CURRICULUM C-14

FOR

DIPLOMA IN

ELECTRICAL & ELECTRONICS ENGINEERING

DIPLOMA IN ELECTRICAL& ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(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:								
EE-101	English	3	-	90	3	20	80	100
EE-102	EngineeringMathematics - I	5	-	150	3	20	80	100
EE-103	Engineering Physics	4	-	120	3	20	80	100
EE-104	Engineering Chemistry &Environmental Studies	4	-	120	3	20	80	100
EE-105	Electrical Engineering Materials	3	-	90	3	20	80	100
EE-106	Basic Electrical Engineering	5	-	150	3	20	80	100
PRACTICAL:								
EE-107	Engineering Drawing	-	6	180	3	40	60	100
EE-108	108-Basic Electrical & Electronics Laboratory Practice	-	6	180	3	40	60	100
EE-109	109-A Physics Laboratory Practice	-	3	90	1½	20	30	50
	109-B Chemistry Laboratory Practice				1½	20	30	50
EE-110	Comp. Fundamentals Laboratory Practice	-	3	90	3	40	60	100
	TOTAL	24	18	1260		280	720	1000

DIPLOMA IN ELECTRICAL& ELECTRONICS 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:								
EE- 301	EngineeringMathematics - II	4	-	60	3	20	80	100
EE -302	DC Machines	4	-	60	3	20	80	100
EE -303	Electric circuits	4	-	60	3	20	80	100
EE-304	Electrical & Electronic Measuring Instruments	4	-	60	3	20	80	100
EE-305	Electronics-I	4	-	60	3	20	80	100
EE-306	General Mechanical Engineering	4	_	60	3	20	80	100
PRACTICAL:								
EE-307	Circuits and Measurements Laboratory Practice	-	6	90	3	40	60	100
EE-308	Electrical Workshop Practice	-	3	45	3	40	60	100
EE-309	DC Machines Laboratory Practice	-	6	90	3	40	60	100
EE-310	Electronics-I Laboratory Practice	-	3	45	3	40	60	100
	TOTAL	24	18	630		280	720	1000

DIPLOMA IN ELECTRICAL& ELECTRONICS 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:								
EE - 401	EngineeringMathematics - III	4		60	3	20	80	100
EE - 402	A.C. Machines - I	5		75	3	20	80	100
EE - 403	Power Systems – I (Generation)	5		75	3	20	80	100
EE - 404	Electrical Installation and Estimation	4		60	3	20	80	100
EE - 405	Electronics -II	4		60	3	20	80	100
EE - 406	Programming in C	4		60	3	20	80	100
PRACTICAL:								
EE - 407	Electrical Engineering Drawing	-	7	105	3	40	60	100
EE - 408	Communication Skills Practice	-	3	45	3	40	60	100
EE - 409	A.C. Machines-I Laboratory Practice	-	3	45	3	40	60	100
EE - 410	Electronics-II Laboratory Practice		3	45	3	40	60	100
	TOTAL	26	16	630		280	720	1000

DIPLOMA IN ELECTRICAL& ELECTRONICS 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:								
EE-501	Electrical Utilisation	4	-	60	3	20	80	100
EE-502	A.C.Machines - II	4	-	60	3	20	80	100
EE-503	Power Systems – II (T&D)	5	-	75	3	20	80	100
EE-504	Industrial Drives	3	-	45	3	20	80	100
EE-505	Digital Electronics	4	-	60	3	20	80	100
EE-506	Maintenance of Electrical Systems	4	-	60	3	20	80	100
PRACTICAL:								
EE-507	Matlab Practice	-	6	90	3	40	60	100
EE-508	Life skills	-	3	45	3	40	60	100
EE-509	A.C.Machines – II Laboratory Practice	-	3	45	3	40	60	100
EE-510	Field Practices	-	6	90	3	40	60	100
	TOTAL	24	18	630		280	720	1000

DIPLOMA IN ELECTRICAL& ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI 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:								
EE- 601	Industrial Management	4	-	60	3	20	80	100
EE-602	Electric Traction	4	-	60	3	20	80	100
EE - 603	Power Systems – III (Switch Gear and Protection)	4	-	60	3	20	80	100
EE - 604	Power Electronics	4	-	60	3	20	80	100
EE - 605	Micro Controllers and Applications	4	-	60	3	20	80	100
EE - 606	Industrial Automation	4	-	60	3	20	80	100
PRACTICAL:								
EE- 607	Electrical CAD & Project Management Practice	-	6	90	3	40	60	100
EE -608	Digital Electronics & Micro Controller Laboratory Practice	-	3	45	3	40	60	100
EE -609	Power Electronics & PLC Laboratory Practice	-	3	45	3	40	60	100
EE -610	Project work	-	6	90	3	40	60	100
	TOTAL	24	18	630		280	720	1000

DIPLOMA IN ELECTRICAL& ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(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:								
EE-101	English	3	-	90	3	20	80	100
EE-102	Engineering Mathematics - I	5	-	150	3	20	80	100
EE-103	Engineering Physics	4	-	120	3	20	80	100
EE-104	Engineering Chemistry &Environmental Studies	4	-	120	3	20	80	100
EE-105	Electrical Engineering Materials	3	-	90	3	20	80	100
EE-106	Basic Electrical Engineering	5	-	150	3	20	80	100
PRACTICAL:								
EE-107	Engineering Drawing	-	6	180	3	40	60	100
EE-108	108-Basic Electrical & Electronics Laboratory Practice	-	6	180	3	40	60	100
EE-109	109-A Physics Laboratory Practice	-	3	90	1½	20	30	50
	109-B Chemistry Laboratory Practice				1½	20	30	50
EE-110	Comp. Fundamentals Laboratory Practice	-	3	90	3	40	60	100
	TOTAL	24	18	1260		280	720	1000

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ENGLISH

Subject Title	:	English			
Subject Code	:	EE-101(common to all branches)			
Periods per Week	:	3			
Periods per Year	:	90			

Time Schedule

SI No	Major Topics	No. of Periods	Weightage of Marks	No of Short Answers	No of Long Answers
1	Vocabulary	5	13	1	1
2	Grammar	30	31	7	1
3	Reading	10	10	-	1
4	Writing	30	40	-	4
5	English in Action	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-14 Curriculum the focus is on the special English needs of technician studies and training. 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 repots, giving instructions and interpreting graphics is of great importance. Therefore the curriculum C-14 focuses on improving communicative abilities equipping the students to become industry- ready and employable.

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

1.0 Build their vocabulary in the direction of their 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

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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 conformation
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

5.0   Practice spoken communication suited to various situations.
5.1   Use appropriate expressions to greet and take leave
5.2   Use proper expressions to make requests

5.3	Use apt expressions for asking and giving directions
5.4	Use suitable expressions to seek and offer suggestions
5.5	Use suitable expressions to state intentions
5.6	Use suitable expressions to state feelings
5.7	Use appropriate expressions to state agreement and disagreement
5.8	Use proper expressions to make complaints
5.9	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)
Santanu Sinha Chaudhuri
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

Engineering Mathematics – I

Subject Title	:	**Engineering Mathematics – I**
Subject Code	:	**EE-102(common to all branches)**
Periods/Week	:	**05**
Periods/Year	:	**150**

Blue Print

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
	Unit - I : Algebra	**Theory**	**Practice**		**R**	**U**	**App**	**R**	**U**	**App**
1	Logarithms	3	0	0	0	0	0	0	0	0
2	Partial Fractions	5	0	3	0	1	0	0	0	0
3	Matrices and Determinants	10	10	16	2	0	0	0	0	1
	Unit - II : Trigonometry									
4	Trigonometric Ratios	2	0	0	0	0	0	0	0	0
5	Compound Angles	3	2	3	1	0	0	0	0	0
6	Multiple and Submultiple angles	4	4	3	0	1	0	0	0	0
7	Transformations	4	4	5	0	0	0	1/2	0	0
8	Inverse Trigonometric Functions	3	2	5	0	0	0	0	1/2	0
9	Trigonometric Equations	3	2	5	0	0	0	1/2	0	0
10	Properties and solutions of triangles	4	4	5	0	0	0	0	0	1/2
11	Hyperbolic Functions	2	0	0	0	0	0	0	0	0
12	Complex Numbers	4	2	3	1	0	0	0	0	0
	Unit III : Co-ordinate Geometry									
13	Straight Lines	4	2	3	1	0	0	0	0	0
14	Circle	4	2	3	1	0	0	0	0	0
15	Conic Sections	5	4	10	0	0	0	0	1	0

No	Topic									
	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
	Unit - V : Applications of Differentiation									
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	7	3	0	2	2 1/2	3 1/2
				Marks	21	9	0	20	25	35

R: **Remembering type**   41 marks
U: **Understading type**   34 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:
     i)   Rational,
     ii)   Proper and
     iii) Improper
2.2   Explain the procedure of resolving rational fractions of the type mentioned below into partial fractions

i) $\dfrac{f(x)}{(x+a)(x+b)(x+c)}$ ii) $\dfrac{f(x)}{(x+a)^2(x+b)(x+c)}$

iii) $\dfrac{f(x)}{(x^2+a)(x+b)}$　　　　iv) $\dfrac{f(x)}{(x+a)(x^2+b)^2}$

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 (emphasis on 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 a 3x3 square matrix 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　Apply the properties of determinants to solve problems.
3.12　Solve system of 3 linear equations in 3 unknowns using Cramer's rule.
3.13　Define multiplicative inverse of a matrix and list properties of adjoint and inverse.
3.14　Compute adjoint and multiplicative inverse of a square matrix.
3.15　Solve system of 3 linear equations in 3 unknowns by matrix inversion method
3.16　State elementary row operations.
3.17　Solve a system of 3 linear equations in 3 unknowns 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±B), cos(A±B), tan(A±B) and cot(A±B)
5.2　Give simple examples on compound angles to derive the values of $\sin15^0$, $\cos15^0$, $\sin75^0$, $\cos75^0$, 　tan 15^0 , $\tan75^0$ 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 sinA= (1- cos2A)/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.

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

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

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

8.5   Derive formulae like $\tan^{-1} x + \tan^{-1} y = \tan^{-1}\left(\dfrac{x+y}{1-xy}\right),\ where\ x \geq 0, y \geq 0, xy < 1$ etc., 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 and solve problems.
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
      (v)   Centre and tangent
14.3   Write the general equation of a circle and find the centre and radius.
14.4   Write the equation of tangent and normal at a point on the circle.
14.5   Solve the problems to find the equations of tangent and normal.

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
15.5   Solve engineering problems in simple cases of Parabola and Ellipse.

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 $\lim\limits_{x \to a} f(x) = l$ and state the properties of limits .

16.2   Mention the Standard limits $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a}$, $\lim\limits_{x \to 0} \dfrac{\sin x}{x}$, $\lim\limits_{x \to 0} \dfrac{\tan x}{x}$, $\lim\limits_{x \to 0} \dfrac{a^x - 1}{x}$,

$\lim\limits_{x \to 0} \dfrac{e^x - 1}{x}$, $\lim\limits_{x \to 0} (1 + x)^{\frac{1}{x}}$, $\lim\limits_{x \to \infty} \left(1 + \dfrac{1}{x}\right)^x$ (All without proof).

16.3   Solve the problems using the above standard limits

16.4   Evaluate the limits of the type $\lim\limits_{x \to l} \dfrac{a x^2 + b x + c}{\alpha x^2 + \beta x + \gamma}$ and $\lim\limits_{x \to \infty} \dfrac{f(x)}{g(x)}$

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

$\lim\limits_{h \to 0} \dfrac{f(x+h)-f(x)}{h}$ 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, tanx, Secx, Cosecx and 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

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

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 in to their   partial fractions covering the types mentioned below:

$$i) \quad \frac{f(x)}{(x+a)(x+b)(x+c)} \qquad ii) \quad \frac{f(x)}{(x+a)^2(x+b)(x+c)}$$

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

3. **Matrices**:

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

Unit-IITrigonometry :

4.Trigonometric ratios: definition   of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.
5. Compound angles: Formulas of sin(A±B), cos(A±B), tan(A±B),cot(A±B),and related identities with problems.

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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 appoint, 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 and (v) centre and tangent equation - general equation of a circle - finding center, radius: tangent, normal to circle at a point on it.
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 - applications of parabola and ellipse to engineering situations.

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, logarthmic 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, subtangent 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.

References:
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   :   **EE-103(common to all branches)**
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	12	13	1	1
4.	Friction	08	10	-	1
5.	Work, Power and Energy	10	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	14	13	1	1
11.	Modern Physics	10	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

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
    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 (upand 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 concept of Work, Power, and Energy
    5.1   Define the terms 1.Work, 2. Power and Energy
    5.2   State SI units and dimensional formula for 1.Work, 2. Power, and Energy
    5.3   Define potential energy
    5.4   Derive the expression for Potential energy with examples
    5.5   Define kinetic energy
    5.6   Derive the expression for kinetic energy with examples
    5.7   State the Work- Energy theorem
    5.8   Explain the relation between Kinetic energy and momentum
    5.9   State the law of conservation of energy

5.10 Verify the law of conversion of energy in the case of a freely falling body

5.11 Solve the related numerical problems

6.0   Understand the concept of Simple harmonic motion
6.1 Define Simple harmonic motion
6.2 State the conditions of Simple harmonic motion
6.3 Give examples for Simple harmonic motion
6.4 Show that the tip of the projection of a body moving in circular path with uniform speed is SHM
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
6.10 Derive expression for Time period of simple pendulum
6.11 State the laws of simple pendulum
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 Explain Boyle's law
7.3 State Charles law in terms of absolute temperature
7.4 Define absolute zero temperature
7.5 Explain absolute scale of temperature
7.6 Define ideal gas
7.7 Derive the Ideal gas equation
7.8 Define gas constant and Universal gas constant
7.9 Explain why universal gas constant is same for all gases
7.10 State SI unit of universal gas constant
7.11 Calculate the value of universal gas constant
7.12 State the gas equation in terms of density
7.13 Distinguish between r and R
7.14 Explain Isothermal process with the help of P-V and T-Ø diagram.
7.15 Explain adiabatic process with the help of P-V and T-Ø diagram
7.16 Distinguish between isothermal and adiabatic process
7.17 State first and second laws of thermodynamics
7.18 Define specific heats & molar specific heats of a gas
7.19 Derive the relation $C_p - C_v = R$
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
8.3 Distinguish between musical sound and noise
8.4 Explain noise pollution and state SI unit for noise
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 List the applications of beats

8.10 Define Doppler effect

8.11 List the Applications of Doppler effect

8.12 Explain reverberation and reverberation time

8.13 Write Sabine's formula

8.14 Explain echoes

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

9.3 State the units and dimensional formulae for stress and strain

9.4 State the Hooke's law

9.5 Define the surface tension

9.6 Explain Surface tension with reference to molecular theory

9.7 Define angle of contact

9.8 Define the capillarity

9.9 Write the formula for surface tension based on capilarity

9.10 Explain the concept of Viscosity

9.11 Provide examples for surface tension and Viscosity

9.12 State Newton's formula for viscous force

9.13 Define co-efficient of viscosity

9.14 Explain the effect of temperature on viscosity of liquids and gases

9.15 State Poiseulle's equation for Co-efficient of viscosity

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 the Ohm's law

10.3 Explain the Ohm's law

10.4 Define specific resistance, conductance and 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 expression for balancing condition of Wheatstone's bridge

10.9 Describe Meter Bridge with legible sketch

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

10.14 State the Magnetic induction field strength-units and dimensions

10.15 Describe 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   Explain Photo-electric effect
11.2   Write Einstein's photoelectric equation
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 fibbers
11.11   List the applications of Optical Fiber
11.12   Define super conductor and superconductivity
11.13   List the examples 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 of a gas - Problems

8. **Sound:**
   Sound- Nature of sound- Types of wave motion - usical sound and noise- Noise pollution – Causes & effects- Methods of reducing noise pollution- Beats- Doppler effect- Echo- Reverberation-Reverberation time-Sabine 's formula- Condition 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 - Poiseulle'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- concepts of superconductivity - applications

REFERENCE BOOKS
   1. Intermediate physics Volume-I   Deepthi
   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

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	12	13	0	1	0	1	0	0
4.	Friction	08	10	0	0	0	0	1	0
5.	Work, Power and Energy	10	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	14	13	0	1	0	0	1	0
11.	Modern Physics	10	03	1	0	0	0	0	0
	Total:	**120**	**110**	**3**	**5**	**2**	**2**	**5**	**1**

ENGINEERING CHEMISTRY & ENVIRONMENTAL STUDIES

Subject Title	:	**Engineering. Chemistry & Environmental Studies**	
Subject Code	:	**EE-104(common to all branches)**	
Periods per week	:	**04**	
Total periods per year	:	**120**	

Time Schedule & Blue Print

S.No	Major topic	No of Periods	Weightage of marks	Short type (3marks)			Essay type (10 marks)			remarks
				R	U	A	R	U	A	
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	
10	**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 fundamental particles of an atom like electron, proton and neutron etc.,
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 concept of Quantum numbers with examples
1.5 Explain 1. Aufbau's principle, 2. Hund's rule and 3. Pauli's exclusion principle with respect to electron stability
1.6 Define Orbital in an atomic structure
1.7 Draw the shapes of s, p and d Orbitals in an atomic structure
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 valance
1.12 Define the four types of Chemical bonding viz., Ionic, Covalent, Coordinate and Metallic
1.13 Explain the four types of Chemical bonding viz., Ionic, Covalent, Coordinate and Metallic
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 Explain Metallic bond with Electron sea model theory
1.18 Define the terms 1. Oxidation, 2. Reduction and 3. Oxidation number
1.19 Calculate the Oxidation Number
1.20 Differentiate between Oxidation Number and Valence

2.0 Calculate Molarity, Molality 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 Explain, with examples, the '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, Bases and Salts
2.7 Define 1.Molarity, 2. Molalty and 3.Normality of solutions
2.8 Explain with examples Normality
2.9 Solve Numerical problems on Mole, Molarity and Normality

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 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 the at least three examples foe 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. Flux and 5. Slag
4.4 Describe the methods of concentration of ore like 1.Hand picking,2. Levigation, and 3. FrothFloatation
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.German silver, and Nichrome
4.9 List the uses of following Alloys: Brass, German silver, Nichrome

5.0 Understand the concepts of Electrochemistry
5.1 Define the terms1. conductor, 2. Insulator, 3.Electrolyte and 4.Non – electrolyte
5.2 Distinguish between metallic conduction and Electrolytic conduction
5.3 Explain Arrhenius theory of electrolytic dissociation
5.4 Explain electrolysis by taking example fused NaCl
5.5 Explain Faraday's laws of electrolysis
5.6 Define 1.Chemical equivalent and 2.Electrochemical equivalent
5.7 Solve the Numerical problems based on Faraday's laws of electrolysis
5.8 Define Galvanic cell
5.9 Explain the construction and working of Galvanic cell
5.10 Distinguish between electrolytic cell and galvanic cell
5.11 Explain the standard electrode potentials
5.12 Explain the electrochemical series and its significance
5.13 Explain the emf of a cell

5.14   Solve the numerical problems on emf of cell.

6.0   Understand the concept of Corrosion

6.1   Define the term corrosion
6.2   Explain the Factors influencing the rate of corrosion
6.3   Explain the concept of electrochemical theory of corrosion
6.4   Describe the formation of a) composition cells, b) stress cells c) concentration cells
6.5   Explain the mechanism of rusting of iron
6.6   Explain the methods of prevention of corrosion: a) Protective 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 and sub surface sources
7.2   Define the terms soft water and hard water with respect to soap consumption
7.3   Define the term of hardness of water
7.4   Explain the various types of hardness of water like temporary and permanent hardness; and carbonate and bicarbonate hardness of water.
7.5   List the usual compounds causing hardness (with Formulae)
7.6   State the disadvantages of using hard water in industries
7.7   Define Degree of hardness, units of hardness (mg/L)
7.8   Explain the methods of softening of hard water: a) Ion-Exchange process, b)Reverse osmosis process(RO)
7.9   List the advantages of RO
7.10   State three essential qualities of drinking water like

        1).Safety, 2). Economy and 3)..Aesthetic

8.0   Understand the concepts of Polymers

8.1   Explain the concept of polymerisation
8.2   Describe the methods of polymerisation   a) addition polymerisation of Ethylene b) condensation polymerisation 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
8.9   Explain the uses of the following plastics:
        1. Polythene, 2. PVC,   3.Teflon, 4. Polystyrene and 5. Urea formaldehyde
8.10   Define the term natural rubber
8.11   State the structural formula of Natural rubber
8.12   Explain the processing of Natural rubber from latex
8.13   List the Characteristics of natural rubber
8.14   Explain the process of Vulcanization
8.15   List the Characteristics of Vulcanized rubber

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8.16 Define the term Elastomer
8.17 Describe the preparation of the following synthetic rubbers a) Butyl rubber, b) Buna-s and c) Neoprene rubber
8.18 List the uses of the following synthetic rubbers a) Butyl rubber, b) Buna-s and c) 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) Bio gas and f) acetylene

B. ENVIRONMENTAL STUDIES
1.1 Define the term environment
1.2 Explain the scope and importance of environmental studies
1.3 Explain the following terms 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere, 4).Biosphere, 5)Pollutant, 6).Pollution, 7).Contaminant receptor - sink, particulates, dissolved oxygen, 8).Threshold limit value, 9).BOD, and 10).COD
1.4 Explain the growing energy needs
1.5 State the differences between renewable and non renewable energy sources-alternative energy sources.
1.6 Define an Ecosystem- biotic component, abiotic component and energy component,
1.7 Define the terms:
      1).Producers, 2).Consumers and 3).Decomposers with examples.
1.8 Explain biodiversity and threats to biodiversity
1.9 Define air pollution
1.10 Classify the air pollutants- based on origin and state of matter
1.11 Explain the causes of air pollution
1.12 Explain the use and over exploitation of forest resources and deforestation
1.13 Explain the effects of air pollution on human beings, plants and animals
1.14 Explain the green house effect - ozone layer depletion and 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 Understand 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 - Hand'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
   – Metallic bond
   Oxidation-Reduction: Concepts of Oxidation-Reduction, 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 distinctions 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 - Arrhenius theory of electrolytic dissociation – electrolysis – Faraday's laws of electrolysis- numerical problems – Galvanic cell – standard electrode potential – electro chemical 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 – numerical problems related to degree of hardness – drinking water – municipal treatment of water for drinking purpose – Osmosis, Reverse Osmosis - advantages of Reverse osmosis

7. Introduction - factors influencing corrosion - electrochemical theory of 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. Polytehene 2. PVC 3. Teflon 4. Polystyrene 5. Urea formaldehyde – Rubber – Natural rubber – processing from latex –Vulcanization – Elastomers – Butyl rubber, 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 resources : uses and over exploitation, deforestation, acid rain, green house effect –ozone depletion – control of air pollution – Water pollution – causes – effects – control measures,

REFERENCE BOOKS

1. Intermediate chemistry Vol 1&2 Telugu Acedemy

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

ELECTRICAL ENGINEERING MATERIALS

Subject Title : **Electrical Engineering Materials**
Subject Code : **EE-105**
Periods/Week : **03**
Periods/Year : **90**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short questions	Essay questions
1.	Conducting Materials	18	26	02	02
2.	Semi Conducting Material	12	13	01	01
3.	Insulating Materials	15	13	01	01
4.	Di- electric Materials	9	8	01	1/2
5.	Magnetic Materials	9	13	01	1
6.	Special Purpose Materials	9	11	02	1/2
7.	Batteries	18	26	02	02
	Total	90	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0   Comprehend the Conducting Materials
1.1   Define Conducting Materials
1.2   State the properties of conducting materials
1.3   Define the terms (i) Hardening (ii) Annealing
1.4   Explain the effects of Hardening and Annealing on copper with regard Electrical and Mechanical properties.
1.5   State the main requirements of Low Resistivity Materials
1.6   State the main requirements of HighResistivity materials.
1.7   List some examples of   i)Low Resistivity Materials

<div align="center">ii)High Resistivity materials</div>

1.8   Mention the Properties & Applications of Copper and Aluminium
1.9   Distinguish between Copper and Aluminium.
1.10   Mention the properties & applications of ACSR Conductors and AAAC.
1.11   State the requirements of High Resistive Materials.
1.12   State the types of High Resistive Materials.
1.13   List the properties & Applications of High Resistive Materials.

      i)   Manganin   ii)   Eureka
      iii) Constantan   iv)   Nichrome
      v) Tungsten   vi)   Platinum
      vii) Mercury   viii)   Carbon

1.14   List the colour codes of the resistors as per BIS.

2.0   Understand the Semi conducting Materials
2.1   Define Semi-conducting materials
2.2   Understand Semi-conducting materials.
2.3   Classify Semi-conducting materials.
2.4   Define i) Intrinsic Semi-conductors   and   ii)Extrinsic Semi-conductors.
2.5   Distinguish between Intrinsic and Extrinsic semi-conductors.
2.6   Explain the formation of   i) P type semi-conductor   and
                              ii)N type semi-conductors.
2.7   Distinguish between P and N type semi-conductors.

3.0   Comprehend the Insulating Materials
3.1   Define Insulating Materials
3.2   Draw energy level diagrams of conductors, insulators and semi-Conductors.
3.3   Distinguish between conductors, insulators and semi-Conductors
3.4   State the important electrical properties of Insulating materials.
      (i) Insulating resistance   (ii) Volume   and   (iii)Surface resistance
3.5   Explain factors affecting insulating resistance.
3.6   Classify Insulating materials on the basis of temperature
      i.e (Y, A, E, B, F, H and C class)
3.7   Classify insulating materials.
3.8   State the properties of   i) Impregnated paper ii)   Wood
      iii)Cardboard   iv)Asbestos   v)Mica   vi)Ceramics   and
      vii)Glass.
3.9   List the applications of the above insulating materials.
3.10   Explain Thermoplastic & Thermosetting resins with examples.
3.11   Explain the properties of PVC
3.12   List the applications of PVC.
3.13   State the effects of the following on P.V.C
      (i) Filler   (ii)   Stabilizer (iii)   Plasticizer (iv) Additives.
3.14   State the Properties of the following gasses
      i) Air (ii) Nitrogen (iii) Hydrogen (iv) Sulphur – Hexafluoride (SF_6).
3.15   List the applications of the following gasses
      i) Air (ii) Nitrogen (iii) Hydrogen (iv) Sulphur – Hexafluoride (SF_6).

4.0   **Know the Di- electric materials**
4.1   Give the Permittivity of commonly used di - electric materials

i)	Air	ii)	Bakelite
iii)	Glass	iv	)Mica
v)	Paper	vi)	Porcelain
vii)	Transformer oil		

4.2 Explain Polarization.
4.3 Explain Dielectric Loss.
4.4 List any four the application of Dielectrics.
4.5 List the colour codes of the capacitors as per BIS.

5.0 Know the Magnetic Materials
5.1 Classify the Magnetic Material as:
 (i) Ferro (ii) Para (iii) Dia-Magnetic materials with examples
5.2 Explain i)Soft Magnetic materials and ii) Hard Magnetic materials
5.3 Draw i) B-H. Curves and ii)Hysteresis loop
5.4 Explain. Hysteresis loop.
5.5 Explain Hysteresis loss and State Steinmetz equation (No-Problems)
5.6 Explain Eddy Current Losses
5.7 State Curie point
5.8 Define Magnetostriction.

6.0 Understand the Special Purpose Materials
6.1 State the need for protective materials
6.2 List the various protective materials like Lead, Paints, Steel Tapes etc.
6.3 Explain the thermo couple materials.
6.4 State the Bi-metals
6.5 State the soldering materials
6.6 Define fuse
6.7 State the different types of materials used for fuse.
6.8 Explain the process of Galvanising and Impregnation
6.9 State the use of Enamel coated copper wires (thin, medium and thick).
6.10 State the importance of Nano Materials.

7.0 Comprehend the Batteries
7.1 Classify cells as primary and secondary cells.
7.2 Distinguish between primary and secondary cells.
7.3 Name the types of storage cells as lead acid, Nickel iron and Nickel Cadmium.
7.4 Explain the parts of lead acid battery.
7.5 Write chemical reactions during charging and discharging of lead acid battery.
7.6 List indications of fully charged lead acid battery.
7.7 Explain parts of Nickel – iron cells
7.8 Write chemical reactions during charging and discharging of Nickel – iron cell.
7.9 State applications of (i) Lead acid battery (ii) Nickel iron cell
 (iii) Nickel Cadmium battery.
7.10 Compare Lead acid cell with Nickel iron cell.
7.11 Explain charging of batteries by i)Constant current method and ii)Constant Voltage method.
7.12 State precautions to be taken during charging & discharging of batteries.

7.13   Explain trickle charging
7.14   State capacity of a battery and factors affecting capacity.
7.15   State Ampere- hour efficiency and Watt- hour efficiency of battery
7.16   Solve problems on the Ampere – Hour Efficiency and Watt – Hour Efficiency
7.17   Define maintenance free battery
7.18   Differentiate between maintenance free batteries and lead-acid batteries
7.19   Explain the construction and working of maintenance free batteries
7.20   State the applications of maintenance free batteries.

COURSE CONTENT

1. Conducting Materials
Hardening, Annealing - Low Resistive Materials – Requirements – Properties and applications of Copper and Aluminum - Comparison between Copper and Aluminum - ACSR Conductors, AAAC, - High Resistive Materials – Requirements- Properties and applications.

2. Semi conducting Materials
Semi-conductors - Intrinsic and extrinsic semi- conductors-`P' and `N' type Materials

3. Insulating Materials
Properties -Insulation resistance - Factors effecting Insulation resistance - Classification of Insulation materials - Properties – Applications.

4. Di- electric materials
Permittivity of di - electric materials- Polarisation - Dielectric Loss – Application of   Dielectrics – Colour codes.

5. Magnetic Materials
Classification of magnetic materials - Soft & Hard magnetic materials- B-H Curves - Hysteresis loop - Hysteresis loss - Steinmetz constant - Eddy Current Loss --   Curie Point – Magnetostriction.

6. Special Purpose Materials
Protective materials – Thermocouple - Bi-Metals- Soldering- Fuses -Galvanizing

and Impregnating - Nano Materials.

7. Batteries
Primary cell and Secondary cells-Lead acid, Nickel iron and Nickel - cadmium-Chemical reactions during charging and discharging – Charging of Batteries-Constant current method and constant voltage method-Trickle charging - Capacity of Battery - Ampere-hour efficiency and watt-hour efficiency - Maintenance free batteries

REFERENCES

1 Electronic Components -Dr. K.Padmanabham
2 Electronic Components -D.V.Prasad
3 Electrical Engineering Materials – N.I T.T.T.R Publications
4 Introduction to Engineering materials – B.K.Agarwal.
5 Materials science for Electrical and Electronic Engineers – Ian P.Jones
   (Oxford Publications)

BASIC ELECTRICAL ENGINEERING

Subject Title   :   Basic Electrical Engineering
Subject Code   :   EE-106
Periods/Week   :   05
Periods/Year   :   150

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short questions	Essay questions
1.	Electric Current-Ohm's law, Resistance.	35	26	02	02
2.	Work, Power and Energy	10	13	01	01
3.	Heating effects of electric Current	15	13	01	01
4.	Magnetic effects of Electric current	30	16	02	01
5.	Electromagnetic Induction	35	26	02	02
6.	Electrostatics	25	16	02	01
	Total	150	110	10	08

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

1.0   Comprehend the basic Principles of Electricity
1.1   Distinguish between conductor, insulator and semi-conductor with respect to valence
          electrons.
1.2   State Ohm's Law.
1.3   Explain Ohm's Law
1.4   List the limitations of Ohms Law.
1.5   Explain the concept of Resistance to flow of electrons.

1.5   Define the terms   i)specific resistance   ii)conductance   and
        iii)conductivity.
1.6   Deduce the relation $R = (\rho l) / a$
1.7   Solve simple problems based on the Ohm's Law & $R = (\rho l) / a$.
1.8   State the effect of Alloying on Resistivity.
1.9   Explain the effects of temperature on resistance
1.10   Develop the expression for resistance at any temperature as $R_t = R_o (1 + \alpha_o t)$
1.11   Define temperature co- efficient of resistance and give its unit.
1.12   Develop the formula for co-efficient of resistance at any temperature as $\alpha_t = \alpha_o / (1 + \alpha_o t)$
1.13   Solve problems based on the $R_t = R_o (1 + \alpha_o t)$ & $\alpha_t = \alpha_o / (1 + \alpha_o t)$.
1.14   Develop the expressions for equivalent Resistance with simple series
connections.
1.15   Develop the expressions for equivalent Resistance with simple parallel
connections.
1.16   Solve problems on equivalent resistance in the case of series- parallel networks.
1.17   Solve problems on division of current when Two Resistors are connected in
parallel.

