain the working of Ultrasonic blood flow meter based on Doppler type with diagram.
- 3.8 Describe with a block diagram the operation of LASER Doppler Blood flow meter.

4.0 Understand the different types of therapeutic instruments

- 4.1 State the need of pacemaker.
- 4.2 Classify different types of pacemakers.
- 4.3 Compare the internal pacemakers over external pacemakers.
- 4.4 List the types of Pacing modes.
- 4.5 Draw the block diagram of a ventricular synchronous demand pacemaker and explain its operation.
- 4.6 State the need of defibrillators.
- 4.7 Draw and explain the circuit diagram of AC defibrillators.
- 4.8 Draw and explain the circuit diagram of capacitive discharge DC defibrillators.
- 4.9 Compare AC defibrillators and DC defibrillators.
- 4.10 Define dialysis.

- 4.11 State the importance of dialysis.
- 4.12 List the functions of dialysis machine.

5.0 Understand the working of following Modern Imaging Systems.

5.1 X-Ray imaging

- a) List the properties of X-Ray.
 - b) Explain the interaction of X-Ray with matter.
 - c) Define Compton Effect.
 - d) Explain the Production of X-Ray with a diagram.
 - e) State the need for grid.
 - f) List the applications.
 - g) List the limitations.
- 5.2 Explain the operation of an X-ray machine with block diagram.
- 5.3 Explain the working of C.A.T Scanner with block diagram.
- 5.4 List the advantages of C.A.T imaging over X-ray imaging.
- 5.5 Explain the working of M.R.I with block diagram.
- 5.6 List the advantages of M.R.I.
- 5.7 List the applications of M.R.I.

6.0 Understand patient monitoring system and patient safety.

- 6.1 Explain patient monitoring in ICU and draw the system of arrangement.
- 6.2 Explain the effects of electrical current, magnetism and electromagnetic radiations on human body.
- 6.3 Define micro and macro shock.
- 6.4 Differentiate between micro shock and macro shock.
- 6.5 List the preventive measures to reduce shock hazards.
- 6.6 List the general and safety requirements of electro medical equipment issued by Bureau of Indian Standards (BIS).

COURSE CONTENTS

1.0 Introduction to Biomedical Engineering: Bioelectric potentials–Resting and action potential, sodium pump, transmission of impulses, Electrodes used for Bio potential measurement, Electrical activity of the heart, Electrical Activity of the muscles- Electrical Activity of the brain.

2.0 Diagnostic Medical Instruments: Electro cardio graph (ECG) - Electrical activity of the heart; ECG waveform. Electro encephalograph (EEG) - Electrical Activity of the brain, EEG wave forms Electro mayo graph (EMG) - Electrical Activity of the muscles, EMG Wave form

3.0 Blood Pressure and Blood Flow Measurements:

Direct and indirect Blood pressure measurement,
Blood Flow meters - Electromagnetic, Ultrasonic and Laser Doppler Blood flow meters.

4.0 Therapeutic Instruments: Pacemakers - Need of Cardiac Pacemakers, internal and external pacemakers, differences between internal and external pacemakers, Ventricular synchronous demand pacemaker, Defibrillation-need of defibrillator, AC and DC defibrillator, dialysis- importance and functions of dialysis machine.

5.0 Modern Imaging Systems: X-Rays - Properties, interaction, production of X-rays, Compton Effect, need for a grid, Applications, Limitations of X-Ray imaging, operation of an X-Ray machine, C.A.T. Scanner – operation, advantages and applications, M.R.I-operation, advantages and applications.

6.0 Patient Monitoring system and patient safety: Patient monitoring in ICU, Physiological effects of electricity, Electromagnetic radiation and magnetism on human body. Shocks- micro and macro shocks, Preventive measures of shock. Safety requirement by BIS.