2.0   Explain the concept of work, power & energy
2.1   State the S.I. System of units for work, power and energy
2.2   Express work, power and energy in Electrical, Mechanical and Thermal Units.
2.3   Define efficiency.
2.4   Calculate electricity bill for domestic consumers.
2.5   Solve problems on work, power and energy in Electrical, Mechanical and
        Thermal units.

3.0   Appreciate 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   Explain the applications of heat produced due to Electric current in
        i) Metal Filament lamps   ii)Electric kettle   iii) Electric cooker   iv)
Electric Iron
        v) Space heaters   vi) Geyser   vii) Infrared lamp.
3.4   Define thermal efficiency.

3.5   Solve problems on the above.

4.0   Appreciate the magnetic effects of Electric Current
4.1   Draw the lines of force around a magnetic.
4.2   Explain the concept of field lines around current carrying conductors
4.3   State Right hand thumb rule.
4.4   Plot the field pattern due to
        i) Straight current carrying conductor   ii) Solenoid   and   iii) Toroid.
4.5   Explain Work law and its applications.
4.6   State Laplace law (Biot-Savart's Law)
4.7   Give expressions for field strength (No derivation)
                i) At Centre of a circular conductor
                ii) At any point on the axis of a circular conductor
                iii) Around a Straight conductor

ⅳ) On the axis of a solenoid
4.8 Explain the Mechanical force on a current carrying Conductor in a Magnetic field.
4.9 Derive an expression for magnitude of the force on a conductor in a magnetic field.
4.10 State the Fleming's left hand rule
4.11 Derive an expression for the force between two parallel current carrying conductors.
4.12 State the nature of the force with different directions of the currents
4.13 Define ampere
4.14 Solve problems on the above.
4.15 Define i) magnetizing force   ii)permeability iii) flux and   iv)Reluctance
4.16 Derive the concept of the Magnetic circuits
4.17 Solve problems on simple magnetic circuits
4.18 Compare magnetic circuit with electric circuit.
4.19 State Magnetic leakage co-efficient.

5.0   Explain Electro Magnetic Induction
5.1 State Faraday's laws of electro - magnetic induction.
5.2 Explain dynamically and statically induced E.M.F.
5.3 State Lenz's law
5.4 Explain Fleming's right hand rule.
5.5 Explain the concept of self and mutual inductance.
5.6 Derive expressions for self and mutual inductance.
5.7 State co-efficient of coupling.
5.8 Explain the total inductance with series connections with reference to direction of flux.
5.9 Develop an expression for energy stored in a magnetic field.
5.10 Develop an expression for energy stored per unit volume
5.11 Develop an expression for lifting power of a magnet.
5.12 Solve problems on the above.

6.0   Comprehend Electric Charge and Electrostatic Field
6.1 State Coulomb's law of electrostatics and define unit charge
6.2 Define absolute and relative permittivity.
6.3 Solve problems on the above
6.4 Explain electrostatic field.
6.5 Plot electrostatic field due to
        ⅰ)   Isolated positive charges
        ⅱ)   Isolated negative charge
        ⅲ) Unlike charges side by side
        ⅳ) Like charges side by side
6.6 State electric flux, electric flux density and field intensity.
6.7 Compare electrostatic and magnetic circuits.
6.8 State Gauss theorem.
6.9 Explain electric potential and potential difference.
6.10 Explain di-electric strength and di-electric constant
6.11 Define capacitance and state its unit.
6.12 Derive the formula for capacitance of a capacitor.
6.13 State different types of capacitors
6.14 Give uses of different capacitors

6.15   Explain equivalent capacitance of
      i)   Capacitors connected in series;
      ii)   Capacitors connected in parallel
6.16   Derive an expression for energy stored in a capacitor
6.17   Solve problems on the above

COURSE CONTENT

1. **Electric Current - Ohm's Law - Resistance**
   Conductor, Insulator , semi-Conductor - Electric Potential – Ohm's law – Resistance – Specific Resistance – Conductivity – Temperature coefficient of Resistance – Resistance in series, parallel and series - parallel combinations

2. **Work, Power & Energy**
   Units of work, power and energy. – Conversion of Units-Efficiency

3. **Heating Effects of Electrical Current**
   Mechanical Equivalent of Heat - Heat produced due to flow of current in resistance- applications

4. **Magnetic Effects of Electric Current**
   Lines of force - Field pattern due to long straight current carrying conductor-Field pattern of solenoid and Toroid -Work Law and its applications -Biot Savart Law(Laplace Law) -Field strength at centre and any point on the axis of a circular current carrying conductor- Field Strength around a straight current carrying conductor- Field strength on the axis of a solenoid-Mechanical force on a current carrying conductor in magnetic field - Direction of force - Fleming's left hand rule -Force between two parallel current carrying conductors – Ampere - Magnetic circuit- Magnetising force – permeability - flux - reluctance - Comparison of Magnetic circuit with electric circuit - Magnetic leakage.

5. **Electro Magnetic Induction**
   Faraday's laws - Dynamically and statically induced E.M.F -Lenz's Law & Fleming's right hand rule -Self and mutual inductance - Co-efficient of coupling - Inductances in series -Energy stored in a magnetic field - Energy stored per unit volume - Lifting power of magnet

6. **Electrostatics**
   Atom, Ion, positive and Negative charges -Laws of Electrostatics – coulomb - Permittivity - Electrostatic induction -Electrostatic field - lines of force - Comparison of electrostatic and magnetic lines of force - Strength of electric field- Flux density -Gauss theorem - Electric potential - potential difference – Dielectric strength - Dielectric constant - Capacitance -Capacitor - types - Capacitors in series and parallel- Energy stored in a capacitor.

REFERENCES

1. B.L.Theraja -Electrical Technology Vol.I- S.Chand &co.
2. T.K.Nagsarkar & M.S.Sukhija -Basic Electrical Engineering– Oxford.
3. Hughes-Electrical Technology
4. J.B.Gupta -Electrical Techology Vol.I

5. G.B.Bharadhwajan & A. Subba Rao -Elements of Electrical Engineering.
6. D C Kulshreshtha.-Basic Electrical Engineering .
7. Engineering D.P.Kothari & I.J.Nagarath -Theory and Problems of Basic Electrical -PHI
8. Abhijit Chakrabarthi,Sudipta nath, Chandan Kumar Chada -Basic Electrical Engineering.

ENGINEERING DRAWING

Subject Title	:	**Engineering Drawing**
Subject Code	:	**EE–107 (common to all branches)**
Periods/Week	:	**06**
Periods Per Year	:	**180**

TIME SCHEDULE

S.No	Major Topics	No. of Drawing plates	Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Importance of Engineering Drawing	--	01	-	-	-
2	Engineering Drawing Instruments	01	05	-	-	-
3	Free hand lettering & Numbering	01	06	5	1	-
4	Dimensioning Practice	01	09	5	1	-
5	Geometrical constructions	03	21	15	1	1
6	Projection of points, Lines, Planes & Solids	03	21	10	-	1
7	Auxiliary views	01	06	5	1	-
8	Sectional views	01	27	10	-	1
9	Orthographic Projection	01	33	10	-	1
10	Pictorial drawing	01	30	10	-	1
11	Development of surfaces	01	21	10	-	1
	Total	**14**	**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

Pre-Requisite: Clear visualization and sound pictorial intelligence
OBJECTIVES
Upon completion of the subject the student shall be able to

1.0 Understand the basic concepts of Engineering Drawing
  1.1 State the importance of drawing as an engineering communication medium
  1.2 State the necessity of B.I.S. Code of practice for Engineering Drawing.
  1.3 Explain the linkages between Engineering drawing and other subjects of study in diploma course.

2.0 Use of Engineering Drawing Instruments
  2.1 Select the correct instruments and draw lines of different orientation.
  2.2 Select the correct instruments and draw small and large Circles.
  2.3 Select the correct instruments for measuring distances on the drawing.
  2.4 Use correct grade of pencil for different types of lines, thickness and given function.
  2.5 Select and use appropriate scales for a given application.
  2.6 Identify different drawing sheet sizes as per I.S. and Standard Lay- outs.
  2.7 Prepare Title block as per B.I.S. Specifications.
  2.8 Identify the steps to be taken to keep the drawing clean and tidy.

Drawing Plate 1: (Having two exercises)

3.0 Write Free Hand Lettering and Numbers
  3.1 Write titles using sloping lettering and numerals of 7mm, 10mm and 14mm height
  3.2 Write titles using vertical lettering and numerals of 7mm, 10mm and 14mm height
  3.3 Select suitable sizes of lettering for different layouts and applications
  3.4 Practice the use of lettering stencils.

Drawing plate 2: (Having 5 to 6 exercises)

4.0 Understand Dimensioning Practice
  4.1 Define "Dimensioning.
  4.2 State the need of dimensioning the drawing according to accepted standard.
  4.3 Identify notations of Dimensioning used in dimensioned drawing.
  4.4 Identify the system of placement of dimensions in the given dimensioned drawing.
  4.5 Dimension a given drawing using standard notations and desired system of dimensioning.
  4.6 Dimension standard features applying necessary rules.
  4.7 Arrange dimensions in a desired method given in a drawing.
  4.8 Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly.

Drawing Plate 3: (Having 08 to10 exercises)

5.0   Apply Principles of Geometric Constructions
     5.1   Divide a given line into desired number of equal parts internally.
     5.2   Draw tangent lines and arcs.
     5.3   Use General method to construct any polygon.
     5.4   Explain the importance of conics
     5.5   Construct conics (ellipse, parabola and hyperbola) by general method
     5.6   Construct ellipse by concentric circles method
     5.7   Construct parabola by rectangle method
     5.8   Construct rectangular hyperbola from the given data.
     5.9   Construct involute from the given data.
     5.10   Construct cycloid and helix from the given data.
     5.11   State the applications of the above constructions in engineering practice.

Drawing Plate -4: Having problems up to construction of polygon
Drawing Plate -5: Having problems of construction of conics
Drawing Plate -6: Having problems of construction of involute, cycloid and helix

6.0   Apply Principles of Projection of points, lines, planes & solids
     6.1   Visualize the objects
     6.2   Explain the I-angle and III-angle projections
     6.2   Practice the I-angle projections
     6.3   Draw the projection of a point with respect to reference planes (HP&VP)
     6.4   Draw the projections of straight lines with respect to two reference
            Planes (up to lines parallel to one plane and inclined to other plane)
     6.5   Draw the projections of planes (up to planes   perpendicular to one plane
            and inclined to other plane)
     6.6   Draw the projections of solids (up to axis of solids parallel to one plane
            and inclined to other plane)

Drawing Plate -7: Having problems up to projection of points and Lines (15 exercises)
Drawing Plate -8: Having problems of projection of planes (6 exercises)
Drawing Plate -9: Having problems of projection of solids (10 exercises)

7.0   Understand the need of auxiliary views
     7.1 State the need of Auxiliary views for a given engineering drawing.
     7.2 Draw the auxiliary views of a given engineering component
     7.3 Differentiate between auxiliary view and apparent view

Drawing plate No.10: (Having 4 exercises)

8.0   Appreciate the need of Sectional Views
     8.1   Explain the need to draw sectional views.
     8.2   Select the section plane for a given component to reveal maximum
            information.
     8.3   Explain the positions of section plane with reference planes
     8.4   Differentiate between true shape and apparent shape of section
     8.5   Draw sectional views and true sections of regular solids discussed in **6.0**
     8.6   Apply principles of hatching.

Drawing Plate–11: Having problems of section of solids (6 exercises)

9.0   Apply principles of orthographic projection
    9.1   Explain the principles of orthographic projection with simple sketches.
    9.2   Draw the orthographic view of an object from its pictorial drawing.
    9.3   Draw the minimum number of views needed to represent a given object fully.

Drawing Plate 12 : (Having 10 to 12 exercises)

10.0   Prepare pictorial drawings
    10.1   State the need of pictorial drawings.
    10.2   Differentiate between isometric scale and true scale.
    10.3   Prepare Isometric views for the given orthographic drawings.

Drawing plate 13: (Having 10 to 12 exercises)

11.0   Interpret Development of surfaces of different solids
    11.1   State the need for preparing development drawing.
    11.2   Prepare development of simple engineering objects (cubes, prisms, cylinders, cones, pyramid) using parallel line and radial line method.
    11.3   Prepare development of surface of engineering components like trays, funnel, 90^0 elbow & rectangular duct.

Drawing plate No. 14: (Having 05 exercises)

Competencies to be achieved by the student

S.No	List of Practical	Competency
1.	Importance of Engineering Drawing	• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
2.	Engineering Drawing Instruments	• Select the correct instruments to draw various entities in different orientation
3.	Free hand lettering & Numbering	• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
4.	Dimensioning Practice	• Dimension a given drawing using standard notations and desired system of dimensioning
5.	Geometrical construction	• Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.
6.	Projection of points, Lines, Planes & Solids	• Draw the projection of a point, straight lines, planes & solids with respect to reference planes (HP& VP)
7.	Auxiliary views	• Draw the auxiliary views of a given Engineering component • Differentiate between Auxiliary view and apparent view
8.	Sectional views	• Differentiate between true shape and apparent shape of section • Use conventional representation of Engineering materials as per B.I.S. Code. • Apply principles of hatching.

		• Draw simple sections of regular solids
9.	Orthographic Projection	• Draw the minimum number of views needed to represent a given object fully.
10.	Pictorial drawing	• Differentiate between isometric scale and true scale. • Draw the isometric views of given objects,.
11.	Development of surfaces	• Prepare development of Surface of Engineering components like trays, funnel, 90^0 elbow & rectangular duct.

COURSE CONTENT

NOTE

1. **B.I.S Specification should invariably be followed in all the topics.**
2. **A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.**

1.0 The importance of Engineering Drawing
Explanation of the scope and objectives of the subject of Engineering Drawing Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 – Mention B.I.S - Role of drawing in -engineering education – Link between Engineering drawing and other subjects of study.

2.0 Engineering drawing Instruments
Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet, Drawing plate: Lay out of sheet – as per SP-46-1988 to a suitable scale.Simple Exercises on the use of Drawing Instruments. Importance of Title Block.

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

4.0 Dimensioning practice
Purpose of engineering Drawing, Need of B.I.S code in dimensioning -Shape description of an Engineering object -Definition of Dimensioning size description -Location of features, surface finish, fully dimensioned Drawing - Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools -Placing dimensions: Aligned system and unidirectional system (SP-46-1988)-Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods-The rules for dimensioning standard, features "Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

5.0 Geometric Construction
Division of a line: to divide a straight line into given number of equal parts internally examples in engineering application.
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 length using general method

Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci of a moving point, Eccentricity of above curves – Their Engg. application viz.   Projectiles, reflectors, P-V Diagram of a
Hyperbolic process,
Construction of any conic section of given eccentricity by general method
Construction of ellipse by concentric circles method
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 application, viz, Gear tooth profile, screw threads, springs etc. - their construction

6.0   Projection of points, lines and 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 planes
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
i)   Axis perpendicular to one of the planes
ii)   Axis parallel to VP and inclined to HP and vice versa.

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

8.0   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

9.0   Orthographic Projections
Meaning of orthographic projection -Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engg objects - Explanation of first angle projection. – Positioning of three views in First angle projection - Projection of points as a means of locating the corners of the surfaces of an object – Use of miter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.

10.0   Pictorial Drawings

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: 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

11.0   Development of Surfaces

Need for preparing development of surface with reference to sheet metal work
 -Concept of true length of a line with reference to its orthographic
projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal and parallel to the other -Development of simple solids like cubes, prisms, cylinders, cones, pyramid (sketches only) -Types of development: Parallel line and radial line development -Procedure of drawing development, drawings of trays, funnels, 90^0 elbow pipes and rectangular ducts.

REFERENCES

1) P I Varghese -Engineering Graphics– McGraw-hill
2) Basant Agarwal & C.M Agarwal Engineering Drawing - McGraw-hill
3) N.D.Bhatt -Engineering Drawing.
4) T.S.M. & S.S.M on " Technical Drawing" prepared by T.T.T.I., Madras.
5) SP-46-1998 – Bureau of Indian Standards.

BASIC ELECTRICAL & ELECTRONICS LABORATORY PRACTICE

Subject Title : **Basic Electrical & Electronics Laboratory Practice**
Subject Code : **EE-108**
Periods/Week : **06**
Periods/Year : **180**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Wiring tools and Accessories	15
2.	Electrical Wiring Joints	21
3.	Lamp Circuits	33
4.	Soldering Practice	15
5.	AC and DC circuits	21
6.	Resistance Measurement	21
7.	Capacitance Measurement	21
8.	Battery voltage measurement	15
9.	Piping and Thread cutting skills	18
	Total	180

OBJECTIVES

Upon completion of the practice the student shall be able to

1.0 Handle the Wiring Tools and Accessories
1.1 Identify the following electrical wiring tools with respect to
i)size   ii)shape   iii)purpose   iv)speed and   v) use .
   a) Screw drivers
   b) Pliers
   c) Drilling machines & Drilling Bits.
   d) Rawl plug jumper, and poker
   e) Voltage/line tester
   f) Splicers (insulation remover)
   g) Standard Wire gauge
1.2 Identify different types of Electrical Wiring accessories with respect to
i)size   ii)shape   iii)purpose   and   iv) Use.
   a) Switches
   b) Ceiling roses
   c) Lamp holders and adopters
   d) Sockets
   e) Plug
   f) Fuses
1.3 Identify different types of main switches with respect to
i)rating   ii)   Purpose and   iii)Use.

SP,DP mains, TP,ICDP, ICTP, SPDT, DPDT, TPDT, Changeover-Knife type/globular, Rotary, micro, modular switches.

   1.4   Study of 2-pole and 3-pole MCB's with respect to rating, purpose, And Use etc.

   1.5   Study different types of wires and cables (1/18,3/20,7/20) with respect to sizes ,rating,

Purpose and Use etc

2.0 Prepare Electrical Wiring Joints
 2.1   Prepare straight joint/ Married joint
 2.2   Prepare T joint
 2.3   Prepare Western union joint
 2.4   Prepare pigtail joint

3.0 Practice Lamp Circuits
3.1   Make a circuit with One lamp controlled by one switch with PVC surface conduit system
3.2   Make a circuit with Two lamps controlled by two switches with PVC surface conduit system
3.3   Make a circuit with One lamp controlled by one switch and provision of 2/3-pin socket.
3.4   Make a circuit for Stair case wiring
3.5   Make a circuit for Godown wiring
3.6   Make a circuit for Electrical bell connection.
.
4.0 Practice Soldering
4.1   Get familiarized to use of various soldering tools and components
4.2   Solder simple electronic circuits with P.C.B

5.0 Demonstrate difference between AC and DC.
5.1   Demonstrate unidirectional current flow with 12 V battery
5.2   Determine polarity using a Voltmeter /LED
5.3   Demonstrate reversal of current using battery and DPDT switch
5.4   Make an Electromagnet and testing it on a DC power supply
5.5   Demonstrate AC using a Low voltage Transformer
5.6   Practice Series and parallel connection of lamps
5.7   Practice Bright and Dim light arrangement (using a series lamp / using a Diode)

6.0 Practice Resistance measurement
6.1   Identify different types of resistors
6.2   Calculate Resistance by its colour code
6.3   Measuring the resistance using multimeter
6.4   Connecting resistors in series and parallel and measuring the resistance using multimeter
6.5   Practice Rheostat connections

7.0 Practice Capacitor measurement
7.1   Identify different types of capacitors
7.2   Find the value/specifications of capacitor from Value printed and Color code
7.3   Demonstrate that capacitor can hold charge ,charging and discharging require a specific time.

7.4   Investigate the effect of connecting capacitors in series and parallel
7.5   Testing the capacitor Using multimeter,

8.0   Practice Battery voltage measurement
8.1   Measurement of Battery Voltage using Voltmeter and Multimeter
8.2   Connecting batteries in series and parallel and observing the output voltage
        using Voltmeter and DMM
8.3   Measurement of current supplied by Battery using ammeter and Multimeter with
        rheostat as load
9.0   Develop Piping and Thread cutting skills
9.1   Cut a metal conduit,G.I.pipe and solid using hack saw
9.2   Practice Thread cutting G.I.pipe metal conduit and solid rod using Die set
9.3   Practice Internal thread cutting using Tap set reamers
9.4   Practice Thread Cleaning
9.5   Make a hexagonal nut from a round rod
9.6   Practice Thread cutting PVC pipe metal conduit using Die set.
9.7   Practice Internal thread cutting using Tap set reamers

Competencies to be achieved by the Student

S.No	Experiment title	Competencies
1	Handle the different wiring a) tools and accessories b) select switches, and MCB's c) Identify wires and cables as per the requirements of the load.	• Identify the size and specifications of various tools used for electrical wiring. • Understand the usage of the standard wire gauge. • Identify the type, size and specifications of DP mains,
2.1	To prepare a Straight joint/Married joint using a 7/20 Al. Cable	• Identify the size of the cable • Perform splicing of Insulation properly. • Perform Straight joint/Married joint
2.2	To prepare a T joint using a 7/20 Al. Cable	• Insert the leads of the wires properly as per the sketches. • Twist the wires properly.
2.3	To prepare a Western union joint using a single strand Al. Cable	• Overlap the two wires properly • Twist the binding wires properly
2.4	To prepare a pig tail joint using a single strand Copper Cable	• Place the wires in V-shape. • Twist the wires in clock wise direction.
3.1	To control one lamp by one 1-way switch with PVC surface conduit wiring system	• Draw wiring diagram • Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder. • Make Connections as per Wiring Diagram

3.2	To control two lamps by two 1-way switches with PVC surface conduit wiring system	• Draw wiring diagram • Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes. • Select colour and length of wire for phase and neutral • Switch on the supply after making of the connections • Disconnect the circuit after testing.
3.3	To control one lamp and 2/3 pin socket by two1-way switches with PVC surface conduit wiring system	• Connect 2/3 pin socket properly with respect to phase, neutral and earth. • Connect phase wire through switches.
3.4	Stair-case wiring	• Select two 2-way switches • Connect 2- way switches as per circuit diagram. • Test with 1-phase, 230V, 50 Hz supply to the circuit connected through ICDP switch.
3.5	Godown wiring scheme	• Draw wiring diagram • Connect the circuit as per the diagram. • Observe sequence of operation of switches • Test with 1-phase,230 V,50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder
3.6	To control Electrical Bell	• Connect the bell through ceiling rose properly. • Make ceiling rose connections properly
4.0	Soldering Practice Of Simple Electronic Circuit	• Proper use of Lead and Flux • Maintain proper temperature of soldering iron.
5.0	Demonstrate difference between AC and DC	• Connect DC source and measure V & I • Connect proper AC source and measure V &I • Make inferences.
6.0	Practice Resistance measurement	• Identifying resistor based on the colour code. • Measuring resistance using multi meter.
7.0	Practice Capacitor measurement	• Identifying capacitor based on the colour code. • Handling multimeter.
8.0	Practice Battery voltage measurement	• Handling multimeter • Handling Rheostats
9.0	Develop Piping and Thread cutting skills	• Identify the size of the rods to be joined. • Perform thread cutting as per the order • Perform thread Cleaning

Reference

1. Electrical work shop By R.P.Singh
2. Experiments in Basic Electrical Engineering by S.K.Bhattacharya , Rastogi- NAI.

PHYSICS LAB PRACTICE

Subject Title : **Physics Lab Practice**
Subject Code : **EE-109A (common to all branches)**
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   Practice the Vernier caliper to determine the volume of a cylinder and sphere
2.0   Practice the Screw gauge to determine thickness of a glass plate and cross section
       of a wire
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
6.0   Determine the Focal length and focal power of convex lenses using U-V method
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 wire material using Meter Bridge
12.0   Practice the mapping of magnetic lines of force

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)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate the volume of given object	• Read the scales • Calculate the volume of given object
2. Hands on practice on Screw gauge(03)	• Find the Least count • Fix the specimen in posit • Read the scales • Calculate thickness of glass place and cross section of wire	• Read the scales • Calculate thickness of given glass plate • Calculate cross section of wire
3. Verification of Parallelogram law of forces and Triangle law of forces(03)	• Fix suitable weights • Note the positions of threads on drawing sheet • Find the angle at equilibrium point • Construct parallelogram • Compare the measured diagonal • Construct triangle • Find the length of sides • Compare the ratios	• Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length
4. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph
5. Velocity of sound in air –Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound • Calculate velocity of sound at 0^0 C

6. Focal length and Focal power of convex lens (Separate & Combination) (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses • Draw u-v and 1/u – 1/v curves	• Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graph
7. Refractive index of solid using traveling microscope(03)	• Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab	• Read the scale • Calculate the refractive index of glass slab
8. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water
9. Coefficient of viscosity by capillary method(03)	• Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method	• Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water
10. Boyle's law verification (03)	• Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value P x l	• Find the length of air column • Find the pressure of enclosed air • Find the value P x l
11. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance

12. Mapping of magnet lines of force(03)	- Draw magnetic meridian - Placed the bar magnet in NN and NS directions - Draw magnetic lines of force - Locate the neutral points along equatorial and axial lines	- Draw magnetic lines of force - Locate the neutral points along equatorial and axial lines

CHEMISTRY LAB PRACTICE

Subject Title   :   **Chemistry Lab Practice**
Subject Code   :   **EE-109B(common to all branches)**
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 different diluted solution.	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 to	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 pipetts, measuring jars, volumetric flask, burettes) and gravimetric measurements (using different types of balances), making dilutions, etc.

2.0   Practice making standard solutions with pre weighted salts and to make 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 different diluted solution (03)	▪ Weighting the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions	▪ Weighting the salt to the accuracy of .01 mg ▪ Measuring the water with volumetric flask, measuring jar, volumetric pipette and graduated pipette ▪ Making appropriate dilutions

Estimation of HCl solution using Std. Na_2CO_3 solution (03)	▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the	▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point
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)	▪ flow of the titrant ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results	▪ Making accurate observations
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)	▪ Familiarize with instrument ▪ Choose appropriate 'Mode' / 'Unit' ▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately ▪ Follow Safety precautions	▪ Prepare standard solutions / buffers, etc. ▪ Standardize the instrument with appropriate standard solutions ▪ Plot the standard curve ▪ Make measurements accurately
Determination of pH using pH meter (03)		
Determination of conductivity of water and adjusting ionic strength to required level (03)		
Determination of turbidity of water (03)		

Estimation of total solids present in water sample (03)	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate ▪ Drying the crucible in an oven	▪ Measuring the accurate volume and weight of sample ▪ Filtering and air drying without losing any filtrate ▪ Accurately weighing the filter paper, crucible and filtrate

COMPUTER FUNDEMENTALS LAB PRACTICE

Subject Title : **Computer Fundamentals Laboratory Practice**
Subject Code : **EE-110 (common to all branches)**
Periods/Week : **03**
Periods/Year : **90**

List of Experiments:

S. No.	Major Topics	No. of sessions each of 3 periods duration	No. of Periods
I.	**Computer hardware Basics**	01	03
II.	**Windows Operating System**	02	06
III.	**MS Word**	09	27
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 widespread 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 Computer system and hardware connections

   b).To start and Shut down Computer correctly
   c). To check the software details of the computer
   2. To check the hardware present in your computer
II. Windows's operating system (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	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	a. Log in using the password b. Start and shut down the computer c. Use Mouse and Key Board	a. Login and logout as per the standard procedure b. Operate mouse &Key Board

1 (c).	To Explore Windows Desktop	a. Familiarize with Start Menu, Taskbar, Icons and Shortcuts b. Access application programs using Start menu, Task manager c. Use Help support	a. Access application programs using Start menu b. Use taskbar and Task manager
2.	To check the software details of the computer	a. Find the details of Operating System being used b. Find the details of Service Pack installed	Access the properties of computer and find the details
3.	To check the hardware present in your computer	a. Find the CPU name and clock speed b. Find the details of RAM and Hard disk present c. Access Device manager using Control Panel and check the status of devices like mouse and key board d. Use My Computer to check the details of Hard drives and partitions e. Use the Taskbar	a. Access device manager and find the details b. Type /Navigate the correct path and Select icon related to the details required
4.	Working with Files and Folders	a. Create folders and organizing files in different folders b. Use copy / paste move commands to organize files and folders c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut to files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	a. Create files and folders Rename , arrange and search for the required folder/file b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	a. Use windows accessories and select correct text editor based on the situation. b. Use MS pain to create /Edit pictures and save in the required format.
6	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References- Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two documents simultaneously d. Choose correct Paper size and Printing options	a. Create a Document and name appropriately and save b. Set paper size and print options

7.	To practice Word Processing Basics	a. Typing text b. Keyboard usage c. Use mouse (Left click / Right click / Scroll) d. Use Keyboard shortcuts e. Use Find and Replace features in MS-word f. Use Undo and Redo Features g. Use spell check to correct Spellings and Grammar	a. Use key board and mouse to enter/edit text in the document. b. Use shortcuts c. Use spell check/ Grammar features for auto corrections.
8.	To practice Formatting techniques	a. Formatting Text b. Formatting Paragraphs c. Setting Tabs d. Formatting Pages e. The Styles of Word f. Insert bullets and numbers g. Themes and Templates h. Insert page numbers, header and footer	a. Format Text and paragraphs and use various text styles. b. Use bullets and numbers to create lists c. Use Templates /Themes d. Insert page numbers date, headers and footers
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table –marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice	a. Open /create an MS Excel spreadsheet	a. Familiarize with excel

	with MS- EXCEL	and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar- Title Bar-Ribbon-Worksheets- Formula Bar-Status Bar	layout and use b. Use various features available in toolbar
10.	To Insert objects, clipart and Hyperlinks	d. Create a 2-page document. &Insert hyperlinks and t Bookmarks. e. Create an organization chart f. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a) Insert hyperlinks &Bookmarks b) Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	c. Use mail merge to prepare individually addressed letters d. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	d. Explore various symbols available in MS Word e. Insert a symbol in the text f. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS- EXCEL	c. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- d. Use Quick Access Toolbar- Title Bar-Ribbon-Worksheets- Formula Bar-Status Bar	a) Familiarize with excel layout and use b) Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit
15.	To edit spread sheet Copy, Cut, Paste, and selecting cells	a. Insert and Delete Columns and Rows-Create Borders-Merge and Center b. Add Background Color-Change the Font, Font Size, and Font Color c. Format text with Bold, Italicize, and Underline-Work with Long Text-Change a Column's Width	Format the excel sheet
16.	To use built in functions and Formatting Data	a. Sort and filter data in a worksheet b. Perform Mathematical Calculations verify -AutoSum c. Perform Automatic Calculations-Align Cell Entries	Use built in functions in Excel
17.	To enter a Formula for automatic calculations	a. Enter formula b. Use Cell References in Formulae c. Use Automatic updating function of Excel Formulae d. Use Mathematical Operators in Formulae e. Use Excel Error Message and Help	Enter formula for automatic calculations

18.	To Create Excel Functions, Filling Cells	a. Use Reference Operators b. Work with sum, Sum if , Count and Count If Functions c. Fill Cells Automatically	a. Create Excel sheets involving cross references and equations b. Use the advanced functions for conditional calculations
19.	To Practice Excel Graphs and Charts	a. Produce an Excel Pie Chart b. Produce c. Excel Column Chart	a. Use data in Excel sheet to Create technical charts and graphs Produce Excel Line Graph b. Produce a Pictograph in Excel
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
22.	To create a simple PowerPoint Presentation	a. Insert a New Slide into PowerPoint b. Change the Title of a PowerPoint Slide c. PowerPoint Bullets d. Add an Image to a PowerPoint Slide e. Add a Textbox to a PowerPoint slide	a. Create simple PowerPoint presentation with photographs/ClipArt and text boxes b. Use bullets option
23.	To Set up a Master Slide in PowerPoint and add notes	a. Create a PowerPoint Design Template b. Modify themes c. Switch between Slide master view and Normal view d. Format a Design Template Master Slide e. Add a Title Slide to a Design Template f. The Slide Show Footer in PowerPoint f. Add Notes to a PowerPoint Presentation	a. Setup Masterslide and format b. Add notes
24.	To Insert Text and Objects	a. Insert Text and objects b. Set Indents and line spacing c. Insert pictures/ clipart d. Format pictures e. Insert shapes and word art f. Use 3d features g. Arrange objects	Inset Text and Objects Use 3d features
25.	To insert a Flow Chart / Organizational Charts	a. Create a Flow Chart in PowerPoint b. Group and Ungroup Shapes c. Use smart art	Create organizational charts and flow charts using smart art

26.	To insert a Table	a. PowerPoint Tables b. Format the Table Data c. Change Table Background d. Format Series Legend	Insert tables and format
27.	To insert a Charts/Graphs	a. Create 3D Bar Graphs in PowerPoint b. Work with the PowerPoint Datasheet c. Format a PowerPoint Chart Axis d. Format the Bars of a Chart e. Create PowerPoint Pie Charts f. Use Pie Chart Segments g. Create 2D Bar Charts in PowerPoint h. Format the 2D Chart i. Format a Chart Background	Create charts and Bar graphs, Pie Charts and format.
28.	To Insert audio &video, Hyper links in a slide Add narration to the slide	a. Insert sounds in the slide and hide the audio symbol b. Adjust the volume in the settings c. Insert video file in the format supported by PowerPoint in a slide d. Use automatic and on click options e. Add narration to the slide f. Insert Hyperlinks	a. Insert Sounds and Video in appropriate format. b. Add narration to the slide c. Use hyperlinks to switch to different slides and files
29.	To Practice Animation effects	a. Apply transitions to slides b. To explore and practice special animation effects like *Entrance, Emphasis, Motion Paths &Exit*	Add animation effects
30.	Reviewing presentation	a. Checking spelling and grammar b. Previewing presentation c. Set up slide show d. Set up resolution e. Exercise with Rehearse Timings feature in PowerPoint f. Use PowerPoint Pen Tool during slide show g. Saving h. Printing presentation (a) Slides (b) Handout	a. Use Spell check and Grammar feature b. Setup slide show c. Add timing to the slides d. Setup automatic slide show

DIPLOMA IN ELECTRICAL& ELECTRONICS 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:								
EE- 301	Mathematics - II	4	-	60	3	20	80	100
EE -302	DC Machines	4	-	60	3	20	80	100
EE -303	Electric circuits	4	-	60	3	20	80	100
EE-304	Electrical & Electronic Measuring Instruments	4	-	60	3	20	80	100
EE-305	Electronics-I	4	-	60	3	20	80	100
EE-306	General Mechanical Engineering	4	_	60	3	20	80	100
PRACTICAL:								
EE-307	Circuits and Measurements Laboratory Practice	-	6	90	3	40	60	100
EE-308	Electrical Workshop Practice	-	3	45	3	40	60	100
EE-309	DC Machines Laboratory Practice	-	6	90	3	40	60	100
EE-310	Electronics-I Laboratory Practice	-	3	45	3	40	60	100
	TOTAL	24	18	630		280	720	1000

Engineering Mathematics – II

Subject Title	:	Engineering Mathematics – II
Subject Code	:	EE-301
Periods/Week	:	04
Periods/Semester	:	60

Blue Print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
				R	U	App	R	U	App
1	Unit – I- Indefinite Integration	18	34	2	1	0	1	1	1/2
2	Unit - II -Definite Integration and its applications	17	31	0	1	1	0	1	1 1/2
3	Unit - III Differential Equations of first order	15	29	2	1	0	1/2	1/2	1
4	Unit - IV -Statistical Methods	10	16	1	1	0	1	0	0
	Total	60	110	5	4	1	2 1/2	2 1/2	3
			Marks:	15	12	3	25	25	30

R:	**Remembering type**	40 marks
U:	**Understading type**	37 marks
App:	**Application type**	33 marks

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

Unit-I - Indefinite Integration
1.0   Use Indefinite Integration to solve engineering problems
   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 ∫ (u + v) *dx* and   ∫ *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*)*   ∫ *f(ax + b) dx where   f(x) dx* is in standard form*.*
        ii*)*   ∫ *[f(x)]^n f ′(x) dx*
        iii*)*   ∫ *f ′(x)/[f(x)] dx*

66

iv) ∫*f {g(x)} g ′(x) dx*

1.5   Find the Integrals of *tan x, cot x, sec x* and *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

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

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 $\int u.vdx$.

1.13   Evaluate the integrals of the form $\int e^x [f(x) + f ′(x)] dx$.

Unit-II-Definite Integrals
2.0   Understand definite integral and use it in engineering applications

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.
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
2.10   Explain the Trapezoidal rule, Simpson's 1/3 rules for approximation of integrals and
provide some examples.

Unit –III- Differential Equations
3.0   Solve Differential Equations in engineering problems.

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 simple problems leading to engineering applications

Unit -IV Data Analysis
4.0   Use Statistical Methods as a tool in data analysis.
   4.1   Recall the measures of central tendency.
   4.2   Explain the significance of measures of dispersion to determine the degree of heterogeneity of the data.
   4.3   Find the measures of dispersion – range, quartile deviation, mean deviation, standard   deviation for the given data.
   4.4   Explain the merits and demerits of the above measures of dispersion.
   4.5   Express relationship between measures of dispersion
   4.6   Find the coefficient of variation
   4.7   Explain bivariate data.
   4.8   Explain the concept of correlation between two variables and co-varience.
   4.9   Explain coefficient of correlation and its properties
   4.10   Calculate the coefficient of correlation between two variables.
   4.11   Find rank correlation co-efficient.

COURSE CONTENTS
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, 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, algebric 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 define integral.

Unit –III-Differential Equations:
3. 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.

Unit –IV
Statistical Methods:
4. Revise measures of central tendency, measures of dispersion: range, quartile deviation, mean deviation, standard deviation for the given data, merits and demerits, relationship between measures of dispersion, coefficient of variation, bivariate data, concept of correlation, covariance, coefficient of correlation and its properties, rank correlation co-efficient.

Reference Books:
1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan
2. Thomas' Calculus, Pearson Addison –Wesley Publishers
3. Statistical Methods Vol.I, Das, Tata McGraw-Hill
4. Statistics, 4/e, Schaum's Outline Series (SIE), McGraw-Hill

D.C. MACHINES

Subject Title : **D.C. Machines**
Subject Code : **EE-302**
Periods/Week : **04**
Periods/Semester : **60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Fundamentals of D.C Generators	14	29	03	02
2.	Armature Reaction and Characteristics of D.C Generators.	16	26	02	02
3.	Fundamentals of D.C Motors	12	26	02	02

4.	Speed Control and Starters for D.C Motors	10	16	02	01
5.	Characteristics and Testing of D.C Motors	8	13	01	01
	TOTAL	**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the Fundamentals of D.C Generators
1.1 State the method of producing dynamically induced E.M.F.
1.2 State Fleming's right hand rule.
1.3 Explain electromechanical energy conversion.
1.4 Explain the working of simple loop generator.
1.5 Understand the conversion of AC to DC by commutator.
1.6 Describe the constructional features of a D.C generator with a legible sketch.
1.7 List the seven main parts of a D.C generator
1.8 List various material used for each part of DC Generator.
1.9 State the functions of each part of D.C generator.
1.10 Explain the working of D.C generator.
1.11 List the types of windings -- (i) Lap (ii) Wave.(Single layer only).
1.12 Define Pole pitch, Y_b, Y_f, Y_R in terms of armature slots.
1.13 Compare Lap and Wave windings in different aspects.
1.14 Derive the E.M.F equation of D.C generator in terms of ϕ, Z, N, P and A.
1.15 Classify D.C Generators based on excitation.
1.16 Draw the equivalent circuit of various DC generators based on excitation by giving their voltage and current equations
1.17 Solve simple problems on the above.
1.18 State the various losses incurred in a D.C Generator.
1.19 Explain power stages in D.C. Generator.
1.20 Define the mechanical, electrical and overall efficiencies of DC Generator.
1.21 Derive the condition for maximum efficiency of a DC generator.
1.22 Solve Problems on efficiencies.

2.0 Comprehend the Armature Reaction and Characteristics of D.C.Generator.
2.1 Define Armature reaction.
2.2 Explain Armature reaction with legible sketches
2.3 Explain the phenomenon of
i)Demagnetization ii) Cross magnetization.
2.4 Derive the formula for i) AT_d / pole ii) AT_c / Pole.
2.5 Solve simple problems on AT_d / pole; AT_c / Pole
2.6 Define Commutation.
2.7 Explain Commutation
2.8 List the different methods of improving commutation.
2.7 Explain the interpole method of improving commutation.
2.8 Plot and Explain i)Open Circuit .Characteristics
     ii)Internal characteristics and
     iii)External characteristics
of the following types of D.C.Generators:

(a) Separately excited   (b) Shunt
(c) Series   (d) Compound

2.9 Determine the critical field resistance and critical speed of DC generators from   Open Circuit .Characteristics
2.10 State the conditions for Buildup of E.M.F.of DC generator.
2.11 State the Conditions for parallel operation of generators. (No Problems)
2.12 Understand the use of Equalizer ring in parallel Operation.
2.13 List the applications of the four types of D.C generators.

3.0 *Comprehend the Fundamentals of D.C Motors*
3.1 Appreciate the usage of the DC machine as a generator and as a motor.
3.2 State Fleming's left hand rule.
3.3 Explain the working of D.C motor.
3.4 Explain the significance of back E.M.F by giving its formula.
3.5 Classify DC motors.
3.6 Draw the equivalent circuits of various types of DC motors by giving their back E.M.F equations.
3.7 Solve Problems on Back E.M.F.
3.8 Define Torque
3.9 Derive the equation for Torque of a D.C motor.
3.10 Develop the formulae for
     i) armature torque (T_a) ii)shaft torque (T_{sh}) iii) loss torque.
3.11 List the different losses in a D.C motor
3.12 Explain the power stages in D.C. motor.
3.13 Solve Problems on the above.
3.14 Plot and Explain the   i)electrical characteristics   and
                      ii) mechanical characteristics
     of the following types of D.C.Motors
     a)Shunt   b)Series   c)compound
3.15 List three applications each of the various D.C motors.

4.0 **Comprehend the Speed Control of D.C Motors and Starters for D.C Motors**
4.1 Explain the necessity of speed control of DC Motors.
4.2 List different types of Starters for DC motors.
4.3 Explain the three different methods of speed Control (Flux, Armature and Voltage) for D.C shunt motors.
4.4 State the advantages and disadvantages of. the three methods of speed Control
4.5 Explain the different methods of speed control of series motors
4.6 State the necessity of a starter.
4.7 Explain the working of 3-point starter with legible sketch.
4.8 Explain the working of 4-point starter with legible sketch.

5.0 *Appreciate the methods of testing of D.C Motors.*
5.1 Describe the direct and indirect methods of testing D.C.motors.
5.2 List different tests of D.C.motors.
5.3 Explain the method of conducting brake test on different types of D.C motors.
5.4 Explain the method of conducting Swinburne's test.
5.5 Solve Problems on the above.

COURSE CONTENT
1.   Fundamentals of D.C Generators
Dynamically induced   E.M.F- Fleming's right hand rule - electromechanical energy conversion - simple loop generator - principle of D.C generator- functions of each part of D.C generator with legible sketches- windings   (i) Lap   (ii) Wave -Classification of generators based on excitation- E.M.F equation - losses incurred in the D.C machines - Voltage and Current equations for different types of D.C Generators- Power stages in DC generators-   efficiency   calculation-simple problems.- condition for maximum efficiency.
2.   Armature Reaction and Characteristics of D.C Generators.
Armature reaction, Demagnetization & Cross magnetization-Derive for AT_d, AT_c / Pole.,- simple problems –Commutation – interpole methods of improving commutation.-O.C.C of Separately excited, Shunt, Series and Compound generators- Conditions for (i) Building up of E.M.F.- Critical field resistance and critical speed from O.C.C - parallel operation of generators - Applications of D.C generators.
3.   Fundamentals of D.C Motors
Usage of a DC machine as a generator and a motor-Fleming's left hand rule - working of D.C motors – classification - significance of back E.M.F- Formula for back E.M.F for different D.C motors-Problems on E.M.F equation – Torque-Torque equation of Dc motor - Armature torque (T_a) , shaft torque (T_{sh}) and loss torque - Different losses - electrical and mechanical characteristics of D.C Shunt, Series and compound motors. Applications of D.C motors.
4.   Speed Control and Starters for D.C Motors
Necessity of speed control- Direct and Indirect methods of speed control-different methods (Flux, Armature and Voltage) of speed controls for D.C shunt motors-State the advantages and disadvantages of above methods-different methods of speed control for series motors- problems -necessity of starter- 3-point starter, 4-point starter,.
5.   Testing of D.C Motors
Performance curves- brake test on different types of D.C motors-Swinburne's test- problems.

REFERENCES

1.   B.L. Theraja -Electrical Technology - Vol - I – S.Chand&co.
2.   B.L. Theraja -Electrical Technology - Vol –II - S.Chand&co.
3.   P.S. Bhimbhra -Electrical machines
4.   M.V.Deshpande -Electrical Machines
5.   D.P.Kothari, J.Nagarath - Electric Machines– TMH

ELECTRICAL CIRCUITS

Subject Title	:	**Electrical Circuits**	
Subject code	:	**EE-303**	
Periods/Week	:	**04**	
Periods/semester	:	**60**	

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	D.C Circuits	**12**	**26**	**02**	**02**
2	Network Theorems	**6**	**10**	**-**	**01**
3	Fundamental of A.C.	**8**	**19**	**03**	**01**
4	Single phase A.C. circuits	**14**	**26**	**02**	**02**
5	Parallel circuits	**8**	**13**	**01**	**01**
6	Poly phase circuits	**12**	**16**	**02**	**01**
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

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

1.0 Understand Kirchoff's laws and star delta Transformations.
1.1 Differentiate between active and passive circuits.
1.2 Explain junction, branch and loop in circuits
1.3 Understand the insufficiency of Ohm's law to solve complex circuits.
1.4 State i) Kirchoff's current law (KCL) ii) Kirchoff's voltage law.(KVL)
1.5 Solve problems by applying KVL and KCL
1.6 Explain star and delta circuits
1.7 Explain the concept of circuit transformation and equivalent circuits
1.8 Develop transformation formulae for star- delta transformations
1.9 Solve problems on the above

2.0 Understand Network Theorems
2.1 Explain ideal voltage source & ideal current source
2.2 Explain Source transformation technique
2.3 State Super position theorem.
2.4 State Thevenin's theorem.
2.5 State Norton's theorem
2.6 State Maximum power transfer theorem.
 (All the theorems with reference to D.C only)
2.7 Solve simple problems on the above theorems

3.0 Comprehend the relationship between the various Electrical quantities connected with alternating current.
3.1 Explain the concept of simple loop generator
3.2 State the relationship between θ_m & θ_e
3.3 State the relation between poles, speed and frequency
3.4 Define the instantaneous value, maximum value, frequency, time period, Average value, R.M.S value, Form factor and Peak factor.

3.5 Calculate the above for different alternating waveforms viz. Half wave, full wave rectified sine wave, triangular wave and square wave forms.
3.6 Explain the term phase and phase difference
3.7 Understand j operator
3.8 Convert polar quantities into rectangular quantities and Vice-versa.

4.0 Comprehend the single phase A.C. Series circuits
4.1 Define the terms resistance, inductance and capacitance
4.2 Derive relationship between voltage and current in a
i) Pure resistive circuit   ii) inductive circuit   and   iii) capacitive circuit.
4.3 Calculate the impedance, current, phase angle, power and power factor in
i)   R-L series circuit   ii)   R-C series circuits
iii) L-C series circuits   iii)   R-L-C series circuits.
4.4 Solve Problems on Series Circuits
4.5 Define Resonance in series circuits
4.6 Derive a formula for resonant frequency of a R-L-C series circuit.
4.7 Define Q- factor
4.8 Explain the importance of Q-factor.
4.9 Solve simple problems on Series Resonance.

5.0 Comprehend the single phase A.C. Parallel Circuits
5.1 Solve Parallel Circuits by
i) Vector method
ii) Admittance method
iii) J- notation method
5.2 Solve Problems on above (i) and (iii) (No admittance method).
5.3 State condition for resonance in parallel circuits.

6.0 **Understand Poly Phase Circuits**
6.1 Define the term `Poly Phase'.
6.2 Explain the methods of generation of 2 phase and 3 phase emfs.
6.3 Write the expressions for Poly phase emfs and represent them by phasor diagram.
6.4 Understand the concept of phase sequence.
6.5 Derive the relation between line and phase values of current and voltage
in 3 phase   i)star circuits   and   ii)delta circuits.
6.6 Derive the equation for power in 3 phase circuit.
6.7 Solve numerical examples in balanced loads.
6.8 Derive the formulae for measurement of 3 phase power by using two watt meters.
6.9 Calculate the power factor of the load by the above method.
6.10 List any 6 advantages of 3 phase system over single phase system.
6.11 Solve simple problems on the above

COURSE CONTENT
1. Kirchoff's Laws and Star - Delta Transformation
Active and Passive circuits - Junction, branch and loop in circuits -Insufficiency of Ohm's law to solve complex circuits, Kirchoff's laws - Star - Delta configurations, star-delta transformations .

2. **Network Theorems**

Ideal Voltage , Ideal current source - Source transformation technique- Super position theorem- Thevenin's Theorem -Norton's Theorem- Maximum power transfer theorem with reference to D.C.-Problems on the above.

3.Fundamentals of A.C.

Simple loop Generator –Relation between θ_m & θ_e -Relation between poles, speed and frequency- Definition of Alternating quantity, cycle, period, frequency, amplitude, instantaneous value and angular velocity - Average value - effective value/R.M.S value definitions and derivations - calculations of these values for half wave rectified sine wave, full wave rectified Sine wave, Triangular and Square wave forms-form factor- peak factor - Representation of alternating quantities by equation, graphs and phasor diagrams - Phase and phase difference – Undestanding of `J' notation for alternating quantities ,transformation from polar to rectangle notations and Vice-versa

4.Single phase A.C. Series Circuits

Resistance, inductance and capacitance as circuit elements - concept of reactance, resistive, purely inductive and purely capacitive circuits - Derivation of voltage , current, power relations including phase relationships, wave forms and phasor diagrams - R-L, R-C , L-C & R-L-C series circuits - Derivation of relation between voltage, current, impedance, power including wave forms and phasor diagrams. Impedance triangle, phase angle, power factor, active and reactive components of current and power in above circuits – Definition of Resonance in series circuits and expression for resonant frequency- Q-factor-Importance of Q- factor- Problems on series circuits and series resonance.

5.Single phase A.C. Parallel Circuits

 Simple Parallel circuits - solution by vector method and by `J' notation – problems - Resonant circuit – Condition for resonance in parallel circuit.

6.Poly phase circuits

Definition of Poly phase - Generation of 2 phase and 3 phase EMF's - Location of coils for obtaining required phase difference - Representation of 2 phase,3 phase EMF's by equations, graphs and phasors - phase sequence - Current in neutral in 2 phase and 3 phase system - Method of connection – star and delta - phasor diagram showing relation between phase and line quantities, Relation between phase and Line values of voltages and currents -power equation - Problems on 3 phase balanced circuits – Measurement of 3 phase power by two wattmeter and power factor in balanced circuits - Effect of Load power factor on wattmeter readings – Problems - Advantages of poly-phase systems over single-phase systems.

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2. V.K.Mehta-Introduction to Electrical Engg.
3. Hughes -Electrical Technology.
4. Parker Smith -Problems in Electrical Engg.
5. William Hayt and JackE,kemmerly -Engineering Circuit analysis -TMH
6. A.Chakrabarthy -Electrical Circuits - Dhanapat Rai and Sons
7. D. Roy Chowdary -Network and Systems - New age international publishers
8. K. Rajeshwaran -Electric Circuit Theory - Pearson educations,2004
9. Vanvalkanburg -Network Analysis - PHI.
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11. Alexander Sadiku -Fundamentals of Electric circuits –- TMH
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ELECTRICAL & ELECTRONIC MEASURING INSTRUMENTS

Subject Title   :Electrical & Electronic Measuring Instruments
Subject Code   :   EE - 304
Periods/Week   :   04
Periods/ Semester   :   60

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1	Basics of Measuring Instruments	08	11	02	1/2
2	Electromechanical Measuring Instruments	22	46	02	04
3	Measurement of Resistance	08	16	02	01
4	Transducers and Sensors	10	16	02	01
5	Electronic & Digital Instruments	12	21	02	11/2
	TOTAL	60	110	10	08

OBJECTIVES
  Upon the completion of the course the student shall be able to
  1.0   Comprehend the Basics of measuring instruments.
  1.1   List any six important electrical quantities to be measured by giving their units

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1.2 Mention the names of the instruments to measure the various electrical quantities..

1.3 Classify instruments on the basis of construction and output as analog (electromechanical and analog electronic) and digital instruments .

1.4 Classify the electromechanical instruments according to Principle of Working.

1.5 Classify the instruments on the basis of method of measuring the value as absolute
and secondary instruments

1.6 Distinguish between Absolute and Secondary instruments

1.7 State the types of secondary instruments (indicating, integrating and recording).by giving suitable examples.

1.8 State the purpose of obtaining deflecting, controlling and damping torques in indicating instruments.

1.9 Explain the methods of obtaining i)deflecting torque ii) controlling torque and iii) damping torque in indicating instruments.

1.10 Define the following terms related to measuring Instruments
i) accuracy ii) precision iii) error iv) resolution v) sensitivity

1.11 Classify the errors according to its source (gross, systematic and random)

2.0 Explain the construction and working of different Electromechanical Measuring instruments.

2.1 Describe the construction of Permanent Magnet Moving Coil Instrument.

2.2 Explain the working of Permanent Magnet Moving Coil Instrument (Voltmeter/Ammeter) .

2.3 List the three types of errors commonly occurring in moving coil (M.C.)instruments

2.4 Mention the remedies.

2.5 State advantages and disadvantages of M.C Instruments.

2.6 List the applications of M.C Instruments

2.7 Describe the construction and working of Moving Iron (M.I)
i)Attraction type Instrument ii)Repulsion type Instrument.

2.8 List the errors commonly occurring in M.I. Instruments.

2.9 State the advantages and disadvantages of M.I.Instruments.

2.10 Compare M.C. and M.I. instruments.

2.11 Describe the method of extending the range of moving coil ammeter with the help of shunt.

2.12 Describe the method of extending the range of moving coil voltmeter with the help of Multiplier.

2.13 Solve the problems on Shunts and Multipliers used for moving coil instruments.

2.14 Describe the construction of a dynamometer type instrument

2.15 Explain the working of a dynamometer type Instrument.

2.16 Draw the circuit diagram for measuring power with wattmeter in a Single – Phase circuit.

2.17 List the common errors in the Dynamometer Instruments.

2.18 List the advantages and disadvantages of dynamometer instruments.

2.19 State the need for instrument transformers (Current Transformer – CT and Potential Transformers - PT) .

2.20 List the applications of CT and PT.

2.21 State the precaution when using CT.

2.22   Draw the circuit diagram for measuring power with wattmeter in Single –
        Phase circuit in conjunction with instrument transformers.
2.23   Describe the construction of a 1-phase induction type Energy meter
2.24   Explain the working of a 1-phase induction type Energy meter.
2.25   State Meter Constant
2.26   State the common errors and their remedies in 1- phase energy meter
2.27   Describe construction and connections of a 3-phase energy meter.
2.28   Describe the construction of Weston synchroscope.
2.29   Explain the working of Weston synchroscope

3.0   Explain the methods of measurement of resistance.
3.1   Classify the resistance into Low , Medium and High Values giving examples
      for each.
3.2   List the methods of measurement of
      i) Low resistance   ii)Medium resistance and   iii)High resistance
3.3   Draw the circuit diagram of basic Ohm-meter.
3.4   Explain the working of basic Ohm-meter.
3.5   Describe the two types of Ohm-meters (series and shunt).
3.6   Distinguish between shunt and series Ohm-meters
3.7   Describe the construction of Megger.
3.8   Explain the working of Megger
3.9   Explain the method of measurement of earth resistance using Earth Megger.
       (Construction and Working of Earth Megger is **not** required).
3.10   State the working principle of basic Potentiometer.
3.11   Describe the Construction of basic Potentiometer with a legible sketch
3.12   Explain the working of basic Potentiometer with a legible sketch
3.13   Explain the measurement of unknown resistance using Potentiometer.
3.14   List the applications of Potentiometer.

4.0   Explain the concept of Transducers and Sensors
4.1   Define Transducer
4.2   State the need of Transducers in Measurement systems
4.3   Classify Transducers
      i)based on the principle of transduction form used
      ii) as Primary and Secondary   iii).as Passive and Active
      iv) as Analog and Digital   and   v) as Transducers and Inverse
                                    Transducers
4.4   Explain the factors influencing the choice of Transducer
4.5   State the applications of Transducers.
4.6   Explain the use of Thermocouple for the measurement of temperature.
4.7   Explain the measurement of temperature using Thermister in a Bridge
      circuit.
4.8   State the working principle of strain gauge.
4.9   Describe the construction of Linear Variable Differential Transformer(LVDT).
4.10   Explain the working of LVDT .
4.11   State the advantages and Disadvantages of LVDTs.
4.12   Explain the concept of Sensor
4.13   List the applications of sensors.
4.14   Explain Semiconductor sensors.

5.0   Understand the working of Electronic & Digital instruments

5.1   List the basic components of analog electronic Instruments.
5.2   List analog electronic Instruments.
5.3   Explain the working of Rectifier type voltmeter and ammeter.
5.4   List the basic components of Digital (Digital electronic) instruments.
5.5   List the advantages of Digital Instruments over Analog Instruments.
5.6   List the types of digital Voltmeters.
5.7   Mention the specifications of digital voltmeter.
5.8   Explain the Working of Digital Multimeter by giving its specifications.
5.9   Explain the Working of Single Phase Digital Energy meter with block diagram.
5.10   Explain the Working of Three Phase Digital Energy meter with block diagram.
5.11   Explain the Working of Digital frequency meter with block diagram.
5.12   State the uses of Tong tester (clamp meter).

COURSE CONTENT

1. Basics of Measuring instruments:

List of important electrical quantities to be measured, their units and the names of the instruments to measure them- Classification of instruments - different types of torques (Deflection ,Controlling and Damping torques) in the indicating instruments-definitions of accuracy ,precision ,error, resolution and sensitivity-types of error.

2. Electromechanical Measuring Instruments:

M.C. and M.I types of Ammeters and Voltmeters - their Construction and working, errors, comparison- shunts and multipliers for M.C instruments – problems on shunts and multipliers for M.C instruments - Dynamometer type Ammeter, Voltmeter and Wattmeter –construction,working, errors- use of Instrument transformers- Measurement of energy – single phase Induction type energy meter- Construction and working, error and adjustments construction and connections of a 3-phase energy meter- Construction and working of Weston Synchroscope.

3. Measurement of resistance:

Classification of resistance- List of methods of measurement of resistance- explanation of basic Ohm meter circuit – difference in series and shunt type ohmmeters- Construction and working of megger – method of measuring earth resistance using earth Megger – working principle,construction and applications of Potentiometer.

4. Transducers and Sensors:

Definition of transducer-need of transducer-Classssification of Transducers - Factor influencing while its selection -Applications of Transducers –Thermocouple- Thermister -   working principle and use of StrainGauge- construction, working and use of LVDT- Basic Concept of Sensors and its applications –Semiconductor sensors .

5. Electronic & Digital Instruments :

Basic components of analog electronic Instruments - Working of Rectifier type Voltmeter and Ammeter- basic components of Digital (Digital electronic) instruments- advantages of Digital Instruments over Analog Instruments- types of digital Voltmeters- specifications of digital voltmeter -working of digital multi meter and its specifications- working of single phase digital energy meter with block diagram-- working of three phase digital energy meter with block diagram- Working of Digital frequency meter with block diagram-use of tong tester(clamp meter).

References:

1. A. K.SAWHNEY -Electrical and Electronic measuring instruments –- Dhanpat Rai
&Sons.
2. E.W. Golding and F.C. Widdis,Electrical Measurements and measuring instruments
–Wheeler publishers.
3. David A Bell -Electronic Instrumentation and Measurements– Oxford.
4. B. L. Theraja -Electrical Technology —– S.Chand &Co.
5. Khandpur -Modern Electronic Equipment
6. J.B. Gupta -Electrical and Electronic measuring instruments.
7. Harris -Electrical measurements
8. K.B.Bhatia -Study of Electrical Appliances and Devices – Khanna Publishers.

ELECTRONICS - I

Subject Title	:	**Electronics - I**
Subject code	:	**EE-305**
Periods/Week	:	**04**
Periods/Semester	:	**60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Passive Components	08	16	02	01
2.	Semi Conductor devices	12	13	01	01
3.	Power supplies	08	16	02	01
4.	Special devices	12	26	02	02
5.	Introduction to Amplifiers	10	16	02	01
6.	Small Signal Amplifiers.	10	23	01	02
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

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

1.0   Comprehend Passive Components (Resistors, Capacitors and Inductors)
1.1   Define resistance.
1.2   State the properties of resistance.
1.3   Identify the value of resistance using colour codes
1.4   Mention the specifications of resistors.
1.5   Classify the resistors based on function and composition
1.6   List the types of resistors based on composition
1.7   Compare the features of carbon and wire wound potentio meters
1.8   Define Capacitance.
1.9   List the specifications of capacitor
1.10   List the factors affecting the value of capacitance.
1.11   List the types of capacitors.
1.12   List the applications of capacitors.
1.13   Define (i)Self Inductance   (ii) Mutual Inductance   (iii)Co-efficient   of coupling.
1.14   List the types of Inductors and Transformers used in electronic circuits.
1.15   Explain the loss in   i)Inductors   and   ii)Transformers
1.16   List different types of core materials used at different frequencies

2.0   Comprehend the Semi-Conductor Devices
2.1   State the electrical characteristics of
        i) insulators   ii) conductors and   iii) semi-conductors
2.2   Distinguish between intrinsic and extrinsic semi-conductors
2.3   Distinguish between P and N type semi-conductors.
2.4   Explain the working of PN Junction diode with no bias, forward bias and reverse bias
2.5   Explain the operation of Zener diode.
2.6   Draw the characteristics of Zener diode.
2.7   Explain formation of PNP transistors
2.8   Explain formation of NPN transistors
2.9   State the different transistor configurations
2.10   Plot the performance characteristics of a transistor in CB, CE configurations.
2.11   Compare the performance characteristics of a transistor in CB and CE configurations.
2.12   List the manufacturer specifications of
        i) PN junction diode   ii) Zener diode   and   iii)Transistor.

3.0   Explain the working Principle of Power supply circuits
3.1   Draw the following circuits using P.N. junction diodes.
        i) half wave   ii) full wave   iii) bridge rectifier
3.2   Explain the working principle of the following with waveforms.
        i) half wave   ii) full wave   iii) bridge rectifier.
3.3   State the need for filter.
3.4   List the different types of filters.
3.5   Explain the function of Zener diode as a regulator in a power supply.
3.6   Explain the function of voltage regulated power supply.

4.0   Describe the Performance of Special Devices

4.1   Describe the construction of special devices   i)UJT   ii)FET
       iii)LEDs   iv) LCD   v)SCR   vi)Solar cell
       vii) Opto-coupler   viii) Photo diode   and   ix) photo transistor.
4.2   Explain the working of special devices: i)UJT   ii)FET
       iii)LEDs   iv) LCD   v)SCR   vi)Solar cell
       vii) Opto-coupler   viii) Photo diode   and   ix) photo transistor.
4.3   Plot the V/I characteristics of above devices
4.4   List the applications of the special devices

5.0   Explain the principle of Working of Amplifiers.
5.1   Explain the operation of transistor as an amplifier.
5.2   State the necessity of proper biasing for amplifier action.
5.3   Explain different biasing methods such as collector to base bias, potential divider bias.
5.4   Determine the operating point on the set of characteristics.
5.5   List the causes for instability of bias in transistor amplifier.