REFERENCE BOOKS

1. Hand Book of Biomedical Instrumentation by R.S.Kandpur, Tata Mcgraw Hill.
2. Biomedical Instrumentation and Measurements by Leslie Cromwell & Fred .J. Weibell and Erich A.Preiffer, PHI.
3. Biomedical Instruments by Dr. Arumugham
4. Principles of Applied Bio medical Instrumentation by L.A.Taddes & Baker
5. Medical Instrumentation by John.G.Webster
6. Advanced Biomedical Engineering by Levine
7. Computer the Machine by LELE, Tata McGraw Hill Co.,
8. Introduction to Biomedical equipment Technology by Joseph Carr & Joseph Brown

MICRO CONTROLLERS AND APPLICATIONS

Subject Title : Micro Controllers and Applications

Subject Code : AEI-503

Periods / Week : 06

Periods / Semester : 90

TIME SCHEDULE

Sl. No.	Major Topics	No. of Periods	Weight age of marks	Short Questions	Essay Questions
1	Architecture of 8051	22	29	3	2
2	Instruction set of 8051	22	29	3	2
3	Programming concepts	20	26	2	2
4	Interfacing Peripherals ICs	14	16	2	1
5	Applications	12	10	0	1
	Total	90	110	10	8

OBJECTIVES: On completion of the study of the subject a student should be able to:

1.0 Comprehend the architecture of Microcontroller 8051

- 1.1 Explain the functional block diagram of 8085 Microprocessor.
- 1.2 List the differences between Microprocessors and microcontrollers.
- 1.3 List the features of 8051 micro controller..
- 1.4 Draw and explain the functional block diagram of 8051 microcontroller.
- 1.5 Explain the register structure of 8051.
- 1.6 State the importance of special function registers and list them.
- 1.7 Draw the pin diagram of 8051 micro controller & specify the purpose of each pin.
- 1.8 Explain internal memory and external memory organization of 8051.
- 1.9 State the need of timers/counters in 8051
- 1.10 List the timers/counters of 8051
- 1.11 Explain the timers/counters of 8051.
- 1.12 List the input/output ports of 8051

- 1.13 Explain the input/output ports of 8051
- 1.14 Define an interrupt
- 1.15 List the interrupts of 8051.
- 1.16 Explain the following interrupts of 8051.
 - i. Timer interrupts (TF0 and TF1)
 - ii. Serial port interrupts (TI/RI)
 - iii. External interrupts (INT0 and INT1)

2.0 Understand the instruction set of 8051 micro controller

- 2.1 State the need for an instruction set.
- 2.2 Draw and explain the instruction format of 8051 with an example.
- 2.3 Define fetch cycle, execution cycle and instruction cycle.
- 2.4 Distinguish between machine cycle and T-state.
- 2.5 Draw the timing diagrams for memory write, memory read operations of 8051.
- 2.6 Define the terms machine language, assembly language, and mnemonics.
- 2.7 Differentiate machine level programming and assembly level programming.
- 2.8 List the major four groups in the instruction set.
- 2.9 Explain the data transfer, arithmetic, logic and branching instructions.
- 2.10 Classify the 8051 instructions into one byte, two byte and three byte instructions.
- 2.11 List the five addressing modes of 8051.
- 2.12 Explain the following addressing modes of 8051.
 - a. Immediate
 - b. Register
 - c. Direct
 - d. Register indirect
 - e. indexed
- 2.13 List and explain data transfer instructions.
- 2.14 List and explain the arithmetic instructions
- 2.15 List and explain the logic instructions.
- 2.16 List and explain the branching instructions.

3.0 Programming concepts

- 3.1 Draw the various symbols used in flow charts.
- 3.2 Draw flow charts for following simple problems.
 - a. Addition of two 8-bit numbers
 - b. Subtraction of 8-bit numbers
 - c. Multiplication of 8-bit numbers
 - d. Sum of n-numbers
- 3.3 Write programs of instructions to perform single byte, double byte and multi byte addition and subtraction.
- 3.4 Write a program to find largest (or smallest) number in an array using jump instruction.
- 3.5 Write a program using timer/counter techniques.
- 3.6 Define a subroutine
- 3.7 List the advantages of subroutine.
- 3.8 Define Program Counter, Stack, and Stack pointer.
- 3.9 Explain the sequence of program when subroutine is called and executed.
- 3.10 Explain how information is exchanged between the program counter and the stack and identify the stack pointer register when a subroutine is called.
- 3.11 Explain LCALL and ACALL instructions.
- 3.12 List and explain unconditional and conditional Return instructions
- 3.13 Explain PUSH, and POP instructions.