6.0   Understand the Principle of Working of Small Signal Amplifiers.
6.1   Classify amplifiers on the basis of   i) frequency   ii) function   iii)type of load
              iv)period of Conduction   and   v)Number of stages.
6.2   Draw the circuit of   i)RC coupled CE amplifier
                                ii)Transformer coupled CE amplifier
6.3   State the function of each component of the above circuits.
6.3   Draw the frequency response characteristics of each circuit, indicate the gain band width, upper cut-off and lower cut-off frequencies.
6.4   Explain the necessity of cascading of amplifiers
6.5   Define `gain' in terms of decibel and `band width'

COURSE CONTENTS
   1. Electronic Components
   Different types of resistors, Colour code, specifications, uses of resistors-Different types of capacitors, specifications, Colour code, uses- Specifications for inductors and transformers- different types of chokes and transformers

2.   Semi-conductor Devices
   Insulators- Semi-conductors-conductor materials- Intrinsic and extrinsic semi-conductors, `P' and `n' type materials, PN Junction, forward and reverse bias- Zener diode, Zener diode characteristics - formation of PNP and NPN transistors- Transistor configurations- CB, CE - Input and output characteristics of CB,CE - comparison of CB,CE, configurations.
3.   Power supplies
    Half - wave, Full wave and bridge rectifiers. types of Filters, Voltage regulated power supply using Zener Diode,
4.   Special Devices
   UJT, FET, LED, LCD, SCR, Solar cell, Optocoupler, Photo diode, Photo transistor- characteristics and their applications.
5.   Introduction to Amplifiers
   Principles of Operation- Biasing and stabilization technique-Operating point and Load line Characteristics.

6.   Small Signal Amplifiers

Classification of Amplifiers, Coupling methods, Frequency Response of R.C coupled, transformer coupled and Cascade Amplifiers and their applications.

REFERENCES
1.   V.K. Mehta Principles of Electronics, S Chand& Co.
2.   Bhargava-Basic Electronics and Linear circuits -TMH Publishers
3.   Malvino -Electronic Principle
4.   Mathur, Chada & Kulashrestha -Electronic devices and circuits
5.   G.K. Mithal -Industrial Electronics
6.   G.K. Mithal -Applied Electronics

GENERAL MECHANICAL ENGINEERING

Subject Title	:	**General Mechanical Engineering**
Subject code	:	**EE-306**
Periods/Week	:	**04**
Periods/Semester	:	**60**

TIME SCHEDULE

SI. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Simple Stresses and Strains	14	26	2	2
2.	Torsion in Shafts	10	16	2	1
3.	I.C. Engines	12	26	2	2
4.	Boilers and Turbines	12	26	2	2
5.	Pumps and Lubricants	12	16	2	1
	Total	60	110	10	08

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

1.0   Understand the concept of simple stress and strain
1.1   Define the terms: i)stress   ii)strain
1.2   Identify the different types of stresses and strains
1.3   Define Hooke's law
1.4   Define moduli of elasticity
1.5   Draw typical stress-strain curve for an M.S. Specimen under tension
1.6   Define factor of safety
1.7   Define Poisson's ratio
1.8   State the relationship between elastic constants.
1.9   Calculate the dimensional changes in the bodies of uniform cross section subjected to tensile and compressive forces

2.0   Appreciate the theory of torsion
2.1   State the function of shafts.
2.2   Specify the standard sizes of shafts.

2.3   Define the term Torque
2.3   State simple torsion equation
2.4   Design the size of solid shaft in
            i) Strength point of view
            ii).Stiffness point of view

3.0   Appreciate the working of I.C.ENGINES
3.1   Describe the constructional details of I.C.Engines
3.2   Define I.C. Engine
3.3   Identify the various parts of   i) Diesel engine   ii) Petrol engine
3.4   Explain the principle of   i)4-stroke diesel engine   ii) 4-stroke petrol
engine
3.5   Explain the principle of   i)2-stroke diesel engine   ii) 2-stroke petrol
engine
3.6   Distinguish between 4-stroke cycle and 2-stroke cycles
3.7   Distinguish between diesel engine and petrol engine
3.8   State the functions of the following components in an I.C.Engine
            i)carburetor   ii)fuel pumps   iii)Governor

4.0   Understand the working of Boilers and Turbines
4.1   Explain the function of a boiler
4.2   Compare fire tube boiler with water tube boiler
4.3   Draw the Sketch of Modern High Pressure boiler
4.4   Explain the working of above boiler
4.5   State the necessity of mountings such as
            i) water level indicator   ii) Pressure gauge
            iii) Stop valve   iv) Feed check valve
            v) safety valve   vi) Fusible plug
4.6   Explain the working principle of the above mountings with legible sketches.
4.7   Explain the principle of working of a steam turbine
4.8   Classify the turbines based on action of steam
4.9   Compare impulse turbine with reaction turbine

5.0   Understand the working of centrifugal pumps.
5.1   Explain the principle of operation of centrifugal pump
5.2   Explain the constructional details of centrifugal pump.
5.3   Explain the method of improving the delivery head by multistage
5.4   State the importance of priming of centrifugal pumps.
5.5   Explain the principle of operation of reversible turbine pump and jet pump
5.6   Explain the function of bearing
5.7   Classify the bearings
5.8   Explain with a line sketch the journal and collar bearings
5.9   List anti friction bearings.
5.10   Explain the working of anti friction bearings
5.11   List the application of ball and roller bearings
5.12   State the specifications of ball and roller bearings
5.13   State the purpose of lubrication
5.14   State the properties of a lubricant
5.15   List the types of lubricants with examples
5.16   List the applications of lubricants.

COURSE CONTENT
1. Simple stress and strains
Definitions of Tensile stress, Compressive stress, Shear stress, Linear strain,lateral strain and, Poisson's ratio, elastic limit, statement of Hook'slaw,stress-strain diagram with salient features for ductile materials undertensile stress. Elastic moduli, Definition and explanation of Young's
modulus, Modulus of rigidity, Bulk modulus, Working stress, Ultimate stress, Factor of safety. Simple problems on tensile and compressive stressand strains in uniform and varying cross section bar (tapering sectionsomitted), Relationship between Young's modulus ,rigidity modulus andbulk modulus (without proof) problems thereon

2. Torsion in shafts
Function of shafts, standard shaft sizes, Torsion equation, Design the sizeof the solid shaft (i) strength point of view and stiffness point of view.

3. Constructional details of I.C. Engines.
Four stroke and two stroke petrol and diesel engines, petrol engine for 4stroke / 2 stroke, diesel engine for 4 stroke/ 2 stroke , Comparison betweenpetrol and diesel engine, Functions of carburetor, fuel injection pump,governor, Classification of boilers fire tube-water tube Sketch anddescription of modern boiler and mention various mountings used.

4.0 Boilers and Turbines
Working principle of Steam turbine- classification on the basis of steam- Comparision between impulse and reaction turbines.
5. Pumps - Introduction
Centrifugal pumps- Single stage, Lubricants - examples and their applications

Note : 1. This subject is to be taught by Mechanical faculty
           2. Paper setting and paper evaluation is also to be done by Mechanical Faculty.
 REFERENCES

1.   Ramamrutham -Strength of materials
2.   Surender Singh-Strength of materials
3.   S.B.Junarker-Strength of materials
4.   Jagadishalal-Hydraulic Machinery
5.   R.S. Kurmi-Strength of Materials

CIRCUITS AND MEASUREMENTS LABORATORY PRACTICE

Subject Title : **Circuits and Measurements Laboratory Practice**
Subject Code : **EE-307**
Periods/Week : **06**
Periods/Year : **90**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1	Techniques of using statistical tools in drawing and use of Graphs.	03
2	Network Laws & Theorems	30
3	Calibration of meters	15
4	1 -Ǿ A.C Circuit Parameters	15
5	Measurement of Power	21
6	Report on observations in Industrial visits	06
	TOTAL	90

OBJECTIVES(LIST OF EXPERIMENTS)

1. Techniques of using statistical tools and rules of drawing graphs
2. a) Verification of Ohm's Law
2. b) Verification of the limitations of Ohm's law
3. a) Verification of Kirchoff's current Law
3. b) Verification of Kirchoff's Voltage law
4. Verification of Super position theorem
5. Verification of Thevenins theorem
6. Calibration of Dynamometer type of wattmeter
7. Calibration of single phase Energy meter
8. Determination of Q-factor and Power factor of an Inductive coil
9. Determination of Idle & Energy components of current in a single phase Inductive circuit
10. a) Measurement of power in 1 -Ǿ circuit by 3-Voltmeter method
10. b) Measurement of power in 1 -Ǿ circuit by 3-Ammeter method
11. Measurement of power in 3 -Ǿ balanced circuit by 2-Wattmeter method
12. a) Visit MRT division Electricity Department to understand the testing and repair of various Measuring instruments.- Write a Report on observations.
12. b) Visit any Electrical / Electronic Measuring Instrument manufacturing industry to observe and understand construction and working of various meters. Write a Report on observations

Note: 1. Every student has to bring insulated tool kit and follow the general safety precautions throughout the lab sessions
2. Whenever handling/using a meter check for 'zero' position of the pointer and adjust for 'zero' position if there is any deviation

Competencies required to be achieved by the student

S.No	Experiment title	Competencies

I	Techniques of using statistical tools and drawing and use of Graphs	• Follow the international standards • Select proper X & Y parameters • Choose proper scale • Analyze the trend of the graph • Correlate trend of the graph with the relation between the parameters
II (2a,2b, 3a.3b, 4,5)	Verification of Network Laws & Theorems	• Draw the relevant circuit diagram • Select proper supply and load. • Select proper meters with proper ranges • Select proper wires to make connections as per circuit diagram • Ensure that all the meters are connected with proper polarity • Perform the experiment by carefully following the experimental procedure and precautions • Observe the readings without any scope for errors and tabulate
III (6,7)	Calibration of meters	• Short M & C terminals of wattmeter • Connect for proper Current range. • Calculate Multiplication factor • Calculate P, Error, %Error • Draw graph between W and % Error
8.	Determination of Q-factor and Power Factor of a coil	• Select proper supply and load. • Select proper meters with proper ranges • Calculate Z,Q-factor • Vary the Inductance to change the load.
9	Measurement of Idle & Energy components of current in a 1-Ø Inductive circuit	• Select proper supply and load. • Select proper meters with proper ranges • Calculate I_x, Iy, sin Ǿ • Draw the vector diagram(I_y Vs I_x) • Vary resistance to change the load
10(a,b)	Measurement of Power	• Select proper supply and load. • Select proper meters with proper ranges • Make connections as per circuit diagram • Calculate the value of Power
11	Measurement of power in 3- Ǿ circuit using the two wattmeter method	• Short M & C Terminals of wattmeters and connect for proper current coil range • Find out the M.F of Wattmeter • Reverse wattmeter terminals for negative readings (Lead values) • Calculate P, power factor(cos Ǿ)

ELECTRICAL WORKSHOP PRACTICE
Subject Title   :   Electrical Workshop Practice
Subject Code   :   EE-308

| Periods/Week | : | 03 |
| Periods/Year | : | 45 |

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	Special Lamp Connections	12
2.	Wiring Practice for Power Loads	18
3.	Motor Connections	09
4.	Earthing	06
	Total	45

OBJECTIVES(LIST OF EXPERIMENTS)
Upon completion of the course the student shall be able to

1   Control two lamps by Series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system
2   Control and practice the wiring for Fluorescent Lamp
3   Control and practice the wiring for Mercury Vapour Lamp
4   Control two sub- circuits through Energy meter, MCB's and two 1-way switches.
5   Control 1.5 ton capacity A/C equipment by MCB and stabilizer.
6   Connect the Inverter to power supply through 2/3 pin socket and 1-way switch (Back up)
7   Connect Computer by main switch board with a miniature circuit breaker.
8   Connect and test the given Public Address System
9   Perform Wiring for Alarm circuit with Relay
10 Prepare switch Board with DOL starter, MCB,1-phase Preventer and Pilot lamps for3 phase Motor
11 Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor
12 Prepare Pipe Earthing.
13 Prepare Plate Earthing.

Note: 1. Every student has to bring insulated tool kit and follow the general safety precautions throughout the lab sessions
2. Should not touch the live terminals.

Competencies to be achieved by the student

S.No	Experiment title	Competencies
1	Series-Parallel connection	• Select colour and length of wire for phase and neutral. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly • Observe glow intensity of lamps for series and parallel connections
2	Wiring practice of fluorescent lamp	• Make connections as per wiring diagram. • Connect top point and bottom point of the choke to tube light properly. • Note the importance and working of starter.

3	Wiring practice of Mercury Vapour lamp	• Identify the size of cable, type of 1-way switch, choke, and M.V. lamp holder. • Read the specifications of Choke and M.V. lamp holder. • Note the importance of choke • Measure the power across the choke.
4	Control two sub circuits through Energy meter, MCB's and two 1-way switches	• Draw wiring diagram. • Identify the size of cable,1-way switch, PVC pipe, MCB, capacity of Inverter and Socket • Read the specifications of MCB, capacity of Inverter and Socket • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Connect supply to Inverter through MCB properly. • Select appropriate socket with switch control. • Make earth wire connections for required points.
5	Control 1.5 ton capacity window type A/C equipment by MCB and stabilizer	• Draw wiring diagram. • Identify the size of cable, PVC pipe, MCB, stabilizer, capacity of A/C and Socket • Read the specifications of MCB, stabilizer, capacity of A/C and Socket • Make connections as per wiring diagram. • Connect supply to stabilizer through MCB • Select appropriate socket. • Make earth wire connections • Test with 1-phase, 230 V, 50 Hz supply.
6	Connect the inverter to power supply through 2/3 pin socket and 1-way switch	• Draw wiring diagram. • Select the size of cable,1-way switch, PVC pipe, MCB, capacity of Inverter and Socket as per specifications. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Connect supply to Inverter through MCB properly. • Select appropriate socket with switch control. • Make earth wire connections for require points
7	Connect computer by main switch board with a miniature circuit breaker.	• Draw wiring diagram. • Identify the size of cable, 1-way switch, PVC pipe, MCB and Sockets • Read the specifications of MCB and Sockets • Make connections as per wiring diagram. • Connect supply to Computer through MCB properly. • Select appropriate sockets with 1-way switch control. • Make earth wire connections for require points.
8	Connect and test the given public address system	• Draw wiring diagram. • Identify the size of cable, 1-way switch, PVC pipe, amplifier, MCB, mouth piece and Speakers • Read the specifications of MCB, Amplifier, speakers and Socket • Select colour and length of wire for phase and neutral.

		• Make connections as per wiring diagram. • Connect supply to amplifier through MCB properly. • Connect mouth piece to amplifier properly. • Connect speakers to amplifier properly. • Make earth wire connections for require points.
9	Wiring for Alarm circuit with Relay	• Draw wiring diagram. • Select the size of cable, 1-way switch, PVC pipe, push button switches Relay and alarm as per the specifications. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Connect 6V DC supply to relay terminals through push button switches. • Connect 230V, 50Hz ,1-phase AC supply to • Test the circuit connected through ICDP switch.
10	Prepare switch Board with DOL starter, MCB and Pilot lamps for 3 phase Motor	• Draw wiring diagram. • Select the size of cable, PVC pipe, star-delta starter, MCB and lamp holder as per specifications. • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Draw wire of the 3-phase to the motor through star-delta starter. • Observe star-delta starter and motor connections. • Observe output terminals of star-delta starter (six) • Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDP switch. • Test by changing any two phases of input supply.
11	Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor	• Select the size of cable, PVC pipe, star-delta starter, MCB and lamp holder • Make connections as per wiring diagram. • Draw wire through PVC pipe properly. • Draw wire of the 3-phase to the motor through star-delta starter. • Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDP switch. • Test by changing any two phases of input supply
12	Prepare Pipe Earthing	• Draw earthing diagram with specifications. • Select suitable GI pipes ,GI wire reducing socket and funnel with wire mesh. • Prepare the earth pit of 2.5 m below the surface of the ground. • Place Earth pipe in vertical position. • Draw GI wire to the earthing pipe fastened with bolts & nuts. • Fix the funnel with wire mesh at the top of GI pipe. • Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe. • Test the earth resistance with Megger

13	Prepare Plate Earthing	- Draw Earthing diagram with specifications - Select suitable GI plate, GI wire and funnel with wire mesh - Prepare the earth pit of 1.5 m below the surface of the ground - Place Earth plate in vertical position - Draw GI wire to the GI pipe fastened to GI plate / copper plate with bolts & nuts. - Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe. - Test the earth resistance with Megger. - Verify the earth resistance.

REFERENCE
1. Electrical work shop By R.P.Singh
2. Electrical Design Estimating And Costing By K.B. RAINA & S.K.BHATTA CHARYA
3. Residential and Commercial Industrial Electrical systems Vol.2 by Joshi-TMH
4. Residential and Commercial Industrial Electrical systems Vol.3 by Joshi-TMH
5. Industrial Safety management by Deshmukh -TMH

DC MACHINES LABORATORY PRACTICE

Subject Title   :   **DC Machines Laboratory Practice**
Subject Code   :   **EE-309**
Periods/Week   :   **06**
Periods/Semester   :   **90**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	**Testing and Speed control of DC motors**	**51**
2.	**Characteristics of DC Generators**	**39**

OBJECTIVES:
Upon completion of the Practice, the student shall be able to

TESTING AND SPEED CONTROL OF DC MOTORS
1. Identify the terminals of the following DC Machines
   (a) DC Shunt motor
   (b) DC Series Motor
   (c) Compound Motor.
2. Study the parts of DC 3 point starter, 4 point starter and Drum Controller Starter.
3. Obtain performance characteristics by conducting Brake Test on DC Shunt Motor
4. Obtain performance characteristics by conducting Brake Test on DC Series Motor.
5. Obtain performance characteristics by conducting Brake Test on DC Compound Motor.
6. Speed control of DC Shunt Motor by
   (a) Rheostatic control method
   (b) Field control method
7. Obtain the performance of a DC Shunt Motor by conducting Swinburne's test.

CHARACTERSTICS OF DC GENERATORS

8. Obtain OCC of a DC shunt Generator at rated speeds.
9. Obtain Internal and External characteristics of DC Shunt Generator.
10. Obtain Internal and External characteristics of DC Series Generator.
11. Obtain Internal and External characteristics of DC Compound Generator

Competencies to be achieved by the student

S.No	Experiment title	Competencies
1	Identify the terminals of the following DC Machines (a)DC Shunt motor (b)DC Series Motor (c)DC Compound Motor.	• Note down the name plate details. • Locate the different terminals of a DC Shunt Motor / DC Series Motor./. DC Compound Motor. • Measure the resistance across different terminals using multimeter. • Record the resistance values of the terminals. • Identify the armature and shunt field / series field resistance according to resistance values observed.
2	Study the parts of DC 3 point, 4 point starter..	• Locate the Line, Armature, Field terminals of the starter (L-A-F) • Locate NVR coil and OLR coils. • Know the purpose of NVR and OLR coils. • Properly connect Starter and motor terminals • Properly handle the Starter terminals. • Properly start the motor.
3,4,5	Performance characteristics of DC (Shunt ,Series, Compound)Motors. by conducting Brake Test	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Start the Motor with the starter. • Note the readings of speed N, current I and spring balance for a particular load. • Pour water in the break drum carefully. • Check the speed and maintain it constant by means of field regulator before taking every reading. • Note readings by varying loads on the motor upto rated current. • Calculate the torque,input, output and efficiency. • Draw performance curves of motor

6	Speed control of DC Shunt Motor by (a)Rheostatic control method (b) Field control method	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Handle the 3- point Starter • Set the Field Resistance of the motor by gradually moving the knob on the rheostat coil. • Record the readings of Ammeter and Tachometer by gradually increasing the resistance in the Field rheostat. • Draw the graph speed Vs Field current. • Observe the graph and write the conclusions.
7	Performance of a DC Shunt Motor by conducting Swinburne's test.	• Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Connect the circuit as per the circuit diagram. • Ensure that all the instruments are connected in proper polarity. • keep the rheostat is maximum position in armature so that minimum voltage is applied to armature
		• Adjusting the field rheostat to minimum position • Adjust the speed of the motor to its rated value by using its Field Rheostat. • Taking the readings of Ammeter and Voltage by opening the Field switch • Taking the readings of Voltage and current by closing the field switch and gradually decreasing the resistance in the Rheostat. • Calculate the efficiency of the DCMachine as a Generator and as a Motor at various loads. • Draw the conclusions.
8	OCC of a DC shunt Generator at rated speeds.	• Draw the relevant circuit diagram for OCC test. • Select the proper DC supply voltage. • Choose the proper range of voltmeter, ammeter and rheostat. • Make the connections according to circuit diagram. • Ensure that all the instruments are connected in proper polarity. • Check the speed and maintain it constant by means of field regulator before taking every reading. • Observe and note the readings in a tabular form. • Draw the graph between I_f Vs E_g.

9,10,11	Obtain Internal and External characteristics of DC (Shunt ,Series, Compound) Generator	- Select the proper DC supply voltage - Choose the proper range of voltmeter, ammeter and rheostat. - Connect the circuit as per the circuit diagram. - Ensure that all the instruments are connected in proper polarity. - Adjust the motor rheostat to minimum position - Adjust the Generator rheostat to maximum position - Adjust the speed of the motor to its rated value - Setting the Field Rheostat of the motor. - Gradually increase the Load current by operating the Load switches. - Measure the terminal voltage. - Measure the load current and armature current. - Measure the Armature resistance by DC Resistance method. - Calculate I_aR_a drop. - Draw the graph for External Characteristics - Draw the graph for Internal Characteristics - Observe the difference between the Graphs of Internal and External characteristics.

REFERENCES

1. Electrical Technology - Vol - I by B.L. Theraja – S.Chand&co.
2. Electrical Technology - Vol –II by B.L. Theraja - S.Chand&co.
3. Electrical machines by P.S. Bhimbhra
4. Electrical Machines by M.V.Deshpande
5. Electric Machines by D.P.Kothari, J.Nagarath – TMH

ELECTRONICS – I LABORATORY PRACTICE

Subject Title	:	**Electronics – I Laboratory Practice**
Subject Code	:	**EE-310**
Periods/Week	:	**03**
Periods/Semester	:	**45**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	**Diode Characteristics**	9
2.	**Zener Diode Characteristics**	6
3.	**Filter Circuits**	6
4.	**Regulated power supply**	9
5.	**NPN Transistor**	9
6.	**FET Characteristics**	6
	Total	**45**

OBJECTIVES

Upon completion of the Practice, the student shall be able to

1.0 PLOT THE CHARACTERSTICS OF DIODE
1.1   To draw the forward & reverse characteristics of Silicon diode.
1.2   Determine Knee voltage.
1.3   Identify Cutoff , and Linear regions
1.4   Connect a 6V lamp in series with diode and test it on DC power supply
1.5   Using the CRO & Curve tracer to observe the Characteristics.
1.6   Heat the diode with a soldering Iron and observe the effect on reverse current

2.0 PLOT THE CHARACTERSTICS OF ZENER DIODE
2.1   To draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage
1.2   Connect resistance ladder circuit(3 resistors) and measure the voltages at the output by varying input voltage while Zener is reverse biased.

3.0 IMPLEMENT RECTIFIER CIRCUITS TO OBSERVE THE EFFECT OF FILTER
3.1   Implementing Half wave rectifier with and without filter
3.2   Implementing Full wave rectifier with and without filter
3.3   Implementing Bridge rectifier with and without filter
3.4   Implementing Voltage Doubler circuit
3.5   Connect a diode IN4007 in series with a 60W 230V Lamp and test it .(Record your observations)

4.0 PLOT THE REGULATION CHARACTERISTICS OF A POWER SUPPLY.
4.1   To build a Regulated power supply and draw the regulation characteristics
i) using Zener diode   ii) using 3 Terminal +ve Regulator
4.2   Implement a –ve 3 Terminal Regulator and draw the regulation characteristics
4.3   Implement a Dual regulated power supply using both +ve and –ve 3 terminal regulators and draw the regulation characteristics
4.4   Obtain a voltage above 30V using Dual RPS in the laboratory and measure them.

5.0 PLOT INPUT AND OUTPUT CHARACTERISTICS OF NPN TRANSISTOR
5.1   To draw Input and output characteristics of NPN Transistor and determine Beta of the transistor
a) in CB configuration   and b) in CE configuration
5.2   Turn on and turn off a relay using Transistor(BC148 as a switch.)
5.3   Connect a 6v lamp in series with BD139 and observe the effect of base current variation on lamp brightness .
5.4   Know the package and differences between BC148A, 148B, 148C and BF194 from the data sheets.

6.0 OBTAIN THE INPUT AND OUTPUT CHARACTERISTICS OF JFET
6.1   Drain the input and output characteristics of JFET and determine pinchoff voltage and transconductance.
6.2   Show that a FET can be used as a constant current source with appropriate bias
6.3   Apply -2 volts to the gate circuit through resistors of value 10k, 100k and 1M separately and measure the output current and analyse.

Competencies to be achieved by the student

S.No	Experiment title	Competencies
1	**Plot the characteristics of diode**	1. Assemble the circuit as per the circuit diagram 2. Identify Diode terminals by observation and also with DMM & Analogue Multimeter. 3. Drawing inference and writing the report
2	**Plot the characterstics of zener diode**	1. Assemble the circuit as per the circuit diagram 2. Identify Zener Diode terminals by observation and with DMM &Analogue Multimeter. 3. Drawing inference and writing the report
3	**Implement rectifier circuits to observe the effect of filter**	1. Assemble the circuit as per the circuit diagram 2. Using the CRO to observe the waveforms 3. Assess the Power supply performance in terms of ripple and % Regulation 4. Drawing inference and writing the report
4	**Plot the regulation characteristics of a power supply**	**1.** Assemble the circuit as per the circuit diagram 2. Identify the 3 terminal Regulator and its package &pin Configuration 3. Find the output voltage and type from the IC Regulator number
5	**Plot input and output characteristics of NPN transistors**	**1.** Draw the symbols of NPN transistor. 2. Read the circuit Diagram 3. Identify transistor terminals 4. Identify the meters and equipment 5. Interpret NPN transistor datasheets and find the specifications
6	**Obtain the input and output characteristics of JFET**	**1.** Draw the symbols of FET, 2. Read the circuit Diagram 3. Identify the FET terminals 4. Identify the meters and equipment 5. Interpret JFET datasheets and finding the specifications.

REFERENCES
1. Principles of Electronics by V.K. Mehta, S Chand& Co.
2. Basic Electronics and Linear circuits by Bhargava, TMH Publishers
3. Electronic Principle by Malvino
4. Electronic devices and circuits by Mathur, Chada & Kulashrestha
5. Industrial Electronics by G.K. Mithal
6. Applied Electronics by G.K. Mithal

DIPLOMA IN ELECTRICAL& ELECTRONICS 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:								
EE - 401	Mathematics - III	4		60	3	20	80	100
EE - 402	A.C. Machines - I	5		75	3	20	80	100
EE - 403	Power Systems – I (Generation)	5		75	3	20	80	100
EE - 404	Electrical Installation and Estimation	4		60	3	20	80	100
EE - 405	Electronics -II	4		60	3	20	80	100
EE - 406	Programming in C	4		60	3	20	80	100
PRACTICAL:								
EE - 407	Electrical Engineering Drawing	-	7	105	3	40	60	100
EE - 408	Communication Skills Practice	-	3	45	3	40	60	100
EE - 409	A.C. Machines-I Laboratory Practice	-	3	45	3	40	60	100
EE - 410	Electronics-II Laboratory Practice		3	45	3	40	60	100
	TOTAL	26	16	630		280	720	1000

Engineering Mathematics – III

Subject Title : **Engineering Mathematics – III**
Subject code : **EE-401(Common Subject)**
Periods/Week : **04**
Periods/semester : **60**

Blue Print

S. No	Major Topic	No of Periods	Weight age of Marks	Short Type			Essay Type		
				R	U	App	R	U	App
	Unit -I Differential Equations								
1	Homogenous Linear Differential equations with constant coefficients	5	6	2	0	0	0	0	0
2	Non-homogenous Linear Differential equations with constant coefficients	10	23	0	1	0	1	1	0
	Unit - II								
3	Laplace Transforms	20	32	1	2	1	1	0	1
	Unit - III								
4	Fourier Series	13	26	1	1	0	0	1	1
	Unit - IV								
5	Probability	12	23	1			1/2	1/2	1
	Total	60	110	5	4	1	2 1/2	2 1/2	3
			Marks:	15	12	3	25	25	30

R: **Remembering type** 40 marks
U: **Understanding type** 37 marks
33 marks
App: **Application type**

ENGINEERING MATHEMATICS – III(Common Subject)

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

Unit-I-Differential Equations
1.0 **Solve Homogeneous linear differential equations with constant coefficients in engineering situations**
1.1 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.

1.2 Solve the higher order homogeneous differential equations with constant coefficients.

2.0 Solve Non Homogeneous linear differential equations with constant coefficients in engineering situations

2.1 Explain the concept of complementary function, particular Integral and general solution of a differential equation.

2.2 Solve nth order differential equation of the type *f(D) y = X* where *f(D)* is a polynomial of nth order and *X* is a function of the form *k, e^{ax} , Sinax, Cosax, x^n*.

Unit-II- Laplace Transforms

3.0 Use Laplace Transforms to solve differential equation in engineering problems

3.1 Write the definition of Laplace Transform and Laplace transform of standard functions.

3.2 Explain the sufficient conditions of existence of Laplace Transform.

3.3 Write the properties of Laplace Transform – Linear property, First shifting property, Change of Scale.

3.4 Solve simple problems using the above properties

3.5 Write formulae for Laplace transform of $t^n f(t)$, $\dfrac{f(t)}{t}$, $f^{(n)}(t)$, $\displaystyle\int_0^t f(u)\,du$

   interms of Laplace transform of $f(t)$.

3.6 Solve simple problems using the above formulae.

3.7 Define unit step function and write the Laplace Transform of unit step function.

3.8 Write second shifting property.

3.9 Define inverse Laplace Transform and write inverse Laplace Transform of standard functions.

3.10 Solve simple problems on 3.9

3.11 Write first shifting property of inverse Laplace Transfrom.

3.12 Solve simple problems on 3.11

3.13 Write inverse Laplace Transforms corresponding to Laplace Transform of the functions mentioned in section 3.5

3.14 Solve simple problems on 3.13.

3.15 Define convolution of two functions and state convolution theorem.

3.16 Solve simple problems on 3.15.

3.17 Use Laplace and inverse Laplace Transforms to solve simple differential equations of second order.

Unit-III- Fourier Series

4.0 Know Fourier Series expansion of functions

4.1 Define the orthogonality of functions in an interval.

4.2 Define Fourier series of a function on the interval $(c, c+2\pi)$ and write the Euler's formulae for determining the Fourier coefficients.

4.3 Write sufficient conditions for the existence of Fourier series for a function.

4.4 Find Fourier series of simple functions in the range $(0, 2\pi)$, $(-\pi, \pi)$.

4.5 Write Fourier series for even and odd functions in the interval $(-\pi, \pi)$.

4.6 Write Fourier series expansion of a function over the interval $(-l, l)$

4.7   Write half range Fourier sine and cosine series of a function over the interval $(0,\ l)$

4.8   Solve simple problems on 4.5, 4.6 and 4.7

Unit-IV- Probability
5.0   Understand the basic concepts of
5.1   Recall sets, operations on sets and Venn-diagrams.
5.2   Explain the terminology – random experiment, outcome, sample space, elementary event and event.
5.3   Define Probability – Empirical approach and axiomatic approach (Mathematical).
5.4   Prove addition theorem of probability for two mutually exclusive and exhaustive events.
5.5   State addition theorem of probability for three mutually exclusive and exhaustive events.
5.6   Solve simple problems on addition theorem.
5.7   Explain dependent, independent events and conditional event.
5.8   State the formula for conditional probability.
5.9   State multiplication theorem of probability.
5.10   State Bayes' theorem.
5.11   Solve simple problems on conditional probability and Bayes' theorem.

Course Content

Differential Equations
1.Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.
2.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.

Laplace Transforms(LT)
3.Definition, sufficient conditions for existence of 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) – applications of LT to solve ordinary differential equations with initial conditions (2nd order only)

Fourier Series
4. Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c,\ c+2\pi)$, Euler's formulae , sufficient conditions for existence of Fourier series for a function, even, odd functions and their Fourier series over the interval $(0,2\pi)$, Change of length of interval – Fourier series , half range series.