- 3.14 Write programs using PUSH, and POP instructions.
- 3.15 Write instructions to set up time delay
- 3.16 Explain the nesting, multiple ending and common ending techniques in subroutines.
- 3.17 Define the term debugging
- 3.18 Explain the following dynamic debugging techniques.
 - i. Single step
 - ii. Break point

4.0 Understand the interfacing of Peripheral ICs

- 4.1 Define the term interfacing
- 4.2 State the need for interfacing
- 4.3 List and name the different types of interfacing peripheral ICs.
- 4.4 List the features of 8255.
- 4.5 Draw the pin diagram of 8255.
- 4.6 Draw and explain the functional block diagram of 8255.
- 4.7 List the operating modes of 8255.
- 4.8 Write CWR (Control Word Register) format of 8255.
- 4.9 Draw and explain the interfacing diagram of 8255 with micro controller 8051.
- 4.10 List the features of 8257.
- 4.11 List the operating modes of 8257.
- 4.12 Draw and explain the functional block diagram of 8257- DMA controller.
- 4.13 Draw and explain the interfacing diagram of 8257 with micro controller 8051..

5.0 Applications of micro controllers 8051.

- 5.1 Explain Traffic light control interfacing through 8051.
- 5.2 Explain the Printer interface using 8051.
- 5.3 Explain the Stepper motor control interface using 8051.
- 5.4 Explain the seven segment display interface using 8051.

COURSE CONTENTS

- 1. Architecture of 8051:** Functional block diagram of 8085 microprocessors and Architecture of 8051 Microcontroller, Pin diagram of 8051, registers, timers, interrupts of 8051.
- 2. Instruction set of 8051:** Instruction set of 8051, instruction format, fetch cycle, execution cycle, instruction cycle, machine cycle, timing diagrams, machine language, assembly language, classification of instructions, addressing modes- Groups of instructions, opcode, and operand.
- 3. Programming concepts:** Flow charts, single and multi byte addition and subtraction, subroutines, nesting, multiple ending and common ending, debugging, time delay programs.
- 4. Interfacing Peripheral ICs:** Functional block diagrams of 8255 and 8257, Interfacing of 8255, 8257 with 8051

- 5. Applications:** Traffic light control, printer interface, stepper motor control, Seven segment display interface

REFERENCE BOOKS:

1. The 8051 Micro controller and embedded systems using assembly and C – Muhammad Ali Mazidi and Janice Gillispie Mazidi, Rolin D. Mckinlay, Publisher: Pearson Education Inc.
2. 8051 Micro controller by Kenneth J. Ayala.
3. Programming customizing the 8051 Microcontroller by Myke Predko TMH
4. Microprocessors and interfacing by Douglas V Hall. McGraw Hill.
5. Intel Microprocessors by Barry Brey, Prentice-Hall.

INDUSTRIAL AUTOMATION

Subject Title : Industrial Automation
Subject code : AEI-504
Periods/Week : 05
Periods/Semester : 75

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Introduction to PLC	15	26	02	02
2.	PLC Programming	20	29	03	02
3	Computer Control	15	29	03	02
4.	SCADA	15	13	01	01
5.	Introduction to Embedded systems	10	13	01	01
	Total	75	110	10	08

OBJECTIVES: Upon completion of the course the student shall be able to:

1. Introduction to PLC

- 1.1 State the Importance of Automation
- 1.2 Explain Relay based Control panel.
- 1.3 Define Programmable Logic Controller (PLC) and list the advantages of PLCs.
- 1.4 Compare Relay based and PLC based Control panel
- 1.5 Explain the Block diagram of PLC
- 1.6 List different types of PLCs based on I/O's ,memory and configuration
- 1.7 Explain Interfacing of PLC with PC.
- 1.8 List the manufacturers of PLC.
- 1.9 List the applications of PLC.

2. PLC Programming

- 2.1 List different types of PLC programming techniques.
- 2.2 Define Ladder diagram
- 2.3 List the rules to follow in drawing Ladder diagram
- 2.4 List and explain PLC Instruction set
- 2.5 Draw ladder diagrams for AND, OR, NOT, NAND, NOR and EXOR gates.
- 2.6 Explain Timers-T ON, T OFF and Retentive timer with ladder diagram.
- 2.7 Explain Counter instructions -CTU, CTD
- 2.8 Explain ladder diagrams on arithmetic and comparison instructions
- 2.9 Draw ladder diagrams for following applications:
 - I. DOL starter and STAR-DELTA starter
 - II. Sequential control of induction motors,
 - III. Traffic lights,
 - IV. Level control
 - V. Conveyer belt.

3.0 SCADA

- 3.1 Define SCADA
- 3.2 Explain the hardware architectures of SCADA.
- 3.3 List the three main components of a SCADA.
- 3.4 Explain Remote Terminal Unit of SCADA.
- 3.5 Explain Master Station of SCADA.
- 3.6 Explain communication infrastructure of SCADA.
- 3.7 Explain the Creation of graphic symbols using Graphic Display builder.
- 3.8 Explain Interfacing of SCADA with PLC.
- 3.9 List the applications of SCADA

4.0 Computer Control

- 4.1 State the role of Computers in Process control
- 4.2 Explain the block diagram of Data Logger
- 4.3 List the applications of Data Logger
- 4.4 Explain the block diagram of Data acquisition system
- 4.5 Explain the block diagram of Direct Digital Control System (DDC)
- 4.6 Define a Robot.
- 4.7 Explain the operation of simple robot with block diagram.
- 4.8 List the applications of a Robot
- 4.9 Explain CNC Machine with block diagram.
- 4.10 List the applications of CNC Machine

5. Introduction to Embedded Systems

- 5.1 Define the term Embedded system.
- 5.2 List applications of Embedded system.
- 5.3 List the components of Embedded system
- 5.4 Explain the hardware architectures of Embedded system
- 5.5 Explain the software architectures of Embedded system
- 5.6 List the commonly used processors in Embedded systems.
- 5.7 State the need for communication interfaces.
- 5.8 List the communication interfaces.
- 5.9 Explain serial communication using USB.

COURSE CONTENT

1.0 Introduction to PLC

Importance of automation- relay based and plc based control panel- PLC Definition- Block diagram-Explanation- different types of PLCs- different types of PLC manufacturers-Interfacing PLC and PC

2.0 PLC Programming

Types of PLC programming- rules for programming -Instruction set- Ladder diagram for AND, OR- Ladder program using bit instructions for DOL starter, Star-Delta Starter, Traffic light control, level control, conveyor controller.

3.0 SCADA

SCADA definition, Architecture and explanation, remote terminal unit, master station, communication infrastructure of SCADA, Graphical symbols used in SCADA, Interfacing of SCADA with PLC, Applications

4.0 Computer Control

Introduction, Role of computers in process control, Data Logger, Data Acquisition, Direct Digital Control System, Robot and its Applications, CNC Machine

5.0 Embedded Systems:

Definition of Embedded system, applications, software and hardware architectures, serial communication, USB.

REFERENCE BOOKS

1. Industrial control engineering by Jacob
2. Industrial automation and process control by Jon Sterenson
3. Programmable Logic controllers by John W.Webb
4. Introduction to PLC by Gary Dunning- Delmar Cengage learning.
5. Embedded Real Time Systems-Dr KVKK Prasad.

INSTRUMENTATION IN PROCESS INDUSTRIES

Subject Title	:	Instrumentation in Process Industries
Subject Code	:	AEI – 505
Periods per week	:	05
Periods per semester	:	75

TIME SCHEDULE

S.No	Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Type Questions
1	Methods of power generation in Power Plant	10	13	1	1
2	Instrumentation and Control in Power Plant	20	29	3	2
3	Petro Chemical plant Instrumentation	15	21	2	1 1/2
4	Iron and Steel Plant Instrumentation	15	21	2	1 1/2
5	Pulp and Paper Plant Instrumentation	15	26	2	2
	Total	75	110	10	8