Probability

5   Review of sets, operations on sets and Venn-diagrams; random experiment, outcome, sample space, elementary event and event, equally likely events, Definition of Probability – Empirical approach and axiomatic approach (Mathematical), addition theorem of probability for two mutually exclusive and exhaustive events, extension of addition theorem for three mutually exclusive and exhaustive events, dependent, independent events and conditional event, probability of a conditional event, multiplication theorem, Bayes' theorem.

Reference Books :

1. Higher Engineering Mathematics, B.V.Ramana, Tata McGraw-Hill

2. Probability, 2/e Schaum's Outlines Series, McGraw-Hill

3. Elementary Probability and Statistics, by S.C.Gupta and V.K.Kapoor

A.C MACHINES - I

Subject Title : **A.C. MACHINES - I**
Subject code : **EE-402**
Periods/Week : **05**
Periods/semester : **75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Single phase Transformers	35	52	04	04
2.	Three phase Transformers	10	16	02	01
3.	Alternators	20	29	03	02
4.	Parallel Operation of Alternators	10	13	01	01
	Total	**75**	**110**	**10**	**08**

OBJECTIVES

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

1.0 Understand the working of single phase transformer and 3 phase transformers
1.1   Define the word `Transformer'.
1.2   Explain the working of single-phase transformer.
1.3   Classify the transformers based on
        i)number of phases   ii)construction   iii)function.
1.4   Describe the constructional details of transformers.
1.5   State the function of each part of the transformer with legible sketch.
1.6   Distinguish between shell type and core type transformers.
1.7   Derive the E.M.F equation of a single power transformer.
1.8   Define 'transformation' ratio.
1.9   Draw Vector diagram for a transformer working on no load.
1.10   Calculate the core loss.
1.11   Explain the procedure for finding R_o and X_o from no load test.
1.12   Develop the vector diagram of a transformer on load for
        (i) Unity power factor
        (ii) Lagging power factor
        (iii) Leading power factor
1.13   State the effects of leakage reactance of primary and secondary windings.
1.14   Draw the equivalent circuit of a transformer by approximation.
1.15   Determine the equivalent circuit constants from no-load test and short circuit test
        data.
1.16   Derive the approximate equation for regulation for transformer.
1.17   Calculate regulation of a Single Phase Transformer for
        (i) Unity power factor
        (ii) Lagging power factor
        (iii) Leading power factor
1.18   List the losses taking place in a transformer.
1.19   Derive the condition for maximum efficiency of a transformer.
1.20   Solve simple numerical problems.
1.21   State the reason for transformer rating in KVA.

1.22   Calculate the all day efficiency for a given load cycle.
1.23   Differentiate between distribution transformer and power transformer.
1.24   Explain the polarity test on single-phase transformer.
1.25   State the need for parallel operation of transformer.
1.26   Mention the conditions for paralleling and load sharing of transformers.

2.0   Understand Three Phase Transformers
2.1   State the advantages of 3 phase transformer over single phase transformer.
2.2   List the different types of three phase transformers by giving their symbolic
       Representation and voltage relationships.
2.3   State the applications of   i)star-star   ii)delta-star   iii)star-delta
              iv)delta-delta connected transformer.
2.4   State the conditions for parallel operation of 3 phase transformers.
2.5   List the special transformers.
2.6   State the advantages and disadvantages of autotransformers
2.7   State the expression for saving of copper in auto transformer.
2.8   State the necessity of cooling of power transformers.
2.9   Explain the methods of cooling of power transformer.
2.10 Draw a legible sketch of a power transformer
2.11 Explain the function of each part of a power transformer.
2.12 Explain the `on load' and `off load' tap changing.
2.13 Explain the procedure for tap changing for on load and no load tap changer.

3.0   Understand the classification, construction, working and testing of alternators
3.1   Explain the Principle of working of Alternators.
3.2   Describe the Constructional details of Alternators with legible sketch.
3.3   Classify the Alternators based on rotor construction.
3.4   Explain the working of the of Alternator having
       i).Cylindrical Rotor   ii) Salient Pole Rotor
3.5   State the advantage of Stationary Armature.
3.6   List the main parts of Alternator along with materials used.
3.7   State the effect of Chording and Distribution factor
3.8   Derive expressions for Chording factor and Distribution factor
3.9   Derive EMF equation of an alternator taking into account distribution factor and
       pitch   factor
3.10 Solve simple problems on E.M.F equation
3.11 State the need for an exciter in an Alternator.
3.12 List the various types of exciters (main, pilot and static)
3.13 Explain Armature Reaction of Alternator at different P.F's.
3.14 State the reasons for voltage variations on Load.
3.15 Define the term synchronous impedance.
3.16 State the effects of synchronous impedance on the operation of the Alternator.
3.17 Draw the vector diagram of voltages and currents for different power factors.
3.18 Define regulation of an alternator
3.19 List the different methods of finding the regulation of alternator.
3.20 Calculate the regulation by synchronous impedance method

4.0   Comprehend the procedure for voltage control and synchronisation
4.1   Explain the necessity for parallel operation of alternators
4.2   State the conditions for synchronisation

4.3   Explain the procedure of synchronisation by using lamp methods.
4.4   Explain the method for adjusting the loads shared by two alternators (or one alternator with infinite bus bar).
4.5   Explain the effect of change in input and excitation of an alternator connected to infinite bus.

COURSE CONTENT
1. Transformers
Classifications of transformers, Construction of transformers, Theory of an ideal transformer - emf equation derivation - Ratio of transformation and relation between turn ratio - Voltage ratio and current ratio, Transformer on no load - No load current components and no load power factor -Transformer on load - Equivalent circuit of transformer - Equivalent circuit constants by transformation, Short circuits test - Regulation of transformer - definition and derivation of approximate equation for regulation based on vector diagram for lagging ,leading, unity power factor - determination of regulation from S.C. Test data , Losses in transformer -determination from O.C. and S.C. tests data- efficiency, condition for maximum efficiency – rating of transformer-All day efficiency definition - Calculation for a given load cycle- problems, Polarity test - Efficiency calculation, Parallel operation of single phase transformers - necessity - conditions for paralleling-load sharing of single phase transformers
2. Three phase transformer
Descriptive treatment of star-star, delta-delta, star-delta and delta-star, voltage current and phase relation for the above groups-conditions to be fulfilled for paralleling 3 phase transformer, open delta working of 3 phase transformers, Auto-transformers –expression for copper saving – applications, Necessity of cooling - Methods of cooling - Sketch of power transformer indicating parts and explain their functions - Tap changing gear - no load and on load tap changing procedure.
3. Alternators
Classification of low, medium and high speed alternators - Brief description of parts with sketches and function of each part, construction, Assembly - Exciter and pilot exciter – Stationary armature type construction – Advantages**,** Concentrated and distributed windings - short pitch and full pitch coils - Effect of chording and distribution factors - EMF equation - Derivation – Problems**,** Cause for variation of voltage on load - Resistance, leakage reactance - Armature reaction - Synchronous reactance and synchronous impedance concepts - phasor diagram for unity, lagging and leading power factor loads, Regulation - definition - derivation of relation between no load voltage and on load voltage for different power factors – Different methods of finding regulation- Calculation of regulation by synchronous impedance method,
4. Parallel operation of alternators
Necessity for parallel Operation - condition to be fulfilled for synchronisation, Synchronisation by lamp methods - Load sharing – simple problems-Effect of change in excitation and input of an alternator connected to infinite.

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POWER SYSTEMS – I

Subject Title	:	**POWER SYSTEMS – I (GENERATION)**
Subject Code	:	**EE – 403**
Periods / Week	:	**05**
Periods / Semester	:	**75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Sources of Energy	06	03	01	
2.	Thermal Power Station	14	16	02	01
3.	Hydro Electric Power Station	16	26	02	02
4.	Nuclear Power Station	12	16	02	01
5.	Renewable Energy sources	12	23	01	02
6.	Combined Operation and Economics	15	26	02	02
	Total	**75**	**110**	**10**	**08**

OBJECTIVES:

Upon completion of the course the student shall be able to

1.0 Appreciate the various sources of power generation.
1.1 List the different sources of energy
1.2 Classify the sources of energy into conventional and non-conventional types.
1.3 State necessity of developing non-conventional methods of power generation.
1.4 Explain the method of generating electrical energy from (i) Solar Power (ii) Tidal Power (iii) Wind Power(iv)Biomass.(v)Geo-thermal power
1.5 State the relative merits and limitations of Conventional and Non-Conventional types of sources.
1.6 State the need of energy conservation.
1.7 List the different methods of energy conservation.

2.0 Comprehend the working of thermal power station.
2.1 List the thermal power stations in South India with their location and their capacity.
2.2 Explain the general principle of working of thermal power stations.
2.3 List the requirements for setting up of Thermal Power Station.
2.4 Mention the requirement for site selection of thermal power plant.
2.5 Draw the detailed line diagram of a condensing type thermal power station.
2.6 Explain the principle of working of each component of thermal power station.
2.7 Describe the energy losses occurring in thermal power plant
2.8 State the methods to improve the efficiency of thermal power plant.
2.9 Define i)Pulverization ii)Condensation
2.10 Mention the advantages of i)Pulverization ii)Condensation
2.11 State the necessity of cooling towers in thermal power plant

2.12   List the types of cooling towers in thermal power plants.
2.13   List the controls used at i) Boilers, ii) Turbines,(iii) Alternators.
2.14   Explain the concept of Energy Auditing
2.15   State the need of Energy Auditing
2.16   List the methods. of Energy Auditing
2.17   Mention the causes of pollution
2.17   List the methods to control Pollution.

3.0   Comprehend the working of hydroelectric power stations.
3.1   List the Hydal power stations in South India with their location and their capacity
3.2   Explain the principle of working of Hydro power station.
3.3   List the requirements for setting up of Hydro Electric Power (HEP).Station.
3.4   Mention the requirement and factors for site selection of Hydro Electric Power Plant.
3.5   Explain Hydrograph.
3.6   Derive waterpower equation
3.7   Define various hydraulic terms used
3.8   Solve numerical problems on waterpower equation
3.9   Classify the H.E.P's based upon
            i) head   ii) duty   iii) location   and   iv)hydraulic considerations.
3.10   Explain with layout diagram working of the following Power Stations
            ii) High Head, ii) Medium Head, iii) Low Head .
3.11   State the need of   i) Surge Tank,   ii) Fore bay,   iii) Spill gates.
3.12   Explain the working of   i) Surge Tank ii) Fore bay   iii) Spill gates.
3.13   List the main controls used at   i)Head works   ii) Turbine   iii) Alternators.

4.0   Comprehend the working of Nuclear Power Stations.
4.1   State the importance of nuclear energy
4.2   Explain fission and fusion reactions.
4.3   State the merits of using nuclear energy
4.4   List the various risks involved in using nuclear energy
4.5   Mention the various nuclear fuels used in nuclear power station by giving their properties.
4.6   Give specific examples of fission and fusion reactions with mass-energy balance.
4.7   Explain types of fission reactions and sustained chain reaction.
4.8   Explain use of moderator in nuclear reactions.
4.9   List the types of reactors used in Nuclear power stations.
4.10   Explain the working of reactors in Nuclear power stations
4.11   State the merits and demerits of reactors in Nuclear power stations.
4.12   Explain the working of a moderate type nuclear power station with a block diagram.
4.13   Mention the materials used for   i)coolant   ii)reflector   iii)control rods
4.14   State the need of   i)coolant   ii)reflector   and   iii)control rods.
4.15   Explain the working of   i)coolant   ii)reflector   and   iii)control rods.
4.16   Explain the mechanism of power control by control rods.
4.17   Explain the measures to control radio activity.
4.18   List the main controls at the reactor

5.0 **Comprehend the power generation through Renewable Energy Sources**
  5.1   State the importance of Renewable energy sources.
  5.2   List the various Renewable and Non-Renewable energy sources.
  5.3   State the amount of solar radiation reaching the earth's surface.
  5.4   State the principle of conversion of solar radiation into heat.
  5.5   Explain the function of flat plate collector.
  5.6   Explain the working principle of solar air heater with legible sketch
  5.7   Identify different types of concentrating collectors.
  5.8   Explain the working principle of concentrating collectors
        i)focusing type   ii)parabolic   iii) trough collector.
  5.9   State the different methods of storing solar energy.
  5.10 State the principle of photo-voltaic conversion
  5.11 Comprehend the solar photo-voltaic arrays.
  5.12 State the working principle of solar cell.
  5.13 Explain the energy conversion of solar cell.
  5.14 Describe the current voltage characteristics of solar cell.
  5.15 Mention the power available in the wind and the force caused by it on the blades.
  5.16 State the collection of wind data and estimate the energy.
  5.17 State the different considerations for site selection for installing wind mill.
  5.18 List the basic components of a wind mill.
  5.19 Describe the construction details of the wind mill.
  5.20 Explain the working principle of the wind mill

6.0 **Appreciate the combined operation and economics of power stations.**
  6.1   State the need for reliability of electrical energy.
  6.2   Differentiate between isolated operation and integrated operation of power stations.
  6.3   List the merits of integrated operation.
  6.4   Explain the process of integrated operation and need for grid at various levels
  6.5   List the voltage levels.
  6.6   List the various Charges and expenses in power station
  6.7   Classify the Charges as fixed and running.
  6.8   Define the terms   i)load curve   ii)load factor
                              iii)diversity factor   iv) maximum demand.
  6.9   Discuss the effects of load factor and diversity factor on the cost of generation
  6.10 Solve numerical problems on the above.
  6.11 Explain various types of consumer tariffs and compare them.
  6.12 Solve numerical problems on the above.
  6.13 Discuss the effects of P.F on electricity charges
  6.14 Mention the methods to improve Power Factor.
  6.15 Solve numerical problems on electricity charges
  6.16 Discuss the need for energy management.

COURSE CONTENT
1. Introduction
        Different sources of energy - Conventional and Non-conventional sources - Need for Non-Conventional Energy based power generation - Methods of generation of energy from different sources of power such as Solar, Wind, Tidal, Bio-mass

and Geo-Thermal - Merits and Limitations of Conventional and Non-conventional sources - Need for energy conservation and their methods.

2. Thermal Power Station

Thermal Power Station - Principle of working - Factors for selection of site. Block diagram of condensing type thermal power station - Thermal power station - Components and principles of working - Energy Losses and methods to improve the efficiency- pulverization, Condensation, Cooling towers and their types - Main controls at Boilers, Turbines and Alternators - Energy auditing of thermal power station - Causes of pollution and methods to control them.

3. Hydroelectric Power Stations

Hydro Electric Power Station - Factors for site selection and limitations in location and operation – Hydraulic terms used - Water power equation - Classification of hydroelectric power stations based on head, duty, location and hydraulic considerations - Layout diagram of High Head ii) Medium Head iii) Low Head Power Stations - Working of surge tank, fore bay, spill gates- Main controls of head works, turbines and alternators.

4. Nuclear Power Stations

Nuclear energy, fission and fusion reactions - Merits and risks in using nuclear energy. Nuclear fuels and their properties - Fission and fusion reactions with mass-energy balance, Fission reactions and sustained chain reaction - Moderator in nuclear reactions - Working of reactors with merits and demerits - Working of moderated type nuclear power station with a block diagram - Need and working of coolant, reflector, control rods – Materials used for them - Power control by control rods- measures to control radioactivity- main controls at the reactor.

5. Renewable Energy sources

Solar radiation - Principle of Conversion of solar radiation into heat - Function of flat plate collector - Working principle of Solar air heater - Different types of concentrating collectors and working of it-methods of storing solar energy - Principle of photo voltaic conversion - Applications-Solar photo voltaic arrays - Working principle of solar cell - VI-Characteristics of Solar cell - Power available in wind - Wind data-energy estimation -Site selection for installing Wind mill- basic components, constructional details and working principle of wind mill.

6. Combined Operation and economics of Power Stations

Isolated operation and integrated operation of power stations - Their merits and limitations - Charges/Expenses involved in power station - Their classification as fixed and running - Load curve, load factor, diversity factor and maximum demand - Effects of load factor and diversity factor in power generation - Solve numerical problems. Consumer tariffs and their comparison - Effect of power factor on the electricity charges and methods to improve it - simple problems - Energy management and conservation.

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ELECTRICAL INSTALLATION AND ESTIMATION

Subject Title   :ELECTRICAL INSTALLATION AND ESTIMATION
Subject code   :   EE- 404
Periods/Week   :   04
Periods/Semester   :   60

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Wiring Systems and Safety Procedures	**08**	**19**	**03**	**01**
2.	Estimation of Lighting and Power Loads	**22**	**39**	**03**	**03**
3.	Estimation of OH Lines and Earthing	**18**	**36**	**02**	**03**
4.	Departmental Test, REC and Electrical Act 2003,	**12**	**16**	**02**	**01**
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0   Mention the use of wires and cables, Types of Installations and wiring Accessories .

1.1   Compare VIR, CTS, PVC, Lead Sheathed, Weather proof aluminium and copper wires.

1.2   Mention the uses of cables LV,HV, EHV and oil filled H types, SL, HSL and types of 3-phase cables

1.3   State the uses of standard wire gauge.

1.4   Specify the gauge of wire and number of strands in a mulitstrand by giving its current carrying capacity

1.5   Explain   (i)C.T.S system   (ii) T.R.S. system,
                  (iii) Surface conduit system   (iv)Concealed wiring system.

1.6   List the Main Switches as: i)Double pole iron clad (DPIC)
                                ii)triple pole iron clad (TPIC)
                                iii)Triple pole iron clad with neutral link (TPICN)
                                iv)Distribution fuse board Ironclad
                                v) MCB types with specifications, MCCB,ELCB and RCCB

       and specify their applications.

1.7   List the different types of fuses as
       i)Rewirable fuses   ii)Open type fuses
       iii)Kit kat type fuses   iv)Cartridge fuses
       and specify the fuse carrier material used, ratings and their usage.

1.8   State the reasons for fire accidents in Electrical system.

1.9   Discuss the reasons for not using fuse in Neutral wire

1.10   Describe the procedure of first aid for shock treatment to an electrocuted person.

1.11　Explain the effects of shocks and electrocution.

2.0　Estimate Lighting and Power loads
2.1　Explain different types of service mains
2.2　Select the service main suited to the given situation
2.3　State the merits and demerits of different systems of interior wiring.
2.4　Select the type of wiring system suitable to the given situation
2.5　List the electrical material used in wiring the service mains.
2.6　List the schedule of rates used in preparing estimate
2.7　Estimate the material requirement for indoor wiring given the plan of a building.
2.8　Draw the wiring layout for a big office building
2.9　Draw the wiring layout for a workshop/ Electrical Laboratory
2.10　Draw the wiring layout of a Big industry.
2.11　Draw wiring layout of a Big Hotel with lift arrangement
2.12　Draw the wiring layout and estimate the material required for a Residential Building with 2 bed room house.
2.13　Prepare layout and draw single line wiring diagrams as per standard practise for a given set of machines in a workshop.
2.14　Select type of wiring system and lighting requirements
2.15　Calculate the wire sizes for various circuits
2.16　Specify important materials used under given condition
2.17　Calculate the quantities of all materials required for the above.
2.18　Prepare the estimate of the complete installation as per　standard practice
2.19　Select the type of wiring and service mains used for the　irrigation pump set.
2.20　Specify the material used in the execution of the irrigation pump set installation.
2.21　Prepare an estimate for electrifying the irrigation pump set scheme
2.22　Prepare an estimation for submersible pump installation

3.0　Estimate the type of material and quantity required for OH Lines and Earthing
3.1　Calculate the total number of insulators required for the given scheme
3.2　Select the type of insulators to be used for over head lines.
3.3　Select the type size and number of cross arms required for the overhead line
3.4　Determine the size and total length of overhead conductor required for the line giving due consideration for the sag to be allowed
3.5　Estimate the quantity of all materials required for given 11 KV and 400 v overhead lines as per standard practice followed by NEC
3.6　Estimate the quantity of material required for the following transformer substations　i)pole mounted　　　　　　　ii)plinth mounted
3.7　Select supporting poles of suitable size and height to install a given transformer as per standard practice in NEC
3.8　Draw plinth and Pole Mounted transformer substation and estimate the quantity of materials required in each case.
3.9　Estimate the quantity of all the electrical accessories and components required for the given
　　　i)Pole mounted transformer i)Plinth mounted transformer
　　including the operating mechanism as per standard practice in NEC

3.10　State the purpose of Earthing and types that are normally used.
3.11　Select the suitable type of Earthing for a given installation as per IS3043.
3.12　Specify the different components used in electrical Earthing of a given installation

3.13   List the materials that are to be used in the earth pit surrounding the earth electrode

3.14   Prepare the estimate for pipe and plate Earthing

4.0   Departmental Test, REC and Electrical Act 2003

4.1   Describe the departmental procedure for obtaining a service connection

4.2   Specify insulation resistance desirable for a given electrical installation

4.3   Specify the value of earth resistance to be maintained for a given electrical installations

4.4   Describe the test procedure for continuity of wiring in an electrical installation.

4.5   Explain the procedure for conducting insulation test of domestic wiring

4.6   Survey the load particulars in a village for
        i)Domestic   ii) industrial   iii) agricultural loads.

4.7   Calculate the capacity of a transformer required assuming suitable diversity factor

4.8   Determine the location point of transformer and calculate the tail end voltage regulations as per the practice in NEC.

4.9   Determine the economic feasibility of the scheme as per the standard norms fixed by REC to execute the scheme.

4.10   State major rules applicable to electrical installations as per Electrical act 2003

4.11   Write as per the Electrical act 2003, the rules and procedures to be adopted during execution of the following electrical installations.
        i)Domestic lighting & Power   ii) Industrial

4.12   State the standards and code of practice followed by NEC in respect of electrical installations and OH lines of 11 KV and 400V pole mounted and Plinth mounted transformers.

4.13   State new I.E. Rules relating to safety and electric supply given by the Central Electricity Authority- 2010.

COURSE CONTENT

1.   Wiring Systems and Safety Procedures

Introduction, size of wires, standard wires, types of wires, CTC, PVC, Lead sheathed .VIR, weather proof wires, flexible wires different types of cable wires – Types and Installation of House Wiring Systems & Wirings Accessories : Methods of installing wiring, clips, screws -round blocks switch boards, sockets socket pins - CTS wiring - Installation of surface conduit wiring - Rigid conduits, flexible conduits - Conduit accessories - elbows bushings - reducers, conduit box saddles, PVC conduit wiring - Concealed wiring - Comparison of various wiring systems -- Distribution fuse boards - Main switches – Different types of fuses and fuse carriers - Safety procedures - Electric shock and first aid, causes for fire hazards in Electrical installations

2.   Estimation of Lighting and power loads

Estimation of domestic lighting installation service main - types of wire - specification - quantity of materials required for service main – estimation and selection of interior wiring system suitable to a given building - number of circuits - calculation of length of wire and quantity of accessories required - estimates of materials for execution of the domestic wiring installation as per National Electrical act 2003 .Power wiring installation Drawing wiring layout for a big office building, electrical laboratory, big industry, big hotel with lift arrangement and a residential building with 2 bed room house.- estimation and costing upto 20 kVA calculation of load current based on ratings of various equipment's to be installed - size of wire - length of wire number of circuits - quantity of accessories for execution of work as per standard practice.

Irrigation pump installation - Estimation upto 10 HP service main - type- calculation of size and quantity of wire and other components required - Labour cost for erection - Type of starter and control panel - accessories quantity and estimation Estimate for the installation of submersible pump.

3.   Estimation of OH Lines and Earthing

Distribution lines of 11 kV and 400Volt OH lines - estimation only quantity of materials required for lines of length 1 km - of number of poles - Cross arms clamps - insulators - conductor length and size for a given power transmission Distribution transformer erection- Estimation of quantity of materials required for structures, isolators - HG fuse operating mechanism, isolators, lightening arrestors for pole mounted substation and plinth mounted substation Quantity estimation for materials required in electrical Earthing both for pipe earthling and plate Earthing suitable to the given equipment or transformer substation

4.   Departmental Tests and REC and Electrical Act 2003

Electrical installation testing - departmental procedure for testing before giving service connection - departmental procedure for obtaining service connection - desirable insulation resistance for domestic and power circuits - Tests for measuring insulation resistance - procedure for conducting insulation resistance test and continuity tests, earth continuity test

Design of rural electrification scheme - Load survey-determination of capacity of transformer - estimation of quantity of materials required for the erection of distribution lines and 11 kV feeder from a nearby 11 kV feeder - determining the economic feasibility of the scheme as per the procedure laid out in NEC, - Extracts from Indian Electricity rules 1956 and code of practice by NEC regarding - domestic power, agricultural industrial wiring installations, erection of 11 kV, 400 Volt distribution lines - pole mounted transformer – New I.E. Rules

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4. Arora -Electrical wiring
5. BVS Rao -Maintenance and Operation of Electrical Equipment –Vol-I-TMH
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ELECTRONICS - II

Subject Title	:	**ELECTRONICS-II**
Subject code	:	**EE-405**
Periods/Week	:	**04**
Periods/Semester	:	**60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of Marks	Short Questions	Essay Questions
1.	Feed Back Amplifiers	**18**	**26**	**02**	**02**
2.	Oscillators	**10**	**26**	**02**	**02**
3.	Linear ICs	**16**	**26**	**02**	**02**
4.	Modulation and Demodulation	**8**	**16**	**02**	**01**
5.	Electronic instruments	**8**	**16**	**02**	**01**
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0   Comprehend the Working of Amplifiers.
1.1   Explain the need for power amplifier
1.2   Distinguish between voltage and power amplifier
1.3   Explain the working principle of a single tuned amplifier
1.4   Define i)feedback   and   ii)feedback factor
1.5   Draw the block diagrams of Voltage Series and Voltage Shunt feedback amplifiers.
1.6   Explain the effect of feed back on gain, band width distortion, noise
1.7   Explain the performance characteristics of emitter follower.
1.8   List the applications of emitter follower.
1.9   Explain the differences between degenerative and regenerative feedback.

2.0   Comprehend the working of Oscillators.
2.1   Define Oscillator.
2.2   Classify different types of oscillators
2.3   State the conditions required for sustained oscillations
2.4   Classify different types of oscillators
2.5   Explain the need for AF Oscillator.
2.6   Explain the working of RC phase shift Oscillator with the help of circuit diagram.
2.7   Explain the need for RF Oscillator.
2.8   Draw the circuit diagram of the following oscillators
       i)Hartley   ii)Colpitts
2.9   State the need for Square wave Oscillator.
2.10   Explain the working of Transistor multi vibrator circuit.
2.11   Explain UJT relaxation oscillator.
2.12   Mention the different applications of oscillator.

3.0   Comprehend Linear Integrated circuits.
3.1   Explain the operation of Differential Amplifier with the help of a circuit diagram.
3.2   Define CMRR (common mode rejection ratio) of differential amplifier.

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3.3   Give reasons for not implementing Differential Amplifier with discrete components.

3.4   List the advantages of ICs over discrete circuits.

3.5   List the characteristics of an Ideal Operational Amplifier.

3.6   Explain the working of Operational Amplifier with the help of a block diagram.

3.7   Draw the symbol of OpAmp. and mark the terminals.

3.8   Explain the working of OpAmp. inverting amplifier with input and output waveform.

3.9   Explain the term virtual ground.

3.10   Explain Non-inverting amplifier configuration with input and output waveform.

3.11   Give formula for Gain.

3.12   List the applications of OPAmps.

3.13   Explain the Operational Amplifier as
        i)summer   ii)integrator   iii)differentiator   iv)scale   changer   and
        v)invertors.

3.14   Give the Pin out diagram of 741 IC.

3.15   Mention four important specifications of 741 IC.

3.16   State the need of timer.

3.17   Draw and explain the internal block diagram of IC 555 timer.

3.18   Draw the Pin diagram of 555IC.

3.19   Explain the function of each pin of 555 IC.

3.20   Give design rules and circuit for implementing ON-Timer using 555IC.

3.21   Explain the working of astable Multi vibrator using 555 IC. And draw the output wave forms.

3.22   Give formula for frequency of 555 astable Multi vibrator

4.0   Appreciate the need for Modulation and Demodulation.

4.1   Define Amplitude modulation and

4.2   Draw the waveforms of amplitude modulated wave.

4.3   Explain the generation of sidebands.

4.4   Define Band width of AM wave.

4.5   Give the equation for AM wave.

4.6   Mention the different components of AM wave in the equation.

4.7   Explain power distribution in AM wave.

4.8   Define Modulation Index of a AM wave.

4.9   Explain the effect of Over modulation and Under modulation with wave forms.

4.10   Define Frequency modulation

4.11   Draw the waveforms of frequency modulated waves

4.12   Define frequency deviation.

4.13   Mention the band width requirements of FM wave

4.14   Compare AM and FM systems.

5.0   Comprehend the various Electronics Instruments

5.1   State the advantages of Electronic Instruments.

5.2   Explain the need of Cathode Ray Oscilloscope(CRO) as a Laboratory Instrument.

5.3   Explain the functions of various stage of a C.R.O. with the help of a block diagram

5.4   State the necessity of time base voltage

5.5   Mention the use of various front panel controls of a C.R.O.

5.6   List the applications of C.R.O.

5.7   Explain Loading effect of voltmeter with an example.
5.8   State the need for A/D converters.
5.9   State the need for D/A conversion.
5.10   Explain the basic principle of D/A conversion.
5.11   Explain the terms resolution, Accuracy, Monotonicity and settling time of D/A converter.
5.12   Explain D/A conversion using R-2R ladder network.
5.13   Explain A/D conversion using successive approximate method.
5.14   Explain the working of Ramp type Digital Voltmeter with the help of a block diagram
5.15   Explain the digital frequency meter with the help of a block diagram.
5.16   Explain the working principle of function generator

COURSE CONTENT
1.   Feed back Amplifiers
Power amplifier-single tuned amplifier- feedback- Voltage Series and Voltage Shunt feedback amplifiers- emitter follower- degenerative and regenerative feedback.

2.   Oscillators
Oscillator.-types of oscillators- AF Oscillator- RC phase shift Oscillator- RF Oscillator- Hartley oscillator-Colpittsoscillator-Square wave Oscillator- UJT relaxation oscillator- applications of oscillators.

3.   Linear Integrated circuits.
Differential Amplifier-CMRR-advantages of ICs-Operational Amplifier- inverting amplifier -Non-inverting amplifier- Gain- summer-integrator-differentiator-scale changer –invertors-741 IC.- IC 555 timer- astable Multi vibrator

4.   Modulation and Detection
Principle of modulation - AM and FM-Linear collector modulation- Comparison between AM and FM-super hetrodyne radio receiver.
5.   Electronic Instruments
Electronic Instruments.-Advantages-CRO-necessity of time base voltage- Ramp

type Digital Voltmeter- Over modulation and Under modulation-digital frequency

meter-function generator- A/D converters.- D/A converters

REFERENCES
1.   G.K. Mithal -Industrial Electronics
2.   David C. Cooper -Electronic Instrumentation
3.   G.K.Mithal -Applied electronics
4.   M. Ramamurthy -Thyristor Engineering
5.   Malvino -Electronic Principles
6.   Bhargava -Basic Electronics - TTTI Publishers.
7.   V.K. Mehtha -Principles of Electronics
8.   Mathur,Chada & Kulakshetra-Electronic devices and circuits
9.   George kennedy -Electronic communication systems TMH
10. Mandal -Basic Electronics –TMH.