OBJECTIVES: Upon completion of the course the student shall be able to

1.0 Understand the Methods of power generation in Power Plant

- 1.1 List various power generation methods.
- 1.2 Give the principle of power generation in thermal power plant.
- 1.3 Draw the general layout of thermal power plant
- 1.4 Explain the above layout of thermal power plant.
- 1.5 Explain the process of generation with the help of diagrams of following
 - a) Hydroelectric power plant
 - b) Wind power plant
 - c) Solar power plant
 - d) Nuclear power plant

2.0 Understand the Instrumentation and Control in Power Plant

- 2.1 State the Importance of measurement and instrumentation in power plant.
- 2.2 Draw the block diagram of boiler process in thermal power plant and explain each block.
- 2.3 Draw and explain a typical combustion system of a boiler.
- 2.4 List the important variables that need to be measured in thermal power plant.
- 2.5 List the measuring locations/points and types of sensors /instruments in a thermal power plants of the following parameters
 - a) Pressure
 - b) Temperature
 - c) Flow
 - d) Level
 - e) Vibration
 - f) expansion
- 2.6 Explain a method of measurement of flow of feed water with a differential pressure transducer diagram.
- 2.7 Explain single element drum level control of boiler with a diagram.
- 2.8 Explain steam temperature control single-stage diagram.
- 2.9 Explain steam/header pressure control with a feed forward-plus-feedback control diagram.
- 2.10 Explain series fuel – air ratio control.
- 2.11 Explain furnace draft control
- 2.12 Explain the measurement of turbine shaft speed with a toothed-wheel diagram,
- 2.13 Mention the turbine shaft vibration
- 2.14 Explain eccentricity measurement of turbine with a diagram.

3.0 Understand the Petro Chemical plant Instrumentation.

- 3.1 Define petroleum refinery.
- 3.2 Draw the general layout of a Petro chemical plant.
- 3.3 Explain the above layout of petro chemical plant.
- 3.4 List basic steps in refinery process (separation, conversion & treatment).
- 3.5 Define the following unit operations
 - a) Thermal cracking

- b) Catalytic cracking
 - c) Polymerization
 - d) Alkalization
 - e) Isomerization
- 3.6 List the bi products of crude oil.
 - 3.7 Define the term distillation column.
 - 3.8 Define batch distillation and continuous distillation columns.
 - 3.9 Explain the working of batch distillation column with a diagram.
 - 3.10 Explain the working of continuous distillation column with a diagram.
 - 3.11 List various physical parameters to be measured in distillation column.

4.0 Understand the Iron and Steel Plant Instrumentation (ISPI)

- 4.1 Draw flow scheme of pig iron production and explain.
- 4.2 Draw flow scheme of steel production and explain.
- 4.3 List raw materials in ISP
- 4.4 List different types of furnaces used in ISP
- 4.5 Explain the working of blast furnace with a diagram
- 4.6 Explain the working of oxygen furnace with a diagram
- 4.7 Explain the working of electric furnace with a diagram
- 4.8 Explain the measurement of molten metal level
- 4.9 Explain the measurement of temperature of furnace.

5.0 Understand the Pulp and Paper Plant Instrumentation (PPPI)

- 5.1 Define the term pulp.
- 5.2 List the types of pulping processes (Mechanical and Chemical processes).
- 5.3 Draw the block diagram of mechanical pulping process and explain.
- 5.4 Draw the block diagram of chemical pulping process and explain.
- 5.5 Define the term paper.
- 5.6 Draw the general layout of paper making process
- 5.7 Explain the basic process of making the paper based on the layout.
- 5.8 List the raw materials for making paper.
- 5.9 List the various types of paper products.
- 5.10 List the physical properties of paper.
- 5.11 List types of control system units used in pulp and paper industry.
- 5.12 Explain the controlling of paper thickness with a diagram.
- 5.13 Explain the graphic displays and alarms in PPP

COURSE CONTENT:

- 1.0 **Methods of power generation in Power Plant:** - Thermal power plant layout- Hydroelectric power plant- Wind power plant-Solar power plant-Nuclear power plant.
- 2.0 **Instrumentation and Control in Power Plant:** block diagram of boiler process in thermal power plant- combustion system of a boiler- measurement of flow of

feed water - single element drum level control of boiler- steam temperature and pressure control- series fuel – air ratio control- furnace draft control- measurement of turbine shaft speed- eccentricity measurement of turbine.

3.0 Petro-chemical Plant instrumentation: plant layout- Crude oil-Distillation column, Batch and continuous distillations.

4.0 Iron and Steel Plant Instrumentation:-Manufacturing process of Iron and steel- Furnace types- blast, oxygen and electric furnaces- Measurement of molten metal level and temperature of furnace.

5.0 Pulp and Paper Plant Instrumentation: - Mechanical and Chemical pulping processes -Paper production-Physical properties of paper-Types of paper products- controlling of paper thickness - Control system units

Reference Books:

1. A course in power plant engineering – Arora and Domkundwar
2. Power plant Instrumentation – K.Krishnaswamy and ponnibala
3. Principles of Industrial Instrumentation – D. Patranabis, TMGH.
4. Instrumentation in Process Industries -- Bela G.Liptak
5. Hand book of applied Instrumentation -- D.M. Consodine
6. Chemical Process Industries -- Austine G.T. Shreeves
7. Power Plant performance -- Gill A.B.
8. Power Station Instrumentation -- Jervis M.J.

PLC AND SCADA LAB

Subject Name	:	PLC and SCADA Lab
Subject code	:	AEI-506
Periods / week	:	03
Periods/semester	:	45

LIST OF EXPERIMENTS

01. Study the PLC.
02. Test the basic gates using PLC
03. Test the universal gates using PLC.
04. Test the EX-OR gate and EX-NOR gates using PLC.
05. Programs on ON-Delay Timer and OFF-Delay Timers
06. Programs on Retentive and Non-Retentive Timers.
07. Programs on Up counter and Down counters
08. Traffic light controller.
09. Conveyor controller.
10. Sequential control of induction motors.
11. Using SCADA software create graphic symbols and associate tags with memory tags.
12. Interface SCADA with PLC and associate tags with memory and I/O and operate the PLC inputs through the switch symbol from the computer screen and view the status of the outputs using lamp and motor graphics symbols in the screen.

MICROCONTROLLERS LAB

Subject Title : Microcontrollers Lab

Subject Code : AEI-507

Periods / Week : 06

Periods / Semester : 90

List of Experiments:

Perform assembly language programming on 8051 Microcontroller for the Following

1. 8 – bit addition and subtraction.
2. Multi byte addition.
3. Block transfer of data.
4. Sum of given n numbers.
5. Sum of first n natural numbers.
6. Multiplication of two 8 bit numbers using MUL instruction.
7. 2's complement of 8-bit number.
8. Biggest data in given array.
9. Hex to BCD conversion.
10. BCD to HEX Conversion.
11. BCD to ASCII conversion.
12. Hex to ASCII conversion.
13. Time delay program using counters.

Micro-Controller Applications

1. Testing the interfacing of stepper motor.
2. To control the Traffic light.
3. Interfacing of seven segment display.

LIFE SKILLS
(Common to all branches)

Subject Title : Life Skills
 Subject Code : AEI-508
 Periods/ Week : 03
 Periods/Semester : 45

TIME SCHEDULE

SI No.	UNITS	No. of periods Allotted		
		Explan ation	Activities	Total
1.	ATTITUDE	1	3	4
2.	ADAPTABILITY	1	3	4
3.	GOAL SETTING	1	3	4
4.	MOTIVATION	1	3	4
5.	TIME MANAGEMENT	1	3	4
6.	CRITICAL THINKING	2	3	5
7.	CREATIVITY	1	3	4
8.	PROBLEM SOLVING	1	3	4
9.	TEAM WORK	1	3	4
10.	LEADERSHIP	1	3	4
11.	STRESS MANAGEMENT	1	3	4
TOTAL		12	33	45

Note: No Written Examination; The total 45 hours are to be considered as Theory hours.