OGRAMMING IN 'C'

Subject Title	:	**Programming in 'C'**
Subject code	:	**EE-406**
Periods/Week	:	**04**
Periods/Semester	:	**60**

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Basics of 'C' Programming	10	11	2	1/2
2.	Decision & Loop Control Statements	12	26	2	02
3.	Arrays& Strings	14	26	2	02
4.	User defined Functions	12	26	2	02
5.	Structures , Unions & Pointers	12	21	2	1 & 1/2
	Total	60	110	10	08

OBJECTIVES

Upon completion of the study of the subject the student shall be able

1.0   Comprehend the Basics of 'C' Programming
1.1   State the Importance of 'C'
1.2   Explain the basic structure of 'C' Programming
1.3   Know the Programming style with sample program
1.4   Execute a 'C' Program
1.5   Know about the character set
1.6   Know about constants, variables, keywords & identifiers
1.7   List various data types with examples
1.8   Explain different arithmetic operators, relational operators and logical operators with their precedence
1.9   Explain the assignment statements
1.10   Explain the increment & decrement operators
1.11   Identify the compound Assignment operators
1.12   Explain the I/P functions printf and scanf
1.13   Know various type conversion techniques

2.0   Understand various Decision & Loop Control Statements
2.1   State the Importance of conditional expressions
2.2   List and explain the various conditional statements
2.3   Explain the switch statement
2.4   List the different iterative loops and explain them(for, do, while statements)
2.5   Define nesting and implement with simple programs
2.6   Differentiate 'break' and 'continue' statements with programs
2.7   Mention about the null statements and comma operator

3.0   Know about the Arrays & Strings
3.1   Define 1-D and 2-D Arrays.
3.2   Know how to initialize above arrays and access array elements
3.3   Explain simple programs using arrays
3.4   Define 'string'
3.5   Know how to declare and initialize string variables

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3.6   Understand various string handling functions
3.7   Implement programs using string functions

4.0   Understand the concept of User defined functions
4.1   Define 'function'
4.2   Understand the need for User defined function
4.3   Know the return values and their types
4.4   Write programs using function call technique
4.5   List the four storage classes supported by C
4.6   Discuss the importance of function proto types in programming
4.7   Differentiate local and external variables
4.8   Identify automatic and static variables and discuss them in detail
4.9   Write simple programs on above

5.0   Understand Structures , Unions & Pointers
5.1   Define a structure
5.2   Describe about structure variable
5.3   Explain initialization of structures
5.4   Know the accessing of members of a structure.
5.5   Illustrate concept of structure assignment
5.6   Explain how to find size of a structure.
5.7   Know passing of individual members of a structure to a function

5.8   Define a Union and Illustrate use of a union
5.6   Declare a pointer, assign a pointer, and initialize a pointer
5.7   Discuss   pointer arithmetic.
5.8   Illustrate with example how pointer can be used to realize the effect of
        parameter passing by reference.
5.9   Illustrate with examples the relationship between arrays and pointers.
5.10   List various conditional and unconditional preprocessor directives

COURSE CONTENT
1.   Basics of 'C' Programming
     Structure of a C programme, Programming rules, Character Set Keywords,
     Constants, Variables, Data types, Type conversion.Arithmetic, Logical, Relational
     operators and precedences – Assignment, Increment, Decrement operators,
     evaluation of expressions. I/P functions

2.   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.   Arrays and Strings
     1 D Array declaration, Initialization, 2 D Array declaration, Initialization,
     Accessing of Array elements, Character Arrays declaration and Initialization of
     Strings, string handling functions

4.   User defined Functions

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

5. **Structures ,Unions & Pointers** Structure features, Declaration and Initialization, Accessing of Structure members, Unions. Pointer declaration, Arithmetic operations and pointers, Pointers and Arrays, Various Preprocessor directives.

REFERENCES

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

ELECTRICAL ENGINEERING DRAWING

Subject Title	:	**Electrical Engineering Drawing**	
Subject code	:	**EE-407**	
Periods/week	:	**07**	
Periods/ Semester	:	**105**	

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short Questions	Essay Questions
1.	Graphical symbols, view of fuses, Couplings and bearings	7	05	01	--
2.	D.C. Machines	10	05	01	
3.	D.C and A.C.windings	17	10		½
4.	Transformers	10	10	--	½
5.	Induction Motors	17	15	01	½
6.	Switch gear, Protection and Cables	10	05	01	
7.	Supporting structures	11	10		½
8.	Substations and Power Plants	13	20		½
9.	Earthing Systems	10	10		½
	Total	105	80	04	03

OBJECTIVES

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

1.0   Comprehend graphical symbols, view of fuses, Couplings and Bearings

(No. of plates:2)

1.1   Draw standard symbols of electrical components and fixtures
1.2   Draw Sectional and end view of
   i)   Rewirable fuse
   ii) Catridge fuse
   iii) HRC fuse
1.3   Draw sectional elevation and end views of a flange coupling (protected type).

2.0   Draw the different views of DC machines(No. of plates:2)
2.1   Draw views, including sectional views of yoke and pole assembly
2.2   Draw sectional view of armature of DC machine
2.3   Draw sectional views of commutator of a DC Machine
2.4   Draw Sectional elevation and end view of a DC Machine.
2.5   Draw end views of end plate with ball bearing.

3.0   **Develop D.C.Windings and A.C.Windings(No. of plates:3)**
3.1   Draw the winding diagram of a Single Layer Lap connected D.C Machine
3.2   Draw the winding diagram of a Single Layer Wave connected D.C Machine

3.3   Draw winding diagram of a 1-phase single layer lap winding.
3.4   Draw winding diagram of a 1-phase single layer wave winding.
3.5   Draw winding diagram of a 3-phase single layer lap winding.
3.6   Draw winding diagram of a 3-phase single layer wave winding.

4.0   Draw the views of Transformers(No. of plates:2)
4.1   Draw different core sections of a Transformer.
4.2   Draw sectional views of a single-phase single stepped core type transformer from the given data
4.3   Draw sectional views of a 3 phase three stepped core type transformers from given data

5.0   Draw the views of Induction Motors (No.of plates-3)
5.1   Draw the assembled views of induction motors.
5.2   Draw the sectional views of different parts of an induction motor (stator, rotor, shaft, end shields and slip rings)
5.3   Draw the sectional views of 3 phase squirrel cage induction motor.
5.4   Draw the sectional views of 3 phase slip ring induction motor.
5.5   Draw the wiring diagram of D.O.L. Starter
5.6   Draw the wiring diagram of Autotransformer starter.
5.7   Draw the wiring diagram of Rotor resistance starter.
5.8   Draw the wiring diagram of Automatic star/delta starter.
5.9   Draw the wiring diagram of Star/delta starter.

6.0   Sketch the Switch gear, Protection and Cables (No. of plates:3)
6.1   Sketch and label the parts of
        (i) Air break switch
        (ii) Circuit breakers - Minimum oil circuit breaker, Bulk oil circuit breaker,
                            Air blast circuit breaker and SF_6.Circuit breaker.
6.2   Sketch the lightning arrestor and name the parts.
        i)   Valve type
        ii)   Thyrite type.
6.3   Draw the cross sectional views of cables
        (i) Single core   (ii) 3-core belted cable   (iii) 4-core cables
        (iv) H- type cable   (v) SL type cable   (vi).HSL type cable

7.0   Draw the sketches of Supporting Structures (No. of plates:2)
7.1   Draw the sketches of
        i) Line supports   ii) Towers   iii) Stays
7.2   Draw the sketches of the following
        i) L.V. line supports
        ii) 132 kV steel towers (single circuit and double circuit)
        iii) 220kv steel towers (single circuit and double circuit).

8.0   Draw the sketch of Substations and Power Plants(No. of plates:3 or4)
8.1   Draw the sketch of
        i)   Pole mounted   11kV / 400 volts substation
        ii)   Plinth mounted 11kV / 400 volts substation.
8.2   Draw the line diagram of 33kV / 11kV substation.
8.3   Draw the line diagram of 220kV / 132kV substation.
8.4   Draw the single line diagram for

i) Medium head hydroelectric plant
ii) High head hydroelectric power plant
iii)Thermal power plant.

9.0   Draw the sketches of different electrical Earthing system.
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(No. of plates:2 or 3)
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9.1   Draw the dimensioned sketch of
   i)   Pipe Earthing
   ii)   Plate Earthing
9.2   Draw the dimensioned sketch of
   i)   Transformer yard Earthing
   ii)   Sub-station Earthing

COURSE CONTENTS
1. Graphical symbols, views of fuse, switches
Graphical symbols as per ISI standards, Views of fuses, Rewirable fuse, Cartridge fuse, HRC fuse, Shaft coupling, Protected, Bearings.

2. DC machine parts : (Assembled views in section)
Stator yoke and pole assembly, pole and field coil assembly main and interpoles, Armature of a small DC machine, Commutator of DC machine, Face plate type 3 point and 4 point starter,

3. D.C Winding and A.C.Winding.
Single Layer Lap and Wave Windings - Winding tables- -Brush location – Equalizer rings. A.C. 1- phase and 3-ϕ single layer lap and wave winding.
4. Transformers
Core sections, sectional views of single-phase single stepped core type, three phase three stepped core type transformers.

5. Induction Motors
Sectional elevation and end views of 3 – phase   Squirrel Cage I.M, 3-Phase Slip Ring I.M – Different types of starters used for 3 – phase IM'S.

6. Switch gear, Protection and Cables
   Different types C.B's -- Valve type & Thyrite type lightning arresters - single core, 3 core belted cable, 4 core Cables, H type cable , SL type cable and HSL type cable.
7. Supporting structures
   Views of - line supports – Towers - Stays for L.V   & H.V

8. Substations and Power Plants
   Layouts of substations, pole mounted and plinth mounted substations- Electrical Layout of 33/11Kv, 220/132 Kv substations, single line diagram of generating stations.

9. Earthing systems
    Pipe earthing, plate earthing, Transformer yard earthing ,Substation earthing system.

REFERECES

1. G.B.Bharadwaja.-Electrical Engineering Drawing
2. Dargon.-Electrical Engineering Drawing
3. Narang.-Electrical Engineering Drawing
4. Surjit singh-Electrical Engineering Drawing

Communication Skills Practice

Subject title : **Communication skills Practice**
Subject code : **EE-408 (Common to all branches)**
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

Sno.	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			
		45	60	40	100

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.

A.C. MACHINES LABORATORY PRACTICE - I

Subject Title : **A.C .Machines Laboratory Practice - I**
Subject Code : **EE- 409**
Periods/Week : **03**
Periods/Year(Sem) : **45**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
I.	Performance of single phase transformers	9
II.	Sumpner's test and Scott connection	9
III.	Parallel operation of transformers and oil testing kit	9
IV.	Alternators	21

OBJECTIVES (LIST OF EXPERIMENTS)

Upon completion of the course the student shall be able to

I. **Observe the Performance of single phase transformers.**
1. Conduct load test on 1-phase Transformer and calculate efficiency and regulation
2. Conduct the following two tests on 1-phase Transformer
   i) O.C. test ii) S.C. tests and from the result
   a) Draw the equivalent circuit.
   b) Calculate efficiency at various loads and p.f.s
   c) find the load at which maximum efficiency occurs.
   d) Calculate All-day efficiency for the given load cycle of 24 hours.

II **Conduct Sumpner's test ,Perform Scott connection and load sharing.**
3. Obtain the efficiency and regulation of two similar 1-phase transformers by conducting sumpner's test.
4. Conduct scott connection (T- connection) on transformers.
5. Connect two identical 1-ph transformers in parallel and observe the load sharing

III. **Observe the Performance of Alternators**
6. Conduct (direct) load test on Alternator and obtain voltage regulation.
7. Obtain the regulation of Alternator by using synchronous impedance method.
8. Synchronise the given Alternator with supply mains by using bright lamp method.

IV. **Report on observations on Industrial visits**
9. Visit a 33/11 KV substation
   i)Observe the connections of 3-phase power transformers
   ii)Draw the wiring diagram of their parallel operation
   iii)List the various equipment used by noting their ratings.
   iv)Write a report on the functioning of various equipment
10. Visit a nearby Generating station.
    i) Understand its layout.

ii).Note down its capacity and duty cycle.

iii) Observe the placement of the various equipment.

iv).Write a report on its working.

11. Visit any nearby Solar installation

i)Understand its functioning

ii)write a report on the functioning of various equipment

iii)Draw the Layout diagram.

Key competencies to be achieved by the student

S.No	Experiment title	competencies	Key competencies
1	Performance of single phase transformers	▪ Draw the required circuit diagram. ▪ Identify the different terminals of the given 1-ph transformer. ▪ Interpret the name plate details. ▪ Select proper supply terminals. ▪ Select proper range and type of meters. ▪ Make connections as per circuit diagram. ▪ Follow the precautions to be taken(ex: Check for loose and/or wrong connections if any and rectify). ▪ Follow the instructions and increase the given load gradually and tabulate the observations. ▪ Draw the efficiency curve and locate the maximum efficiency point.	• Identify the different terminals of 1-ph transformer. • Select proper range and type of meters • Increase the given load gradually
2	Conduct Sumpner's test ,Perform Scott connection and conduct parallel operation of Transformer.	▪ Select proper range and type of meters. ▪ Make connections as per circuit diagram. ▪ Follow the instructions and perform sumpner's test by giving required rated voltage on primary side. ▪ Check for series opposition (back to back) connection on secondary side. ▪ Give required reduced voltage on secondary side. ▪ Tabulate observations. ▪ Calculate efficiency and regulation. ▪ Identify main and teaser trans formers and their terminals ▪ Give the required 3-ph supply. ▪ Take readings on both 3-ph and 2-ph side. ▪ Interpret the readings and verify 3-ph to 2-ph transformation. ▪ Conduct polarity test and ascertain the relative polarities of secondary windings for parallel operation of Transformers.	• Give required rated voltage on primary side. • Check for series opposition (back to back) connection on secondary side. ▪ Identify main and teaser trans formers and their terminals

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3	Performance of Alternators	▪ Draw the required circuit diagram. ▪ Identify the different terminals of 3-ph Alternator, exciter and prime mover . ▪ Interpret the name plate details. ▪ Select proper supply for prime mover and exciter. ▪ Select proper range and type of meters. ▪ Make connections as per circuit diagram. ▪ Increase the given load gradually and tabulate the observations. ▪ Calculate regulation at each load. ▪ Select proper supply for armature resistance test. ▪ Make connections for armature resistance test. ▪ Give required voltage , take readings and obtain armature resistance . ▪ Calculate synchronous impedance and regulation. ▪ Give required field current . ▪ For bright lamp method, Synchronise the alternators when all the conditions are satisfied.	▪ Select proper supply for prime mover and exciter. ▪ Select proper supply for armature resistance test ▪ For bright lamp method, Synchronise the alternators
4	Report on Industrial visits	▪ Understand its layout ▪ Draw the wiring diagram ▪ Writing a report	• Writing a report

COURSE CONTENT
1. Performance of single phase transformers :
Load test on 1-ph transformer - obtaining the equivalent circuit parameters ,calculate efficiency , regulation , All-day efficiency of 1-ph transformer by conducting O.C. and S.C. tests.

 2. Sumpner's test and Scott connection :
Obtaining the efficiency and regulation of two similar 1-phase transformers by conducting sumpner's test - scott connection(T- connection) on transformers. Connect two 1-ph transformers in parallel and observing the load sharing

3..Alternators :
Load test on Alternator – obtain the regulation of alternator by using synchronous Impedance method – Synchronisation of the given Alternator with supply mains by using bright lamp method.

5. Industrial visits:
Visit a 33/11 KV substation, Generating station and Solar installation and write a report on them.

ELECTRONICS –II LABORATORY PRACTICE

Subject Title : **Electronics – II Laboratory Practice**
Subject Code : **EE-410**
Periods/Week : **03**
Periods/Semester : **45**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	**RC coupled Amplifier Characteristics**	**12**
2.	**Oscillators Characteristics**	**9**
3.	**Photo Electric Devices**	**9**
4.	**555 IC**	**15**
	Total	**45**

COURSE CONTENT

1.0 OBTAIN THE CHARACTERSTICS OF A RC COUPLED AMPLIFIER
1.1 Plot the frequency response characteristics of a RC coupled Amplifier*.*
1.*2* Calculate the gain, f1, f2 and band width from the response.
1.3 Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion*.*
1.*4* Measure the voltage across Emitter Resistance using CRO, with and without emitter bypass capacitor Ce.
1.*5* Measuring the output power using AC power meter

2.0 OBTAIN THE CHARACTERSTICS OF THE OSCILLATORS
2.1 To observe the output of a tuned circuit oscillator and identify the type from the components in the circuit
a) Colpitt's oscillator   b) Hartley oscillator
2.2 2.2 Observe the effect of varying the core of inductor
2.3 Observe the effect of using a crystal in the oscillator circuit

3.0 OBTAIN THE CHARACTERSTICS OF THE PHOTO ELECTRIC DEVICES
3.1 To plot the characteristics of a Photo diode.
3.2 To plot the characteristics of a Photo transistor
3.3 To plot the characteristics of a LDR.

4.0 FAMILIARIZE TO WORK WITH 555 IC.
4.1 To Implement Monostable multi vibrator
4.2 To Implement Astable multivibrator

OBJECTIVES:
Upon completion of the Practice, the student shall be able to

1.0 OBTAIN THE CHARACTERSTICS OF A RC COUPLED AMPLIFIER
1.1 Assembling the circuit as per the circuit diagram
1.2. Identifying the coupling and bypass capacitors(types, values)
1.3. Observing the 3db points

1.4. Observing the distortion(clipping) of signal on CRO and adjusting the input for distortionless output

1.5. Plot the output characteristics on semi log graph sheet and also on normal graph sheet.

1.6. Calculating the gain in db

2.0 OBTAIN THE CHARACTERSTICS OF THE OSCILLATORS

2.1 To observe the output of a tuned circuit oscillator and identify the type from the components in the circuit
a) Colpitt's oscillator   b) Hartley oscillator

2.2 Observe the effect of varying the core of inductor

2.3 Observe the effect of using a crystal in the oscillator circuit

3.0 OBTAIN THE CHARACTERSTICS OF THE PHOTO ELECTRIC DEVICES

3.1 To plot the characteristics of a Photo diode.

3.2 To plot the characteristics of a Photo transistor

3.3 To plot the characteristics of a LDR.

4.0 FAMILIARIZE TO WORK WITH 555 IC.

4.1 Familiarize with 555 pin configuration

4.2 Performing the experiment as per procedure's

4.3 Observing wave forms on CRO.

4.4 Observing the effect of changing R, C component Values

4.5 Observe wave forms at Pins 2 , 3 and 5

4.6 Observe the effect of applying a voltage to pin 5

4.7 Observe the effect of connecting pin 4 to ground.

Competencies to be achieved by the student

S.No	Experiment title	Competencies
1	**Obtain the characteristics of a RC coupled amplifier**	1. Assembling the circuit as per the circuit diagram 2. Identifying the coupling and bypass capacitors(types, values) 3. Observing the 3db points 4. Observing the distortion(clipping) of signal on CRO and adjusting the input for distortionless output 5. Plot the output characteristics on semi log graph sheet and also on normal graph sheet. 6. Calculating the gain in db
2	**Obtain the characteristics of the Oscillators**	1.Observe the effect of varying the core of inductor 2. Observe the effect of using a crystal in the oscillator circuit
3	**Obtain The Characteristics Of The Photo Electric Devices**	1.To plot the characteristics of a Photo transistor 2.To plot the characteristics of a LDR.
4	**Familiarize to work with**	Draw Inference from the Observed waveforms b) use 555 for Square wave Oscillator/Clock and

	555 IC	Voltage controlled Oscillator applications

REFERENCES
7. Principles of Electronics by V.K. Mehta, S Chand& Co.
8. Basic Electronics and Linear circuits by Bhargava, TMH Publishers
9. Electronic Principle by Malvino
10. Electronic devices and circuits by Mathur, Chada & Kulashrestha
11. Industrial Electronics by G.K. Mithal
12. Applied Electronics by G.K. Mithal

DIPLOMA IN ELECTRICAL& ELECTRONICS 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:								
EE-501	Electrical Utilization	4	-	60	3	20	80	100
EE-502	A.C.Machines - II	4	-	60	3	20	80	100
EE-503	Power Systems – II (T&D)	5	-	75	3	20	80	100
EE-504	Industrial Drives	3	-	45	3	20	80	100
EE-505	Digital Electronics	4	-	60	3	20	80	100
EE-506	Maintenance of Electrical Systems	4	-	60	3	20	80	100
PRACTICAL:								
EE-507	Matlab Practice	-	6	90	3	40	60	100
EE-508	Life skills	-	3	45	3	40	60	100
EE-509	A.C.Machines – II Laboratory Practice	-	3	45	3	40	60	100
EE-510	Field Practices	-	6	90	3	40	60	100
	TOTAL	24	18	630		280	720	1000

ELECTRICAL UTILISATION

Subject Title	:	**ELECTRICAL UTILISATION**
Subject Code	:	**EE-501**
Periods/Week	:	**04**
Periods/semester	:	**60**

TIME SCHEDULE

SI. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electric Lighting	**16**	**29**	**3**	**2**
2.	Electric heating	**14**	**26**	**2**	**2**
3.	Electric welding	**10**	**23**	**1**	**2**
4.	Refrigeration, Air conditioning and Auto Wiring	**10**	**16**	**2**	**1**
5	Energy saving devices	**10**	**16**	**2**	**1**
	Total	**60**	**110**	**10**	**8**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the principles of lightings
1.1 Explain the nature of light and of its propagation
1.2 State the units of wave length
1.3 Define
- i) Plane and solid angles
- ii) luminous flux
- iii) Luminous intensity
- iv) Lumen
- v) Candle power
- vi) Illumination
- vii) Brightness
- viii) Polar curve
- ix) MHCP
- x) MSCP
- xi) MHSCP

1.4 Explain the production of light by
- i) Excitation
- ii) Ionisation
- iii) Fluorescence and phosphorescence

1.5 List the types of lamps used for illumination for different situations such as
- i) Domestic
- ii) Industrial
- iii) Decoration
- iv) Advertisement
- v) Street lighting schemes

1.6 Define glare
1.7 State the requirements of good lighting
1.8 List the lamp fittings used in domestic and Industrial applications
1.9 Draw different lamp fittings
1.10 State the uses and advantages of each type of Lamp fittings.
1.11 State the laws of illumination.
1.12 Explain the laws of illumination.
1.13 Solve Problems on Illumination
1.14 Define the terms:

i) Utilisation factor	ii) Depreciation factor	iii) Waste light factor
iv) Reflection factor	v) Reduction factor	vi) Absorption factor
vii) Luminous efficiency	viii) Specific energy consumption	ix) Space - height ratio

1.15 Design a simple lighting scheme for
   i) Indoor,
      a) Drawing Halls
      b) Assembly Halls.
      c) Factory
   ii) Out door
      a) Flood lights for open area.
      b) Street lighting by light flux method

2.0 Understand the principle of electric heating and its industrial applications
2.1 State the advantages of electric heating
2.2 List the requirements of good heating material
   i) State the materials employed for heating
   ii) Design of heater element and problems
2.3 Explain with legible sketch
   i) Direct resistance heating
   ii) Indirect resistance heating
2.4 State the industrial application of
   i) Direct resistance heating
   ii) Indirect resistance heating
2.5 Explain the different methods of temperature controls with legible sketch
2.6 Explain the different types of electric arc furnaces with legible sketch:
         i) Direct arc furnace   ii) Indirect arc furnace
2.7 Explain the basic circuit for electric arc furnace showing the arrangement of OCB Control panels, CTs through relays, furnace transformer and arrangement of electrode movement
2.8 Explain the application of direct arc furnaces in industry
2.9 Explain the application of indirect arc furnaces in industry
2.10 Explain the principle of operations of induction furnaces with legible sketches (low and
   high frequency, core type and core less type)
2.11 List the industrial application of the following Furnaces.
   i) core type   ii) coreless type   iii) high frequency type
2.12 State the principle of dielectric heating
2.13 List the industrial applications of the dielectric heating
2.14 Solve problems on Dielectric heating.

3.0 Explain the types, applications and equipments of electric welding
3.1 State different types of electric welding
3.2 Explain the principles of

i) Resistance Welding	ii) Spot Welding
iii) Seam Welding	iv) Butt Welding
v) Arc Welding	vi) Metal Arc Welding
vii) Carbon Arc Welding	

3.3 List the conditions for Successful Welding

3.4   Explain the characteristics of a welding generator
3.5   Explain with legible sketch the principle of operation of welding transformer with a reactance coil
3.6   Explain the different types of electrodes used for welding
3.7   Explain electronic circuits used for welding
3.8   Explain the `Sequence Weld' with a block diagram

4.0   **Understand the Electrical equipment of a refrigerator, Air conditioner, Two wheeler, Four wheeler and Car Stereo wiring**
4.1   Draw the block diagram and electric circuit of Refrigerator
4.2   State the function of each component in the electric circuit of a Refrigerator
4.3   Draw the block diagram and electric circuit of Air conditioner
4.4   State the function of each component in the electric circuit of a Air conditioner
4.5   Draw the Circuit diagram of Lighting, Ignition, self starting and Battery charging of two wheeler.
4.6   Draw the Circuit diagram of Lighting, Ignition, self starting and Battery charging of four wheeler.
4.7   Draw the Circuit diagram of Car stereo wiring.

5.0   Appreciate the Concept of Electric Power saving Devices
5.1   State the need of power saving devices.
5.2   Draw Automatic temperature control circuits for (coolers, greasers, air conditioners, and iron boxes)
5.3   Draw Automatic illumination control circuits using LDR's.
5.4   List the advantages of CF Lamps.
5.5   List the advantages of LED lamps over other types of lamps.
5.6   Compare CF lamps with tungsten filament lamps.
5.7   Explain the working of magnetic Induction lamps.
5.8   List the advantages of Remote operated Power utility devices like TV, Fan and lamps.
5.9   State the principles of Energy efficient systems.
5.10   List the advantages of using energy efficient systems for Electric motors, transformers and Power factor improvement devices.
5.11   Explain the concept of energy auditing and Management.

COURSE CONTENT
1. **Electric Lighting**
        Nature of light and its production, electro magnetic spectrum physical spectrum - units of wave length - Terms and definitions plane and solid angle, luminous flux, Lumen, C.P. Illumination, brightness, polar curve, MHCP, MSCP, MHSCP, Principle of production of light by excitation, ionisation, fluorescence and phosphorescence - types of lamps - Requirements of good lighting different types of lamp fittings laws of illumination. Terms and factors used in design of lighting schemes for indoor, factory, outdoor and street lighting schemes - problems
2. **Heating**
        Advantages of electric heating - requirements of good heating material and materials generally employed, direct resistance heating - principle and application design of heating element - Indirect resistance heating - Principle and applications - Temperature control of resistance furnaces - Electric arc furnaces - direct and indirect types - applications - Induction heating core type and coreless

type - Applications - Dielectric heating - principle advantages and applications – problems on dielectric Heating.

3. **Welding**

Types of welding - Principle and applications of Resistance welding - spot welding -seam welding - butt welding - Arc welding –Metal Arc welding- Carbon Arc welding - use of coated electrode power supply - Welding generator, welding transformer - welding control circuits. Sequence welding circuits

4. **Refrigerator, Air conditioner and Auto Electric Circuits**-

Block diagram and Electric circuit of Refrigerator - function of each component- Block diagram and electric circuit of Air conditioner- function of each component- Electrical circuit diagram of Lighting, Ignition, self starting and Battery charging of two wheeler and four wheelers.- Circuit diagram of Car stereo wiring - functions of various components.

5. **Power saving Devices :**

Need of power saving devices.- Automatic temperature control circuits- Automatic illumination control circuits using LDR's- Advantages of CF Lamps- Advantages of LED lamps over other types of lamps- Compare CF lamps with tungsten filament lamps-Advantages of Remote operated Power utility devices - Principles of Energy efficient systems- Advantages of using energy efficient systems for Electric motors, transformers and Power factor improvement devices- Concept of energy auditing and Management.

REFERENCES

1. Electrical power   by S.L. Uppal
2. Electrical Utilisation   by   Gupta
3. Utilisation of Electric Power   by   Openshaw Taylor
4. Utilisation of Electric energy   by   R.K. Gang
5. Art and Science of electric power   by   H. Partab
6. Electric Traction   by   H. Partab
7. Study of Electrical Appliances and devices   K.B.Bhatia.

A.C. MACHINES – II

Subject Title	:	A.C. MACHINES –II
Subject Code	:	EE-502
Periods/ Week	:	04
Periods /Semester	:	60

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Synchronous motors.	14	26	2	2
2.	3- Phase Induction Motors	22	49	3	4
3.	1- Phase Induction Motors	12	19	3	1
4.	1- Phase Commutator Motors	12	16	2	1
	Total	**60**	**110**	**10**	**8**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0   Comprehend the working of synchronous motors.
1.1   Principle of Production of Rotating Magnetic Field in 3-phase System.
1.2   Explain the construction of synchronous motor and it's parts with legible sketch.
1.3   Explain the principles of working of synchronous motors.
1.4   Explain the performance of synchronous motor on no load & Load with phasor diagrams.
1.5   Explain the effects of varying excitation at constant load with phasor diagrams,
1.6   Explain the significance and account for the shape of 'V' curves, Inverted V curve,
1.7   Explain how a Synchronous motor can be used as a Synchronous condenser.
1.8   Explain the phenomenon of HUNTING.
1.9   State how HUNTING is prevented.
1.10   Explain the starting methods of synchronous motor by
         (i).Auxiliary motor   and   (ii).Damper winding
1.11   List the applications of synchronous motor.

2.0   Comprehend the working of 3 phase Induction Motors,
2.1   Explain the construction of Induction motor- slip ring and squirrel cage
2.2   Compare Slip ring & Squirrel cage Induction motors.
2.3   State the principle of working of 3 phase induction motor.
2.4   Explain working of 3 phase induction motor on   i)no-load and ii) Load.
2.5   Derive the equation relating TORQUE, POWER and SLIP.
2.6   Draw Torque – Slip curves,
2.7   Explain how an induction motor is treated as a generalized transformer.
2.8   Explain **:**   (i)No-load test   (ii) Blocked rotor test and
         Draw circle diagram with the help of above tests.

2.9 Solve problems on evaluation of the performance of induction motors.

2.10 Explain methods of starting of induction motors.

2.11 Explain the working of the following starters with the help of circuit diagram.
- (i) D.O.L. starter.
- (ii) Star/Delta Starter.
- (iii) Auto – Transformer starter.
- (iv) Rotor resistance starter.

2.12 Explain construction features of double cage rotor motor.

2.13 Explain the speed control of inductor motors by
- (i). Frequency changing method
- (ii). Pole changing method.
- (iii) Injecting voltage in rotor circuit.
- (iv).Cascading

2.14 State the advantages of inductor motors

2.15 List at least six applications of inductor motors

2.15 Compare synchronous motors with induction motors.

3.0 Comprehend the working of 1- Phase induction motors.

3.1 List the types of 1- phase induction motors.

3.2 Describe the parts and construction of 1 phase Induction Motor with legible sketch.

3.3 Explain the working principle of 1 – phase Induction motor by
- i) Cross field theory
- ii) Double field revolving theory.

3.4 Explain why a Single-phase Induction motor is not a Self starting motor.

3.5 Describe the Construction of the following motors with legible sketch.
i)split phase motor   ii)capacitor start motor   iii) shaded pole motor.

3.6 Explain the working of the following motors with legible sketch.
i)split phase motor   ii)capacitor start motor   iii) shaded pole motor

4.0 Comprehend the working of single phase Commutator motors .

4.1 Describe the construction of the following types of single phase Motors
i)Commutator motorsii) A.C.Series motors iii)universal motors.

4.2 Explain the working of the following types of single phase Motors
i)Commutator motorsii) A.C.Series motors iii)universal motors.

4.3 List the types of Stepper motors.

4.4 Explain the Principle and working of Stepper motor.

4.5 Explain the working of the following Stepper motors
i)Permanent magnet   ii)variable reluctance I   ii)hybrid stepper motors
iv)Permanent magnet brushless motor with a legible sketch.

4.6 List atleast three applications of above Stepper motors.

COURSE CONTENT

1. Synchronous Motors

Introduction - Rotating Magnetic field, synchronous speed, parts of synchronous Motor – Excitation of rotor working Principle – Back EMF – Resistance and synchronous Reactance – Effects of no load & Load, Vector diagrams – Load Angle, power relation, Effects of change of Excitation at constant Load, Vector diagrams for:(a).   Normal,
(b).   Under and c) Over excitation conditions, Effects of Excitation on Armature current and power factor, Relation between Back EMF, applied voltage, Simple problems - V – Curves and inverted V – curves ,constant power lines – Hunting and its undesirable Effects – prevention of Hunting- Methods of Countering hunting, starting Device necessity – Methods of starting , Applications of synchronous motor.

2. Three Phase Induction Motors

Introduction – Constructional features and differences in respect of cage and wound rotor types. Principle of working & self starting features, actual rotor speed and synchronous speed, slip. Effect of loading on slip – frequency and magnitude of rotor EMF and reactance – Expression for rotor current on no load and on Load – problems. Induction motor as a generalized transformer. Losses and Power transfer stage by stage from stator to rotor – Derive the relation between rotor copper losses – Rotor output and rotor input and problems. Torque equation derivation – Starting torque, condition for maximum torque – Relation Between full load torque, starting Torque and maximum torque – Torque slip curves effects and variation rotor resistance and reactance on starting, full load and maximum torque. Effect of supply voltage on torque and speed, problems. Losses and efficiency – No load and blocked rotor tests, circle diagram from test data – Evaluation of torque – efficiency, problems on circle diagram.Starters for Induction motor – necessity, Direct Switching, D.O.L starter, Star / Delta starter, Auto Transformer starter and rotor resistance starters, Double cage rotor motor – Improvement in performance features. Speed variation of induction motors ,Advantages- Application of induction motors. Comparison of Synchronous and induction motors.

3.   **Single phase Induction Motors**
Essential parts and constructional features of single phase motors – self starting -split phase, capacitors start, capacitor run and shaded pole types and Principles of working –Applications and relative merits.

4.   **Commutator Motors (Single phase)**
Essential parts and Constructional features of A.C series motor – principles of working –Applications - Universal motor- parts, constructional features, principle of working- Applications- Stepper motors – essential features , principle of working and Applications- permanent magnet brushless motor –Applications.

REFERENCES
1.   B.L. Theraja Electrical Technology– S.Chand &Co.
2.   J.B. Gupta -Electrical Technology
3.   H. Cotton -Electrical Technology
4.   T.K.Naga Sankar, M.S.Sukhija -Basic Electrical Engineering- Oxford publications.
5.   Langsdorf-Performance of A.C. Machines
6.   M.V. Deshpande-Electrical motors applications and control
7.   DP Kothari, IJNagrath- Electrical machines-McGrawHill.

POWER SYSTEMS - II
(Transmission & Distribution)

Subject Title : **POWER SYSTEMS - II**
Subject Code : **EE- 503**
periods / week : **05**
Periods / Semester : **75**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Transmission lines	30	34	3	2 & 1/2
2.	HVDC transmission	04	3	1	
3.	Line structures for transmission and Distribution	21	26	2	2
4.	Cables	6	13	1	1
5.	Substations	6	13	1	1
6.	Distribution	8	21	2	1&1/2
	Total	**75**	**110**	**10**	**8**

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

1.0 **Comprehend the need for transmission and choice of supply systems**
1.1 State the need of transmission lines and distribution lines
1.2 Explain the transmission supply systems
   i) D.C   ii)A.C
1.3 State the advantages of D.C and A.C. transmission systems..
1.4 State the supply systems based on the conductor material required for overhead lines and underground cables
   i)   AC - 1 ph 2 wire system
   ii)   AC - 3 ph 3 wire system
   iii) DC – 2 wire system
1.5 Explain the effects of the following on Transmission lines.
   i)Supply frequency   ii)Supply voltage
1.6 Explain the effect of voltage on
   i)Line efficiency   ii)Voltage drop   iii)Line loss
   iv)Active & reactive Power   v)Volume of conductor material
   vi)Cost of-transformers, insulators, switchgear, supports etc.
1.7 State the empirical formula for determining the system voltage
1.8 State the type of transmission line conductors
   a) Solid   b) Stranded   c) Hollow   d) Bundled conductors
1.9 State the relative merits of different types of above conductors
1.10 Explain the current distortion effects

     i)Skin effect   ii)Proximity effect
     iii)Spirality effect   iv)Kelvin's law

1.11 State the different types of conductors used in transmission lines.
1.12 Derive expression for inductance of 1 phase system
1.13 Give the expression for the inductance of 3 phase symmetrical and
    asymmetrically spaced round conductors (No derivation)
1.14 State the need for transposition of overhead lines
1.15 Explain the effects of transposition of overhead lines
1.16 Compute inductance in transposed lines
1.17 Define capacitance
1.18 Derive the expressions for capacitance of1 phase system.
1.19 Give the expressions for capacitance of3 phase symmetrically spaced,
    asymmetrically spaced and transposed lines round conductors (No- Derivation)
1.20 Use the conductors tables for determining the inductance and capacitance of
    overhead lines of different voltage
1.21 Define short, medium and long lines.
1.22 State the reasons for the constants lumped in short lines and medium
transmission lines.
1.23 Define `regulation' and percentage regulation.
1.24 Derive the approximate formula for percentage regulation.
1.25 Compute the following for short line
    i)   Sending end voltage
    ii)   Sending end P.F
    iii)   percentage regulation
    iv)   Efficiency for the given receiving end condition
1.26 Solve problems on short lines
1.27 Compute the percentage regulation, efficiency of medium transmission lines with
    given receiving end conditions and line parameters using
    i)   Nominal (pie) method
    ii)   Nominal T- method
1.28 Draw the phasor diagram in the above methods
1.29 Solve problems in medium transmission lines
1.30 Explain the charging current in lines and power loss due to it
1.31 State `Ferranti' effect
1.32 Compute the rise in voltage at the receiving end
1.33 State the factors affecting corona
1.34 Explain corona in transmission lines
1.35 State the disruptive critical voltage and give its formula
1.36 State the empirical formula for power loss due to corona
1.37 State the effect of corona
1.38 Explain the methods of reducing corona
1.39 Explain the concept and applications of hot line technique

2.0 Appreciate HVDC transmission
2.1 Discuss basic concepts of HVDC transmission
2.2 List the types of HVDC.
2.3 Know the location of Projects in India.
2.4 Discuss the advantages and disadvantages of HVDC transmission
2.5 Discuss the protective measures to be adopted for HVDC system

3.0   Comprehend Line structures for transmission and Distribution
3.1   State the main components of overhead lines
3.2   State the requirements of line supports
3.3   List the factors influencing the selection of the line supports
3.4   List the types of line supports
3.5   State the advantages and disadvantages of the above line supports
3.6   State the need for cross arms
3.7   Give the formula for economical spacing of conductors
3.8   State the necessity for pole guys
3.9   Describe the methods of fixing of guys
       i)   Bow   ii)Fly guys   iii)Strut pole
3.10   State the factors on which the conductor spacing and ground clearance depend
3.11   List the common conductor spacing and ground clearances adopted for
       i)   66 KV   ii) 33 KV   iii) II KV   iv)L.T. lines
3.12   List the Maximum earth resistance value together with the size of pipe or plate
       used for Earthing.
3.13   State the minimum ground clearances adopted for
       i)66 KV   ii)132 KV   iii)220 KV
3.14   Explain a method of laying foundation to towers
3.15   Define `sag'
3.16   State the factors affecting the sag
3.17   Derive an equation for the approximate method of calculating sag.
       i)when the supports are at the same level (a) in still air   and
                              (b) with the effect of wind and ice
       ii)when the supports are at different levels
3.18   solve the problems on above.
3.19   State the disadvantages of loose spans(sag more than prescribed value)
3.20   State the purpose of insulators in transmission and distribution lines
3.21   State the requirements of insulators
3.22   State applications of the following insulators.
       i)Pin type   ii)Strain type   iii)Suspension type   iv)Shackle type
3.23   Tabulate the relative merits of pin type insulator over suspension type insulators
3.24   Show that the voltage across a string does not distribute uniformly across the
       individuals discs
3.25   Define the terms i)Flashover ii)Puncture   iii)String-efficiency
3.26   Solve problems on distribution of voltage across string
3.27   State the methods of improving string efficiency
       i)   By eliminating ground capacitance
       ii)   By grading of the units
       iii)   Static shielding(guard ring)
3.28   Solve problems on equalisation of potential across a string
3.29   State the need for arcing horns and guard rings
3.30   List causes of failure of insulators in transmission and distribution lines
4.0   Comprehend Underground Cables
4.1   Define cables
4.2   Compare overhead lines with underground cables
4.3   State the classification of cables based on
       i)   Number of conductors
       ii)   Voltage
       iii) Insulation and lead sheathing

iv) The methods of improving the dielectric stress
4.4 Describe the construction of different types of cables
i) Low voltage cables   ii) H.T cables
iii) Super tension cables   iv) EHV cables
4.5 Derive an equation for the insulation resistance of a cable
4.6 Solve problems on insulation resistance

5.0 Comprehend substations
5.1 Explain the need for substations
5.2 State the relative merits of indoor substation ,outdoor substation and Gas insulated
      Substations over others.
5.3 List the equipment used in substation.
i) Bus bars   ii) Insulators   iii) Transformers
iv) Switch gear   v) Indicating and Metering equipment
vi) Protective relays   vii) Lightning arrestors
viii) Cables   ix) Fire fighting equipment
5.4 State the purpose of each of the above equipment.
5.5 Explain Substation auxiliary supply

6.0 Understand the Different Distribution Systems
6.1 Distinguish between primary distribution and secondary distribution
6.2 Explain Feeder, distributors and service mains
6.3 Classify the type of distribution systems according to
i) Type of current   ii) Construction
iii) Service   iv) Number of wire
v) Scheme of connections
6.4 List the type of distribution systems
i)Radial   and   ii)Ring main systems
6.5 State the advantages and disadvantages of the following systems
i)radial   and   ii)ring main systems
6.6 List the steps involved in the voltage drop calculations in A.C. distributors
6.7 Solve problems on voltage drop calculations in D.C & A.C. Distributors.

COURSE CONTENTS
1. **Transmission Lines-**Need for transmission lines-Transmission supply systems, Relative advantages of AC & DC Transmission, Choice of frequency, Choice of voltage, Effect of voltage, Empirical formula for determining the system voltage, H.V.D.C. power Transmission, Operational techniques of H.V.D.C, Requirements of conductor material - Types of conductor-Solid-Stranded-Hollow- Bundled conductors -Relative merits of different types of conductors-Kelvin law - Transmission parameters: Resistance, Inductance capacitance-skin effect, proximity effect, spirality effect-Determination of resistance of solid, ACSR and AAAC conductors using conductor tables-Determination of inductance of Round and Parallel Conductors ,Transposition of O.H. lines-Effect of transposition on Inductance calculations in transposed lines, Calculation of capacitance in round and parallel conductors -Use of conductor tables of determination of inductance and capacitance of transmission lines-Regulation and % Regulation-Approximate formula for Regulation-Short line calculation of-Efficiency-Regulation-Sending end voltage-sending end p.f. for the given receiving end conditions -Regulation-Sending end voltage-sending end p.f. for the given receiving end conditions in

medium transmission lines using Nominal pie method-Nominal T method -Vector diagrams in the above methods-Charging current in lines-Ferranti's effect-Carona in transmission lines-Power loss due to corona-Effects of corona-Methods of reducing corona - Hot line technique - concept and application

2. **High voltage DC Transmission:** Basic Concepts and Types of HVDC transmission- HVDC projects in India -   Advantages and disadvantages of HVDC transmission. Basics of protection of HVDC systems.

3. **Line structure for Transmission and Distribution:** Requirements of line supports, Factors influencing the selection of line support-Types of lines supports-Foundation for poles Descriptive treatment- Cross arms for L.T and H.T lines upto 33 KV- Pole guys- Conductors spacing and ground clearance-Methods of earthing- L.T., 11 KV and 33 KV lines-Max. earth resistance-Types of towers used for 66 KV and 132 KV and 220 KV /400kv   lines   spaces-Approximate ground clearance-Foundation to towers Earthing of towers Sag, Factors affecting sag, calculating sag. Disadvantages of loose span, stringing charts, Insulators, Requirements of insulators , Materials used , Types of Insulators, Voltage distribution across string of suspension Insulators, string efficiency, Flashover, Puncture, string efficiency, improving string efficiency, eliminating the ground capacitance, grading, static shielding , Arcing horns and guard rings, Causes for failure of insulators

4. **Cables**
   Cables, Comparison between O.H. Lines and underground cables, Classification of cables, General construction of cables,Types of cables, Insulation resistance of cables, Specifications of cables

5. **Sub-stations**
   Definition and classification of sub-stations, Relative merits of indoor and outdoor sub-stations equipment in sub-stations Bus-bars, Insulators, Switch gear, Transformer, Protective relays, Meters, Lightning arrestors, Cables, Fire fighting equipment, Bus bar arrangements - Typical sketches Typical layouts and sketches of 33/11KV SS, 66/11 KV, 132/11 KV, Earthing adopted in 132/11KV, 66/11 KV, 33/11 KV and pole mounted and plinth mounted SS, Substation Earthing

6. **Distribution**
   Primary and secondary distribution, Feeders, distribution and service mains, Classification of Distribution systems, Radial and Ring system of Distribution,D.C & A.C. Distribution(single phase), Steps in voltage drop calculation
   Reference Books
   1. V.K. Mehta -Principle of Power systems
   2. S.L. Uppal - Electrical power
   3. Sony,Gupta&Bhatnagar -Text book of Elect. Power
   4. JB Gupta -Electrical Power
   5. CL Wadhwa -Electrical power Systems - New Age International(P) limited.
   6. KR Padiyar - HVDC Power Transmission system Technology
   7. S.N. Singh -Electrical Power generation, transmission and distribution, PHI,2003

INDUSTRIAL DRIVES

Subject Title : **Industrial Drives**
Subject code : **EE- 504**
Periods/Week : **03**
Periods/Semester : **45**

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electrical Drives	12	39	3	3
2.	Electric Braking	12	39	3	3
3.	Domestic applications of Drives	9	11	2	½
4.	Industrial applications of Drives	12	21	2	1½
	Total	45	110	10	8

OBJECTIVES

Upon completion of the course the student shall be able to
1.0 Appreciate the different types of Electrical Drives.
1.1 List the factors governing the selection of electric drive.
1.2 Classify the drives and explain the drives.
  i)Basing on their operation   ii)Basing on their application
1.3 State the advantages and disadvantages of different types of drives.
1.4 State the types of loads for which drives are needed
1.5 Draw the Load curves for different ratings of motors.
1.6 Solve the Problems on the motor Ratings.
1.7 State the need of load equalization
1.8 State the use of fly wheels
1.9 List the different types of enclosures and bearings
1.10 State the methods employed for reduction of noise
2.0 Understand braking of electric motors.
2.1 State different systems of braking of electric motors.
  (i)Mechanical   (ii)Compressed air   (iii)Vacuum brake
  (iv)Magnetic Brake   (v) Electric Braking.
2.2 State advantages of electric braking over other forms of brake
2.3 Explain different methods of electric braking
2.4 Discuss the methods of plugging of the following motors.
  i)D.C. shunt motors   ii)D.C. series motors   iii)Induction Motor.
2.5 Solve the Problems on the above
2.6 Explain the method of Rheostatic braking of the following motors.
  i)D.C. shunt motors   ii)D.C.series motors.
2.7 Describe the method of Regenerative braking of the following motors.
  i)D.C. shunt motor   ii)D.C series motor   iii)Three-phase induction
motor.

2.8   Solve the Problems on the above.

3.0   **Understand theDomestic applications of Drives**
3.1   List atleast eight domestic applications of drives.
3.2   Select the suitable motors for the following drives
        i) Domestic ii) refrigeration iii) Vacuum cleaner iv) Washing machine (v) Mixies
        vi) Grinders vii) Air conditioners viii) Pumps.
3.3   Explain the working of the drives for the above applications.

4.0   **Industrial applications of Drives**
4.1   List atleast twelve domestic applications of drives.
4.2   Select the suitable motors for the following drives
         (i) Steel mills (ii) sugar mills (iii) flour mills (iv) Cranes (v) Lifts & Hoists
         (vi)Lathes (vii) Drilling and Grinding machines (viii) Pump sets
         (ix) Punches & Presses (x) Wood working machines (xi) Printing
         (xii) Belt conveyor (xiii) Textile mills (xiv) Paper mills (xv) Rolling mills
         (xvi) Ship propulsion (xvii) Mines (xviii) Cement works.
4.3   Explain the working of the drives for the above applications.

COURSE CONTENT
1. Electrical drives
Advantages of Electric Drives – factors governing selection of motors –nature of electric supply- DC & AC – Nature of Drives – Group drives- Individual drives their merits and demerits – Nature of load – analysis of type of load- Operations required –matching of motors with given loads - Rating of motors basing on temperature rise and load equalization – purpose of load equalization- use of Flywheel – types of enclosures and bearings – Reduction of noise.
2. Electric Braking
Braking – Types of Braking – Merits & de-merits of Electrical braking – Plugging applied to Shunt, Series and Induction Motor – Simple Problems – Rheostatic braking applied to Shunt, Series and Induction motors – Regenerative braking applied to shunt, series and Induction motor.
3. Domestic applications of Drives
Electric motors used in Domestic applications , Refrigeration, Vacuum cleaners, Washing machines, Mixies, Grinders, Air conditioners, Pumps.
4. Industrial applications of Drives
Electric motors used in - Steel mills- Sugar mills - Flour mills- Cranes – Lifts - Hoists - Lathes -Drilling and Grinding machines - Pump sets - Punches & Presses - Wood working machines - Printing - Belt conveyor -Textile mills - Paper mills - Rolling mills - Ship propulsion -Mines -Cement works.

REFERENCES
1.Hand book of process control - Lyptak
2.A first course on Electric Drives- S.K.Pillai.
3.Electrical motors applications and control by M.V.Deshpande
4.Electrical power by S.L.Uppal
5.Electrical power by J.B.Gupta

Subject Title : **DIGITAL ELECTRONICS**
Subject Code : **505**
Periods/Week : **4**
Periods/Semester : **60**

TIME SCHEDULE

SI	Major topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Basics of Digital Electronics	12	16	2	1
2	Logic Families	15	29	3	2
3	Combinational Logic circuits	15	26	2	2
4	Sequential Logic Circuits	10	26	2	2
5	Registers and Semiconductor Memories	8	13	1	1
	Total	**60**	**110**	**10**	**8**

OBJECTIVES
On completion of the course the student shall 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 a given decimal number into Binary, Octal, and Hexadecimal numbers and vice versa.
1.3 Convert a given binary number into octal and hexadecimal number system and vice versa.
1.4 Perform binary addition, subtraction, Multiplication and Division.
1.5 Write 1's complement and 2's complement numbers for a given binary number.
1.6 Perform subtraction of binary numbers in 2's complement method.
1.7 Explain the use of weighted and Un-weighted codes.
1.8 Write Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa.
1.9 Explain the use of alphanumeric codes (ASCII & EBCDIC)
1.10 Explain the importance of parity Bit.
1.11 State different postulates in Boolean algebra.
1.12 Explain the basic logic gates AND, OR, NOT gates with truth table.
1.13 Explain the working of universal logic gates (NAND, NOR gates) using truth tables.
1.14 Explain the working of an exclusive – OR gate with truth table.
1.15 State and explain De-Morgan's theorems.
1.16 Realize AND, OR, NOT operations using NAND, NOR gates.
1.17 Apply De-Morgan's theorems related postulates to simplify Boolean expressions (up to three variables).
1.18 Explain standard representations for logical functions (SOP and POS form)
1.19 Write Boolean expressions from the given truth table.
1.20 Use Karnaugh map to simplify Boolean Expression (up to 4 variables only)

2.0 Understand different logic families.
2.1   Give the classification of digital logic families.
2.2   Explain the characteristics of digital ICs such as logic levels, propagation delay, Noise margin, Fan-in, Fan-out, and Power dissipation.
2.3   Draw and explain TTL NAND gate with open collector.
2.4   Draw and explain TTL NAND gate with Totem pole output.
2.5   Draw CMOS NAND gate circuit and explain its operation.
2.6   Draw and explain the basic emitter coupled logic OR/NOR gate.
2.7   Compare the TTL, CMOS and ECL logic families.
2.8   Give IC numbers of two input Digital IC Logic gates.

3.0   Understand the working of combinational logic circuits
3.1   Give the concept of combinational logic circuits.
3.2   Draw the Half adder circuit and verify its functionality using truth table.
3.3   Realize a Half-adder using NAND gates only and NOR gates only.
3.4   Draw the full adder circuit and explain its operation with truth table.
3.5   Realize full-adder using two Half-adders and an OR – gate and write truth table
3.6   Draw and explain a 4 Bit parallel adder using full – adders.
3.7   Draw and Explain 2's compliment parallel adder/ subtractor circuit.
3.8   Explain the working of a serial adder with a Block diagram.
3.9   Compare the performance of serial and parallel adder.
3.10 Draw and explain the operation of 4 X 1 Multiplexers
3.11 Draw and explain the operation of 1 to 4 demultiplexer.
3.12 Draw and explain 3 X 8 decoder.
3.13 Draw and explain BCD to decimal decoder.
3.14 List any three applications of multiplexers and decoders.
3.15 Draw and explain Decimal to BCD encoder.
3.16 State the need for a tri-state buffer and list the four t types of tri-state buffers.
3.17 Draw and explain One bit digital comparator.

4.0   Understand the working of Sequential logic circuits
4.1   Give the idea of Sequential logic circuits.
4.2   Explain NAND and NOR latches with truth tables
4.3   State the necessity of clock and give the concept of level clocking and edge triggering,
4.4   Draw and explain clocked SR flip flop using NAND gates.
4.5   Study the need for preset and clear inputs .
4.6   Construct level clocked JK flip flop using S-R flip-flop and explain with truth table
4.7   Analyze the race around condition.
4.8   Draw and explain master slave JK flip flop.
4.9   Explain the level clocked D and T flip flops with the help of truth table and circuit diagram.
4.10 Give the truth tables of edge triggered D and T flip flops and draw their symbols.
4.11 List any four applications of flip flops.
4.12 Define modulus of a counter
4.13 Draw and explain 4-bit asynchronous counter and also draw its timing diagram.
4.14 Draw and explain asynchronous decade counter.
4.15 Draw and explain 4-bit synchronous counter.
4.16 Distinguish between synchronous and asynchronous counters.
4.17 Draw and explain asynchronous 3 bit up-down counter.

4.18 List any six commonly used IC numbers of flip flops, registers and counters.

5.0 Understand working of Registers and memories
5.1 State the need for a Register and list the four types of registers.
5.2 Draw and explain the working of 4 bit shift left and shift right registers
5.3 Draw and explain the working of 4-bit bi-directional shift register.
5.4 Draw and explain parallel in parallel out shift register
5.5 Explain the working of Universal shift register (74194)
5.6 Explain the working of ring counter and list its applications
5.7 List the four common applications of shift registers.
5.8 State memory read operation, writes operation, access time, memory capacity, address lines and word length.
5.9 Classify various types of memories based on principle of operation, physical characteristics, accessing modes and fabrication technology..
5.10 Differentiate between ROM and RAM
5.11 Explain basic principle of working of diode ROM
5.12 Distinguish between EEPROM and UVPROM.
5.13 List six types of ROM and RAM ICs
5.14 Explain the working of basic dynamic MOS RAM cell.
5.15 Compare static RAM and dynamic RAM
5.16 Explain the working principle of NVRAM
5.17 State the difference between Flash ROM and NV RAM

COURSE CONTENT

1 Basics of Digital Electronics
Binary, Octal. Hexadecimal number systems. Conversion from one number system to another number system. Binary codes, excess-3 and gray codes. Logic gates :AND, OR, NOT, NAND, NOR, Exclusive-OR. Logic symbols. Boolean algebra, Boolean expressions. Demorgan's Theorems. Implementation of logic expressions, SOP and POS forms, Karnaugh map application.

2. Logic families
Characteristics of digital circuits: logic levels, propagation delay, Noise margin, Fan-in, Fan-Out, power dissipation, TTL NAND gate: open collector, totem pole output, CMOS NAND gate, ECL OR/NOR gate , comparison of TTL,CMOS and ECL logic families.

3Combinational logic circuits
Implementation of arithmetic circuits, Half adder, Full adder, Serial and parallel Binary adder. Parallel adder/subtractor, Multiplexer, demultiplexer, decoder, encoder, tri-state buffer, 2-bit Digital comparator.

4 Sequential logic circuits
Principle of flip-flops operation, Concept of edge triggering, level triggering, RS, D, JK, T, JK Master Slave flip-flops., synchronous and asynchronous inputs and their use. Applications of flip flops,. Binary counter- ripple counter, synchronous counter, up-down counter.

5. Registers and Memories
Shift Registers- Types, shift left ,shift right, bidirectional, Parallel in parallel out ,universal shift registers, ring counter and its applications, Memories-terminology related to memories, RAM, ROM, EEPROM, UVEPROM, static RAM, dynamic RAM, Flash ROM, NVRAM,

REFERENCE BOOKS

1. Digital Computer Electronics by Malvino and leach., TMH
2. Modern Digital Electronics By RP JAIN TMH
3. Digital Electronics Tokhem TMH
4. Digital Electronics Puri TMH
5. Digital Computer Fundamentals by Thomas Bartee.
6. Digital Electronics by GK Kharate, Oxford University Press.

MAINTENANCE OF ELECTRICAL EQUIPMENTS

Subject Title : **Maintenance of Electrical Equipments**
Subject Code : **EE-506**
Periods/ Week : **04**
Periods /Semester : **60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Testing of Domestic Appliances	21	29	3	2
2.	UPS and SMPS	09	13	1	1
3.	Maintenance of Electrical Power devices	15	39	3	3
4.	Safety	15	29	3	2
	Total	60	110	10	8

OBJECTIVES

Upon completion of the course the student shall be able to

1.0   Comprehend the Testing of Domestic Appliances
1.1   List the tools required for testing and repair of Domestic appliances
1.2   List the meters and testing equipment required .
1.3   For the following Domestic appliances:

       i).Automatic electric iron   ii).Electric kettle
       iii) Ceiling, table fan   iv) Water heater
       v) Geyser   vi) Wet grinder
       vii) Mixies   viii) Room heaters
       ix) Electric oven   x) Toaster
       a).State the principle
       b) Describe the construction
       c).Draw the electrical wiring diagram
       d) List the steps involved in dismantling and assembling.
       e) Give the testing procedure
       f) Identify the fault
       g) carry the repair work.

Note : Suitable tests to be conducted on the above Electrical Domestic appliances are Open circuit, Short circuit, Earth fault and Leakage tests.

2.0   Know the UPS and SMPS
2.1   List the types of disturbances in commercial power supply.
2.2   List the devices used to suppress spikes in supply voltages.
2.3   Classify UPS
2.4   Draw the block diagram of an off-line UPS.
2.5   Draw the block diagram of on-line UPS.
2.6   List the storage batteries used in UPS.
2.7   List the advantages of SMPS.
2.8   Explain SMPS with block diagram.
2.9   Draw the circuit of SMPS using SMPS IC (TL497).

3.0   Comprehend the Maintenance of Electrical Power devices
3.1   Give the preventive and periodical maintenance schedule of the following
        electrical power devices.

i) Batteries (Dry / Wet)	ii) UPS / Inverters
iii) DC Motors	iv) AC Motors
v) Motor starters (AC & DC)	vi) Air conditioners
vii) Power transformers	viii) Pole mounted transformer yard
ix) Plinth mounted transformer yard	x) Circuit breakers(SF_6 ,air blast, minimum

oil)
        xi) Relays(distance, directional, impedance)
        xii) Lightning arrester(thyrite type, valve type)

4.0   Understand the various Safety Procedures.
4.1   Explain the need of safety
4.2   List the Equipment used for Electrical and general safety purpose
4.3   Explain the different types of Electrical hazards / accidents
4.4   Explain the causes of different Electrical hazards / accidents
4.5   Explain the methods to avoid Electrical hazards / accidents
4.6   Explain the First-Aid methods followed to rescue a person met with Electric
        shock.
4.7   List the Do's & Dont's of Electrical supervisor at substations.
4.8   Explain the operation of different fire extinguishers
4.9   List the various applications of different fire extinguishers.

Course contents
1.0   Testing of Electrical Domestic Appliances
        Tools & meters required for testing and repair of Domestic appliances-Principle,
        construction & working with fault finding, dismantling, assembling and testing
        after repair of the Domestic appliances.
        Note : Suitable tests to be conducted on the above Electrical Domestic
appliances are
                Open circuit, Short circuit, Earth fault and Leakage tests.
2.0   U.P.S and SMPS
        Commercial power supply-Disturbances and Spikes in supply voltages- UPS –
        SMPS

3.0   Maintenance of Electrical Power devices
        Preventive and periodical maintenance schedule of the following electrical power
        devices. i.e Batteries (Dry / Wet), UPS / Inverters, DC & AC Motors, Motor
        starters (AC & DC), Air conditioners, Power transformers, Pole mounted & Plinth
        mounted transformer yards, Circuit breakers

4.0   **Safety**
        Need of safety - Equipment used in Electrical and general safety - Different types
        of Electrical hazards / accidents - Causes of different Electrical hazards /
        accidents - Methods to avoid Electrical hazards / accidents - First-Aid methods
        followed to rescue a person met with Electric shock - Do's & Don't's of Electrical
        supervisor at Electrical substations - Different fire extinguishers- operation and
        application of different fire extinguishers.

References:

K.B.Bhatia	Study of Electrical Appliances and, devices	Khanna publication
B. L. Theraja Delhi	Electrical Technology Vol I To IV	S. Chand & Co., New
B. V. S. Rao	Operation & Maintenance of Electrical Machines Vol – I Publisher	Media Promoters &
		Ltd. Mumbai
B. V. S. Rao	Operation & Maintenance off Electrical Machines Vol – II Publisher	Media Promoters &
		Ltd. Mumbai
C.J. Hubert Journals	Preventive Maintenance	Hand Books &

MATLAB PRACTICE

Subject Title : **MATLAB PRACTICE**
Subject code : **EE- 507**
Periods/Week : **06**
Periods/Semester : **90**

TIME SCHEDULE

Sl. No	Major Topics	Periods
1.	C Programming Basics	6
2.	Decision & Loop Control Statements	12
3.	Exercises on functions	15
4.	Arrays, Strings and Pointers in C	15
5.	Structures, Unions & Preprocessor Directives	12
6.	MAT Lab Practice	30
	Total	60

OBJECTIVES (LIST OF EXPERIMENTS)
Upon the completion of this lab practice, the student shall be able to perform

1. Editing, compiling and executing simpleprograms
2. Exercises on printf and scanf functions
3. Exercises on Selective Structures
4. Exercises on Repetitive Structures
5. Exercises on functions to demonstrate prototyping, parameter passing, function returning values.
6. Exercises on recursion
7. Exercises on global variables.
8. Exercises on arrays and Strings
9. Exercises to demonstrate use of Pointers, pointers as function arguments, functions   returning pointers
10. Exercise on structures.
11. Exercises on C preprocessor Directives.