Marks: Internal – 40;

External – 60

OBJECTIVES:

Upon the completion of this course, the student shall be able to

1.0 Understand the concept of Attitude

- 1.1 Define 'Attitude'
- 1.2 Explain the importance of Attitude
- 1.3 Distinguish between Positive and Negative Attitudes
- 1.4 Life Response: Need for change of Attitude
- 1.5 Positive Attitude: Key to success in Personal and Professional Lives

2.0 Understand the concept of Adaptability

- 2.1 Define the term 'Adaptability'
- 2.2 Explain the concept of Adaptability
- 2.3 Advantages of Adaptability
- 2.4 Disadvantages of Lack of Adaptability
- 2.5 Need for positive response to change

3.0 Understand the concept of Goal setting

- 3.1 Define the terms 'Goal' and 'Goal Setting'
- 3.2 Explain the significance of Goal setting & Long and Short term goals
- 3.3 Explain the following concepts
 - a) Wish b) Dream c) Goal
- 3.4 Explain the reasons for and consequences of not setting goals
- 3.5 The SMART features in Goal setting

4.0 Understand the concept of Motivation

- 4.1 Define 'Motivation' ; Inspiration Vs Motivation
- 4.2 Importance of motivation in Goal setting
- 4.3 Distinguish between Internal (Self) Motivation and External Motivation
- 4.4 De-motivating Factors and how to overcome them
- 4.5 Motivating oneself and others

5.0 Understand Time Management skills

- 5.1 Define 'Time Management'.
- 5.2 Comprehend the significance of Time Management.
- 5.3 Explain the Time Quadrant
- 5.4 Common Time wasters and how to overcome them.
- 5.5 How to meet deadlines and targets within time

6.0 Understand Critical Thinking

- 6.1 Define "Critical Thinking",
- 6.2 Understand the importance of Critical Thinking
- 6.3 Distinguish between facts and opinions (assumptions)
- 6.4 Inculcating different perspectives
- 6.5 Developing Reasoning abilities and form sound judgments

7.0 Understand Creativity

- 7.1 Understand the importance of and need for creative ideas
- 7.2 Distinguish between Linear Thinking and Lateral Thinking
- 7.3 Distinctive qualities of creative people
- 7.4 Unusual or creative use of familiar objects
- 7.5 Creative ways of solving problems

8.0 Understand Problem Solving

- 8.1. Define the concept of Problem solving
- 8.2 Viewing the problems as challenges
- 8.3 Different steps in solving a problem
- 8.4 Selecting the best solution to solve a problem
- 8.5 Lateral thinking in Problem solving

9.0 Understand Team Work

- 9.1 Define Team work
- 9.2 Develop Team skills
- 9.3 Advantages of team work
- 9.4 Understand responsibilities as a team player
- 9.5 Problems of working in a team and possible solutions

10.0 Understand Leadership

- 10.1 Define Leadership
- 10.2 Identify Leadership qualities
- 10.3 Analyze one's strengths and limitations as a leader
- 10.4 Types of Leadership: Autocratic and Democratic
- 10.5 Leadership by example

11.0 Understand Stress Management

- 11.1 Define Stress
- 11.2 Explain the causes of stress
- 11.3 Learn Stress Management skills
- 11.4 Need for positive thinking and self esteem
- 11.5 Practice Stress Management strategies

BIOMEDICAL & ANALYTICAL INSTRUMENTATION LAB

Subject title	:	Bio-Medical and Analytical Instrumentation Lab
Subject code	:	AEI-509
Periods /week	:	03
Periods /semester	:	45

LIST OF EXPERIMENTS

1. Study of ECG machine and placement of electrodes
2. Study of EEG machine and placement of electrode
3. Study of EMG machine and placement of electrode.
4. Use of sphygmomanometer for measurement of blood pressure
5. Study the use of defibrillator.
6. Study and Demonstration of X-ray Machine.
7. Study the use of CT scanner.
8. Measure the P^H value of the given solution using P^H meter.
9. Measure the conductivity value of the given solution using conductivity meter
10. Analyze the composition of the given sample using IR Spectro Photo Meter
11. Study the use of Auto analyzer.
12. Using Flame Photo Meter, determine the presence of metal in a given sample.
13. Determine the dissolved Oxygen in given sample using Dissolved Oxygen meter.
14. Find out the refractive index of the given sample using refractometer.
15. Find the concentration of a given sample using Polarimeter.

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS**

VI SEMESTER

AEI - 601 INDUSTRIAL TRAINING

S.NO	Subject	Duration	Items	Max Marks	Remarks
1	Practical Training in the Industry	6 Months	1.First Assessment (at the end of 3 rd month)	100	
			2. Second Assessment (at the end of 6 th month)	100	
			3.Training Report a)Log Book b)Record	30 30	
			4. Seminar	40	
TOTAL		300			

The industrial training shall carry **300** marks and pass marks are **50%**.A candidate failing to secure the minimum marks should complete it at his own expenses. No apprenticeship training stipend is payable in such case

During Industrial training the candidate shall put in a minimum of **90%**attendance.

**DIPLOMA IN APPLIED ELECTRONICS AND INSTRUMENTATION ENGINEERING
(CURRICULUM C-16)**

VI SEMESTER

(INDUSTRIAL TRAINING)

Duration : 6 months

OBJECTIVES

On completion of a spell of practical training in a industry, the student will be able to

1.0 Know the organizational set up from top executive to workmen level

1.1 Know the function of each department/section

1.2 Know the inter relationship among various department/sections

2.0 Know the various raw materials used as feed stock and their source.

2.1 Understand the various intermediates produced and their further processing and / or waste disposal.

2.2 Know the final products, its composition and its commercial importance's, uses and applications.

3.0 Understand the various stages involved in processing, sequential arrangement of different equipment.

3.1 Draw the flow diagram, detail flow diagram of each process

3.2 Understand the arrangement of various equipment and machinery in systematic manner in a less possible area of site.

4.0 Know the various analytical methods used in the quality control department

4.1 Understand the experimental methods to find out the quality of the product

4.2 Understand various tools, instruments used for quality checking.

5.0 Know the trouble shooting in process operation

5.1 Know preventive precautions of each equipment in the plant.

5.2 Startup and shut down procedures for the equipment and plant.

6.0 Know the importance of safety in industries

- 6.1 Understand the safety about personnel protection, equipment protection
- 6.2 Know the usage of various safety devices
- 6.3 Precautionary measures to be taken.

7.0 Know the various pollutants emitted from the plant.

- 9.1 Understand effects of pollutants.
- 9.2 Understand treatment method and disposal.
- 9.3 Know the effective methods pollution control.

COURSE CONTENTS

- 1. Organizational set up
- 2. Raw materials, intermediates and end products
- 3. Process descriptions (Process flow diagrams and line tracing, detailed flow diagrams etc.)
- 4. Quality control of raw materials, intermediates and end products
- 5. Operational troubles and preventive measures
- 6. Safety aspects (personnel, equipment etc.)
- 7. Pollution control

INDUSTRIAL TRAINING SCHEME

VI SEMESTER

- 1. A candidate shall be assessed twice in the spell of industrial training i.e. at the end of third month and finally before he/she completes the industrial training
- 2. The assessment shall be carried out by a committee comprising of
 - (a) A representative of the Industry where the candidate is undergoing training
 - (b) A staff member of the concerned section of the polytechnic.
- 3. The assessment at the end of the third month and the end of training shall each carry 100 marks for the progress made during the corresponding period of training.
- 4. The remaining 100 marks are allotted as follows:
 - For the training report (Record) 30 marks,
 - For maintenance of log book 30 marks
 - For seminar 40 marks.

These are to be evaluated at the institution at the end of training by a committee consisting following staff members

- (1) Head of Section.
- (2) External Examiner preferably from Industry
- (3) Staff member who assessed the student during the Industrial Training.

5. The progress made during the end of assessment will be evaluated on the basis of the following parameters.

ASSESSMENT SCHEME

S. No.	Name of the Parameter	Max. Marks Allotted for each Parameter
1.	Attendance and punctuality	05
2.	Familiarity with Technical terms	06
3.	Familiarity with tools and material	10
4.	Attitude towards job	07
5.	Manual skills	04
6.	Application of knowledge	10
7.	Problem solving skills	10
8.	Comprehension and observation	04
9.	Safety and Environmental consciousness	03
10.	Human relations	04
11.	Ability to communicate	06
12.	Supervising ability	10
13.	General conduct during the period	06
14.	Maintenance of dairy	15
	Total	100