MATLAB- Simulink Practicals
1. Generate square, sine, sawtooth and triangular waveform using Function generator.
2. Step response of RL and RC circuit
3. Op-amp applications (Inverting, Non inverting,Integrator & Differentiator)
4. Verification of Superposition theorem
5. Verification of Thevenins theorem
6. Verification of Nortons theorem
7. Simulate the UJT relaxation oscillator and draw the waveform across the load
8. Simulation of Half wave controlled rectifier with R and RL load
9. Simulation of full wave rectifier mid point configuration with R load
10. Simulation of single phase half controlled bridge rectifier with R and RL load
11. Simulation of single phase fully controlled bridge rectifier with R and RL load
12. Simulation of AC voltage regulator
13. Simulation of Cycloconverter.
14. Simulation of single phase multiple pulse inverter

LIFE SKILLS

Subject Title	:	**Life skills**
Subject Code	:	**EE – 508 (Common to all Branches)**
Periods per week	:	**03**
Period per semester	:	**45**

TIME SCHEDULE

SI No.	Major Topics	No. of periods		
		Theory	**Practical**	**Total**
1.	Concept of life skills	03	00	03
2.	Enhancing self esteem	01	02	03
3.	Goal setting	01	02	03
4.	Positive attitude	01	02	03
5.	Managing emotions	1 1/2	4 1/2	06
6.	Stress management	1 1/2	4 1/2	06
7.	Time management	1/2	2 1/2	03
8.	Interpersonal skills	01	02	03
9.	Creativity	01	02	03
10.	Problem solving and Decision making skills	01	02	03
11.	Assertiveness	1 1/2	4 1/2	06
12.	Leadership skills &Team spirit	1 1/2	11/2	03
	TOTAL	15 1/2	29 1/2	45

Note: No Written Examination
The students may be asked to Demonstrate 1 or 2 skills from unit 2 to unit 12.
Marks: Internal – 40; External - 60

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

1.0   Understand the concept of life skills
   1.1   Define Life skills
   1.2   Explain need and impact of Life skills programme
   1.3   List the elements of Life skills
   1.4   Identify the sources of Life skills
   2.0   Understand the concept of Self esteem
   2.1   Define the term self esteem
   2.2   Explain the concept of self esteem
   2.3   List the characteristics of High self esteem
   2.4   List the characteristics of Low self esteem
   2.5   Explain the advantages of High self esteem
   2.6   Explain the behavior patterns of low self esteem
   2.7   Explain the causes of Low self esteem
   2.8   List the steps to build a positive self esteem

Practicals

Exp No	Exercise	Activity (Questionnaire / Game and Role play)
1.	Identifying the Behavior	• Identifying the behavior patterns of low self-esteem people.
2.	Practice Positive Self Esteem	• Steps to build a positive self esteem

3.0 Understand the concept of Goal setting
   3.1   Define the term Goal
   3.2   Explain the significance of Goal setting
   3.3   Explain the following concepts
          a) Wish   b) Dream   c) Goal
   3.4   Explain the reasons for not setting goals
   3.5   Explain the effective goal setting process
   3.6   List the barriers to reach goals

Practicals

Exp No	Exercise	Activity
1	Differentiate among Wish, Dream and Goal	• Drawing a picture of Your Self/ Your Country/ Your Society after 10yrs. • Discussion: Setting Personal Goals • Story Telling • Identifying of barriers • Analysis of barriers • Overcoming Barriers

4.0 Practice positive attitude
   4.1   Define Attitude
   4.2   Explain the concept of positive attitude
   4.3   Explain the concept of negative attitude
   4.4   Explain the affects of negative attitude
   4.4   Identify the attitude of self and peers
   4.5   Explain the effect of peers on self and vice-versa.
   4.6   List the steps to enhance positive attitude
   4.7   Explain the strategies to enhance positive attitude

Practicals

Exp No	Exercise	Activity (Psychological Instrument/ Game & Role play)
1.	Identify Positive attitude	• To study & to identify the attitude of self and peers. • List & practice the strategies to enhance positive attitude.

2	Observe	• Positive attitudes of self and Peers
		• Negative attitudes of self and Peers
3	Practice Strategies to enhance Positive attitude	• Celebrating the success
		• Listing the successes

5.0   Practice managing emotions
5.1   Explain the concept of emotion
5.2   List the different types of emotions
5.3   Differentiate between positive and negative emotions
5.4   Identify the type of emotion
5.5   Explain the causes of different types of emotions.
5.6   Implement the methods to manage major emotions (anger / depression)
5.7   Define Emotional Intelligence.
5.8   Explain the method to enhance emotional Intelligence.

Practicals

Exp No	Exercise	Activity (Story / simulated situational act /GD & Role play)
1.	Identify the Type of Emotion	• To identify the type and to study the cause of the emotion.
2	Managing Emotions	• Managing major emotions -Anger and Depression

6.0   Practice stress management skills
6.1   Define Stress
6.2   Explain the concept of stress
6.3   List the Types of stress
6.4   Explain the causes of stress
6.5   Comprehend the reactions of stress
       a) Physical   b) Cognitive   c) Emotional   d) Behavioral
6.6   Explain the steps involved in coping with the stress by
       a) Relaxation b) Meditation   c) Yoga
6.7   Practice the stress relaxing techniques by the 3 methods.
       a) Relaxation b) Meditation   c) Yoga
6.8   Comprehend the changing personality and cognitive patterns.
6.9   Observe the changing personality and cognitive patterns.

Practicals

Exp No	Exercise	Activity(Questionnaire /Interview and practice)
1	Identify the type of stress	• To study & to identify the type and causes of stress.
2	Stress –Relaxation Techniques	• Practice some simple Stress –Relaxation Techniques, Meditation, Yoga.

7.0   Practice Time management skills
7.1   Define Time management.
7.2   Comprehend the significance of Time management.

7.3   Explain the strategies to set priorities.
7.4   List the steps to overcome barriers to effective Time management.
7.5   Identify the various Time stealers.
7.6   Explain the Time-Management skills.
7.7   List different Time-Management skills.
7.8   Comprehend the advantages of Time-Management skills.

Practicals

Exp No	Exercise	Activity (Group work and Games)
1	Identify Time stealers	• Assign a activity to different Groups – Observe the time of accomplishing the task, Identify the time stealers.
2.	Practice Time-Management skills	• Perform the given tasks- Games

8.0   Practice Interpersonal skills
8.1   Explain the significance of Interpersonal skills.
8.2   List the factors that prevent building and maintaining positive

relationships.
8.3   Advantages of positive relationships.
8.4   Disadvantages of negative relationships

Practicals

Exp No	Exercise	Activity
1	Identify Relationships	• Positive Relationships, Negative Relationships – Factors that affect them- Through a story
2.	Practice Rapport building	• Exercises on Rapport building • Developing Correct Body Language

9.0   Understand Creativity skills
9.1   Define Creativity
9.2   List the synonyms like Invention , Innovatioin, Novelty
9.3   Distinguish between Creativity , Invention, innovation, and novelty
9.4   Discuss the factors that lead to creative thinking like observation and
       imitation , improvement etc.
9.5   Distinguish between Convergent thinking and divergent Thinking
9.6   Explain various steps involved in Scientific approach to creative thinking
       namely a) Idea generation b) Curiosity c) Imagination d)Elaboration e)
       Complexity
       f). Abstract ion and simplification g). Divergent Thinking h) Fluency i).
       Flexibilty
          j).Persistance k).Intrinsic Motivation l).Risk taking
             m).Projection/empathy
          n).Originality o). Story telling p). Flow.
          List the Factors affecting the creativity in Individuals.
9.7   Give the concept of Vertical thinking and lateral thinking.
9.8   Explain the importance of Lateral thinking.
9.9   Compare lateral thinking and Vertical thinking

Practicals

Exp No	Exercise	Activity (Games and Group work)
1	Observe any given object	• Identifying finer details in an object
2.	Imagine	• Imagining a scene • Modifying a story (introduce a twist) • Improving a product • Finding different uses for a product
3	Skills	• Making paper craft
4	Product development	• Brain storming session
5	Developing originality	• Come up with original solutions for a given problem

10.0 Understand Problem solving and decision making skills

10.1 Define a Problem
10.2 Analyze the performance problems
10.3 Categorize the problems
10.4 List the barriers to the solutions to problems.

Practicals

Exp No	Exercise	Activity (Brainstorming – checklist technique free association, attribute listing)
1	Gather the facts and Data and Organizing the information.	• Information gathering and organizing • Identifying the solutions to the problem • Identifying the barriers to the solutions • Zeroing on Optimum solution
2.	Problem solving	• Games on Problem solving

11.0 Understand Assertive and non Assertive behavior

11.1 List the 3 types of Behaviors 1. Assertive 2. Non assertive (passive) 3. Aggressive Behaviour 4.Submissive behaiviors
11.2 Discuss the personality of a person having above behaviours
11.3 Explain the usefulness of assertive behavior in practical situations.
11.4 Explain the role of effective communication in reflecting assertive attitude
11.5 Give examples of Assertive statements a) Assertive request b) assertive NO
11.6 Explain the importance of goal setting
11.7 Explain the method of Conflict resolution.
11.8 Discuss the methods of controlling fear and coping up with criticism.

Practicals

Exp No	Exercise	Activity (Simulated situational act)
1	Observation of behavior	• Identifying different personality traits from the body language
2.	Practicing assertiveness	• Write statements

		• Reaction of individuals in a tricky situation
		• Facing a Mock interview
		• Detailing the characteristics of peers
		• setting goals – Games like throwing a coin in a circle
		• Giving a feedback on a)Successful program b) Failed project
		• Self disclosure
3	Skills	• Dealing with a critic
		• Saying NO
		• Dealing with an aggressive person
4	Simulation	• Role play- skit
		1. Assertive statements
		2. goal setting
		3. self disclosure

12.0 Practice Leadership skills

12.1 Explain the concept of leadership
12.2 List the Traits of effective leader
12.3 Distinguish between Managing and leading
12.4 List the 3 leadership styles
12.5 Compare the above styles of leadership styles
12.6 Discuss choice of leadership style
12.7 Explain the strategies to develop effective leadership.
12.8 Explain the importance of Decision making
12.9 Explain the procedure for making effective decisions.

Practicals

Exp No	**Exercise**	**Activity** (Games and Group work)
1	Observation	• Questionnaire
2.	Identification of a Leader	• Give a task and observe the leader
		• Discuss the qualities and his /her leadership style
		• Ask the other members to identify the leadership qualities
		• Reflection on the self
3	Skills	• Decision making – followed by discussion
4	Building Team spirit	• Motivation – Intrinsic and Extrinsic
		Training- Communication- Challenge

Competencies for Practical Exercises

S.No	Title	Competency
1.	Concept of life skills	• Explain need and impact of Life skills
2.	Enhancing self esteem	• Follow the steps to build a positive self esteem
3.	Goal setting	• Practice the effective goal setting process
4.	Positive attitude	• Practice the steps to enhance positive attitude. • Observe the effects of peers on self and vice-versa.
5.	Managing emotions	• Practice the steps to manage emotional intelligence • Identify different types of emotions • Exercise control over Emotions
6.	Stress management	• Practice stress management techniques
7.	Time management	• Practice Time management techniques
8.	Interpersonal skills	• Identify positive and Negative Relations
9.	Creativity	• Lead a small group for accomplishment of a given task. • Build positive relationships.
10.	Problem solving and decision making skills	• Identify the various Problem solving and decision making skills • Make appropriate Decision
11.	Assertive and non Assertive behavior	• Practice Assertive and non Assertive behavior
12.	Leadership skills	• Exhibit Leadership skills

COURSE CONTENT
1.0　Concept of life skills
Definition of life skills, Need and impact of life skills programme

2.0　Enhancing self esteem
Concept, Characteristics of high and low self esteem people, Advantages of high self
esteem, Causes of low esteem- Identification of behavior patterns of low self esteem – Practice session of Questionnaire / Game -Steps to build a positive self esteem – Practice session of Role play

3.0　Goal setting
Significance of goal setting,Concepts of Wish, Dream, and Goal Identify Wish, Dream, and Goal and differentiate among them Reasons for not setting the goals, Barriers to reach goals,Identify Barriers Effective goal setting process & Practice Effective goal setting

4.0　Positive attitude

concept ,affects of negative attitude,attitude of self and peers,effect of peers on self and   vice-versa, steps to enhance positive attitude,strategies to enhance positive attitude

5.0   Managing emotions
    Problem-definition, performance problems ,Categorize the problems,
    barriers to the solutions to problems.

6.0   Stress management
    concept of stress, Types of stress, causes of stress, reactions of stress, coping with the   stress, stress relaxing techniques, changing personality and cognitive patterns

7.0   Time management
    Definition, significance of various Time stealers, Time management, strategies to
set   priorities, steps to overcome barriers, Time-Management skills- its advantages.

8.0   Interpersonal skills
    Significance of Interpersonal skills,positive relationships- Advantages, negative
    relationships- Disadvantages

9.0   Creativity
    Definition, Invention, Innovation, Novelty,creative thinking , observation and
imitation ,   improvement,Expertise ,skill, and motivation, components of Creativity ,Convergent   thinking and divergent Thinking, various steps involved in Scientific approach to creative   thinking namely , Factors affecting the creativity in Individuals, Vertical thinking and   lateral thinking.

10.0   Problem solving and decision making skills
    Definition, performance problems –analysis, categorizing,barriers to the
solutions to   problems.

11.0   Assertive and non Assertive behavior
    Types of Behaviors – their characteristics, need for controlling and avoiding
    aggressive behaviors, making and refusing an assertive request – their
    evaluation, importance of goal setting, method of giving feed back.

12.0   Leadership skills
    Concept , importance, Role of a Leader in an Organization, Traits of effective
      leader, Managing and leading, leadership styles-their Comparison, theories of
      leadership, strategies to develop effective leadership, importance of Decision
      making, concept of ethical leadership and moral development.

REFERENCES

1.Robert NLussier, Christopher F. Achua Leadership: Theory, Application, & Skill development: Theory, Application.

AC MACHINES LABORATORY PRACTICE - II

Subject Title : **AC Machines Laboratory Practice - II**
Subject Code : **EE-509**
Periods/Week : **03**
Periods/Year : **45**

TIME SCHEDULE

S. No.	MAJOR TOPICS	NO OF PERIODS
1.	Tests on 1-phase and 3-phase AC Motors	15
2.	Drawing circle diagram on AC Motors	18
3.	Identify and rectify faults in AC motors and starters	12
	Total	45

OBJECTIVES

Upon completion of the practice the student shall be able to

1. Conduct brake test on 3-phase squirrel cage induction motor.
2. Conduct Brake test on 3-phase slip ring induction motor.
3. Perform Load test on Single phase split type induction motor.
4. Perform Load test on single phase capacitor type induction motor
5. Conduct suitable tests and draw circle diagram of squirrel cage induction motor.
6. Conduct suitable tests and draw circle diagram of slip ring induction motor
7. Conduct load test on synchronous motor and draw V and inverted V curves.
8. Identify and rectify faults in AC motors.
9. Identify and rectify faults in AC starters

Competencies & Key competencies to be achieved by the student

S.No	Experiment Title	Competencies	Key competency
1	Brake test on 3-phase squirrel cage induction motor.	▪ Draw the circuit diagram ▪ Identify the different terminals of 3-ph induction motor ▪ Select the suitable starter. ▪ Identify the terminals of the starter. ▪ Select the range and type of the meters ▪ Make the connections as per the circuit diagram ▪ Start the motor using a starter Apply the load up to full load in steps ▪ Pour water in the brake drum ▪ Note down the readings of ammeter and voltmeter for each load. ▪ Calculate the output, torque and efficiency etc ▪ Plot the performance characteristics ▪ Verify the performance of the machine.	▪ Apply the load up to full load in steps ▪ Pour water in the brake drum ▪ Before Switching off the motor remove the load
2	Brake test on 3-phase slip ring induction motor.	▪ Draw the circuit diagram ▪ Interpret the name plate details ▪ Identify the different terminals of the 3-ph	▪ Before giving supply Slip rings must be

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			short circuited
		• Select the suitable starter. • Identify the terminals of the starter. • Select the range and type of the meters • Make the connections as per the circuit diagram • Start the motor using a starter • Verify the performance of the machine.	induction motor • Speed should be measured accurately
3,4	Load test on a)split phase induction motor. b) capacitor type induction motor	• Draw the circuit diagram • Identify the different terminals of the 1-ph split phase induction motor /1-ph capacitor type induction motor and the starter • Select the ranges and type of the meters • Make the connections as per circuit diagram • Start the motor using a starter • Apply the load in steps • Record the meter readings • Verify the performance of the machine.	• Start the motor using a starter without load • Apply the load up to full load in steps
5	Load test on single-phase Universal motor.	• Draw the circuit diagram • Identify the different terminals of the 1-ph universal motor • Select the range and type of the meters • Make the connections as per the circuit diagram • Start the motor using a starter • Apply the brake load lightly • Verify the performance of the machine	• Apply the brake load lightly • Take the readings properly
6,7	Conduct suitable tests and draw circle diagram of a)squirrel cage induction motor b)slip ring induction motor	• Draw the circuit diagram for No-load test and Blocked rotor test • Make the connections for no-load test and Blocked rotor test as per the circuit diagram • Start the motor without load • Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test. • During the Blocked rotor test fully tighten the rotor shaft • Record the meter readings • Calculate the output, torque ,efficiency etc. • Plot the performance characteristics. • Verify the performance of the machine. • Draw the circle diagram on a graph sheet using the test data • Select proper scale to draw the circle diagram	• Apply the rated voltage to the motor in the no-load test and rated current to the blocked rotor test. • During the Blocked rotor test fully tighten the rotor
8	Conduct load test on synchronous motor and draw V and inverted V curves	• Draw the circuit diagram • Identify different terminals of the 3-ph synchronous motor • Select the range and type of the meters • Make the connections as per the circuit • Start the motor as per the procedure • Switch on the excitation at correct time • Vary the excitation in steps	• Switch on the excitation at correct time • Vary the excitation in steps • First switch off the excitation

		▪ Pour water in the brake drum for cooling. ▪ Reduce the load to zero gradually. ▪ Switch off the motor. ▪ Disconnect the circuit. ▪ Calculate the output, torque ,efficiency etc. ▪ Plot the performance characteristics. ▪ First switch off the excitation and then only switch off the mains ▪ Draw the V and inverted V curves on a single graph sheet	and then only switch off mains
9	Identify and rectify faults in AC motors	▪ Select a faulty motor ▪ Identify the different terminals of ac motors. ▪ Interpret the name plate details. ▪ Identify the different parts of the motor Identify the problems in the motor by physical observation ▪ Verify all the connections of the motor and the starter ▪ Check for burnout fuses. ▪ Identify any loose connections if any to tighten the connections ▪ Check the condition of bearings. ▪ Check the continuity of different windings by using DMM or Test lamp. ▪ Identify any open or short circuits in the windings. ▪ Check the continuity between windings and body earthing. ▪ Start the motor using a starter without load. ▪ Observe whether the motor is running or not ▪ If running with normal speed no problem in the motor. ▪ If running with low speed check for reversal of phase and Reduce the load to Zero gradually ▪ Switch off the motor ▪ Disconnect the circuit.	▪ Identify the problems in motor by physical observation ▪ check for reversal of phase and Reduce the load to Zero gradually ,If the Motor is running with low speed
10	Identify and rectify faults in AC starters	▪ Check the input and output terminals of the starter ▪ Check the condition of contactors for opening and closing ▪ Check for open circuit and short circuit in the coils of contactor. ▪ Check the condition of over load relay coil and no volt coil ▪ Check the current setting dial for proper current setting ▪ Check the contactor opening and closing time.	▪ Check the current setting dial for proper current setting

FIELD PRACTICES

Subject Title	:	**FIELD PRACTICES**
Subject code	:	**EE-510**
Periods/Week	:	**06**
Periods/Semester	:	**90 (30 Sessions - 3 periods/session)**

TIME SCHEDULE

Sl. No	Major Topics	Periods
1.	Estimation of Power loads	9
2.	Identification of faults in Distribution lines	6
3.	Maintenance /Charging of the Batteries.	6
4.	Testing and repair of Domestic appliances	18
5.	Installation and Testing of solar panels, Ups, Inverters, MG set.	9
6.	Practice on Motor winding	12
7.	Overhauling of DC Machine	9
8	Overhauling of AC Machine	9
9	Maintenance of transformer	3
10	Departmental procedures of distribution companies	3
11	Study of HT substation (Industrial Visit)	6
	Total	90

OBJECTIVES

Upon completion of the practice the student shall be able to

1. Estimation of Power loads
2. Identification of faults in Distribution lines
3. Maintenance /Charging of the Batteries.
4. Testing and repair of domestic appliances
5. Installation and Testing of solar panels & appliances, Ups, Inverters, MG set
6. Practice on Motor winding
7. Overhauling of DC Machine
8. Overhauling of AC Machine
9. Maintenance of transformer
10. Departmental procedures of distribution companies
11. Study of HT Substation(Industrial visit to nearby Substation)

Competencies & Key competencies to be achieved by the student

SI. No	Experiment title	competency	Key Competencies
1.	Estimation of Power loads	➤ Recording the details of total load and layout of the Electrical installation. ➤ Preparing the Electrical circuit layout. ➤ Listing the quantity required and specifications of electrical materials. ➤ Listing of different tools required to execute the installation work. ➤ Preparing the work schedule and identify the Vendors. ➤ Estimation of cost of material and labour. ➤ Execute the Electrical installation.(with dummy loads)	✓ Drawing of Electrical wiring circuits of above fields. ✓ Estimating the Materials, tools and labour cost for the above fields. ✓ Identifying the vendors. ✓ Executing work schedules.
2.	Identification of faults in Distribution lines	➤ Survey the Distribution lines in a **given area**. ➤ Record the electrical components used. ➤ Record the voltage level and type of distribution used. ➤ Observe the loose spans if any. ➤ Record the jumpers and its condition. ➤ Observe the physical condition of Insulators. ➤ Observe the physical condition of the PSCC poles. ➤ Observe the physical conditions of ACSR conductor, cross arms and stays.	✓ Surveying the New distribution lines in rural areas. ✓ Estimation of line components. ✓ Repair of loose spans. ✓ Testing the conditions/quality of PSCC poles, insulators, conductors, stays, cross arms.
3.	Maintenance /Charging of the Batteries.	➤ Record the Electrical specifications of the Battery. ➤ Record the specific gravity of the Electrolyte of each cell using Hydrometer. ➤ Note the level of Electrolyte in each cell. ➤ Add the distilled water if necessary. ➤ Record the Voltage of each cell using multi-meter. ➤ Keep the ventilating plugs open while charging if it is not a maintenance free battery. ➤ Connect the battery to the Battery charger by selecting proper method	✓ Choosing a battery rating. ✓ Measurement of specific gravity of electrolyte. ✓ Preparation of electrolyte.

		(constant current, Constant voltage), and voltage.	
		➢ Observe the temperature of the battery after charging.	
		➢ Clean the terminals and apply Grease/petroleum Gelli to avoid sulphation.	
4.	Testing and repair of domestic appliances	➢ Perform the dismantling, assembling, and testing of following Domestic appliances with electrical wiring circuits. ➢ Automatic electric Iron, Electric kettle, Electric oven, Ceiling fan, Exhaust fan, Water heater, Grinder, Mixers, Room heaters, Air conditioner,	✓ Dismantling, assembling, testing and repair of Domestic appliances.
5.	Installation and Testing of solar panels, Ups, Inverters, MG set.	➢ Identify the solar collector used. ➢ Note the applications of solar energy in different areas like water heaters, driers, cookers, furnaces, Green houses, water distillation, Pond Electric power plant. ➢ Identify the type of solar cell, different module, panel and array construction. ➢ Note the rating of UPS and sequence of operations of switching ON/OFF. ➢ Record the maintenance of UPS, batteries and inter connections. ➢ Note the block diagram of Inverter and describe about each block. ➢ Design the rating of Inverter as per the given load ➢ prepare the external wiring to connect an Inverter to a particular installation. ➢ Observe the rating of the DG set . ➢ List the electrical accessories required to connect the Generator output through panel board. ➢ List the electrical accessories required to connect Motor to an Electric supply. ➢ Record the maintenance procedures/ steps involved in operation of MG set	✓ Selection of Solar panels as per the atmospheric conditions. ✓ Testing, installation, maintenance of Solar panels. ✓ Interconnection of UPS/ DG sets/ MG sets/ Inverters to panel boards.
6.	Practice on Motor winding	➢ Note the type and rating of the given motor. ➢ Record the type of bearings employed in the motor. ➢ Identify and test the condition of windings using test lamp / megger. ➢ Note the gauge of the winding coil used. ➢ Record the class of insulation used. ➢ Note the fault in a given machine.	✓ Selection of suitable ratings of the Motor as per the application. ✓ Identifying the faults and its

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		➢ Draw the winding diagram according to its construction. ➢ Estimate the quantity and cost of material required. ➢ Prepare the coils using coil winding machine ➢ Insulate the slots by using slot insulating material (Milmen paper, Wooden strips). ➢ Insert the coils in to slots and make end connections , insulate the coils using tape and varnish the winding.	trouble- shooting.

7.	Overhauling of DC Machine	➢ Note the type of given DC machine.
		➢ Dismantle the End covers.
		➢ Remove the Armature.
		➢ Remove the Bearing using Bearing pullers.
		➢ Test the condition of winding and commutator using electric growler.
		➢ Test the insulation resistance of the armature and field resistance using megger.
		➢ Observe the bearings, clean and apply grease.
		➢ Increase the insulation resistance of the winding by coating/ applying varnish (if insulation resistance is low).
		➢ Heat the winding to absorb the moisture using Electric Oven/ High wattage lamps (to improve insulation resistance).
		➢ Note the condition of Mica insulation between two commutator segments.
		➢ Gently clean the surface of the commutator.
		    ➢ Record the condition of the brushes and brush holders.
		    ➢ Reassemble the machine.
		    ➢ Record the speed, noise, output and temperature raise of the machine.
			✓ Dismantling, assembling, testing and repair of DC Machine.
			
			✓ Drawing the winding diagrams.
			
			✓ Testing insulation strength of the conductor and coating of varnish.

8	Overhauling of AC Machine	➢ Note the type of given AC machine. ➢ Dismantle the End covers. ➢ Remove the Armature. ➢ Remove the Bearing using Bearing pullers. ➢ Note the condition of armature winding using electric growler. ➢ Record the insulation resistance of the stator and rotor using megger. ➢ Record the condition of bearings, clean and apply grease as per the	✓ Dismantling, assembling, testing and repair of AC Machine. ✓ Drawing the winding diagrams. ✓ Testing insulation strength of the conductor and coating of varnish.

		condition. ➢ Improve the insulation resistance of the winding by coating/ applying varnish (if insulation resistance is low) ➢ Heat the winding to using Electric Oven/ High wattage lamps to absorb the moistur (to improve insulation resistance) ➢ Reassemble the machine. ➢ Record the running condition of the machine both mechanical & electrical aspects	
9	Maintenance of transformer	➢ Recording the rating of the transformer ➢ Note the various components/ terminals. ➢ Record the dielectric strength of the transformer oil using Oil testing equipment. ➢ Observe the condition of the silica gel in breather and replace if needed. ➢ Record the earth resistance of the transformer1	✓ Selection of suitable transformer. ✓ Testing of dielectric strength of Oil. ✓ Replacing Silica gel.
10	Departmental procedures of distribution companies	➢ Preparation of al procedures to get service connections for domestic (1 phase, 3 phase). ➢ Record the departmental procedures to obtain service connection to Agriculture pump set. ➢ Record the departmental procedure to obtain service connection for a small scale industry. ➢ Record the procedure to calculate Earth resistances of above installations1	✓ Preparation of procedures to obtain new service connections for Domestic, Agriculture & Industrial loads.
11	Submit a Report on Study of HT substation (Visit)	➢ Draw the layout of Sub station. ➢ Record the technical specifications of each equipment (Incoming and outgoing feeders, Bus-bar, Lightning arrester, Circuit breakers, Isolators, Protective relays, Current transformers, Potential transformers, Metering and Indicating instruments used, Distribution Transformers, Wave trappers, capacitor banks, Batteries, Earth switches etc.) ➢ Note the staff structure and duties of each staff and day to day activities carried by staff. ➢ Record the maintenance procedures	✓ Drawing the layout of substation. ✓ Obtaining the knowledge of every equipments used in substations. ✓ Understanding the duties and functions of staff working at the

		adopted as per IS code and note typical earth resistance values. ➤ Record the preventive maintenance schedule of all substation equipment ➤ Record the details of frequent faults/breakdowns occurred. ➤ Note the safety equipments used and precautions to be taken. ➤	substation. ✓ Understanding the various frequent faults and safety equipments used.

Important note : The field practice exercises listed above should pave way for student staff interaction and selection of a project work to be performed in the next semester.

Text Books:

Name of Authors Publisher	Titles of the Book	Name of the
B. L. Theraja Delhi	Electrical Technology Vol I To IV	S. Chand & Co., New
B. V. S. Rao	Operation & Maintenanceof Electrical Machines Vol – I Publisher	Media Promoters & Ltd. Mumbai
B. V. S. Rao	Operation & Maintenance off Electrical Machines Vol – II Publisher	Media Promoters & Ltd. Mumbai
C.J. Hubert Journals	Preventive Maintenance	Hand Books &

DIPLOMA IN ELECTRICAL& ELECTRONICS ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI 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:								
EE- 601	Industrial Management	4	-	60	3	20	80	100
EE-602	Electric Traction	4	-	60	3	20	80	100
EE - 603	Power Systems – III (Switch Gear and Protection)	4	-	60	3	20	80	100
EE - 604	Power Electronics	4	-	60	3	20	80	100
EE - 605	Micro Controllers and Applications	4	-	60	3	20	80	100
EE - 606	Industrial Automation	4	-	60	3	20	80	100
PRACTICAL:								
EE- 607	Electrical CAD & Project Management Practice	-	6	90	3	40	60	100
EE -608	Digital Electronics & Micro Controller Laboratory Practice	-	3	45	3	40	60	100
EE -609	Power Electronics & PLC Laboratory Practice	-	3	45	3	40	60	100
EE -610	*Project work*	-	6	90	3	40	60	100
	TOTAL	24	18	630		280	720	1000

Subject Title : **INDUSTRIAL MANAGEMENT**
Subject Code : **EE-601**
Periods/Week : **04**

Periods/semester   :   60

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Overview Of Business	4	6	2	
2.	Management Process	6	13	1	1
3.	Organizational Management	6	13	1	1
4.	Human Resource Management	12	23	1	2
5.	Financial Management	10	16	2	1
6.	Materials Management	8	13	1	1
7.	Project Management	14	26	2	2
	Total	60	110	10	8

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

1.0 Explain the basics of Business
1.1   Define Business
1.2   State the Types of Business (Service, Manufacturing, Trade)
1.3   Explain the business procedures in Engineering sector (Process industry, Textile industry, Chemical industry, Agro industry,)
1.4   State the need for Globalization.
1.5   List the Advantages & Disadvantages of globalization w.r.t. India.
1.6   Explain the importance of Intellectual Property Rights (I.P.R.)

2.0   Explain the Management Process:
2.1   Define Management.
2.2   Explain the concept of management
2.3   Explain the Different Levels of management
2.4   Explain Administration & management
2.5   State the principles of Scientific management by F.W.Taylor
2.6   State the principles of Management by Henry Fayol (14 principles)
2.7   List the Functions of Management
            i) Planning
            ii) Organizing
            iii) Directing
            iv) Controlling
2.8   Explain the four Functions of Management.
3.0   Appreciate the need for Organizational Management

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3.1   Define Organization
3.2   List the Types of organization :a) Line b) Line & staff c) Functional d) Project
3.3   Explain the four types of organization.
3.4   Define departmentation.
3.5   Explain the following types of departmentations
        i) Centralized & Decentralized
        ii) Authority & Responsibility
        iii) Span of Control
3.6   Explain the Forms of ownership
        i)Proprietorship
        ii) Partnership
        iii) Joint stock
        iv) Co-operative Society
        v)Govt. Sector

4.0   Appreciate the need for Human Resource Management
4.1   Define Personal Management.
4.2   Explain the functions of Personal Management
4.3   Define Staffing .
4.4   State the importance of HR Planning.
4.5   Explain the various Recruitment Procedures.
4.6   Explain the need for Training & Development .
4.7   State the various types of training procedures(Induction, Skill Enhancement etc)
4.8   State the different types of Leaderships,
4.9   Explain the Maslow's Theory of Motivation
4.10   Explain the Causes of accident and the Safety precautions to be followed.
4.11   Explain the importance of various Acts – Factory Act, ESI Act, Workmen
        Compensation Act, Industrial Dispute Act etc.

5.0   Explain the basics of Financial Management
5.1   State the Objectives of Financial Management.
5.2   State the Functions of Financial Management.
5.3.   State the necessity of Capital Generation & Management.
5.4   List the types of Capitals.
5.5   List the Sources of raising Capital.
5.6   Explain the Types of Budgets i) Production Budget (including Variance Report)
                     ii) Labour Budget.
5.7   Describe Profit & Loss Account (only concepts) .
5.8   Describe the proforma of Balance Sheet.
5.9   Explain   i) Excise Tax ,
        ii) Service Tax
        iii) Income Tax
        iv) VAT
        v) Custom Duty.

6.0   Explain the importance of Materials Management
6.1.   Define Inventory Management (No Numerical).
6.2   State the objectives of Inventory Management.
6.3   Explain ABC Analysis.
6.4   State Economic Order Quantity.
6.5   Describe the Graphical Representation of Economic Order Quantity.

6.6   State the objectives of Purchasing.
6.7   State the functions of Purchase Department.
6.8   Explain the steps involved in Purchasing.
6.9   State the Modern Techniques of Material Management.
6.10   Describe the JIT / SAP / ERP packages.

7.0   Explain the importance of Project Management
7.1   State the meaning of Project Management.
7.2   Describe the CPM & PERT Techniques of Project Management.
7.3   Identify the critical path and find the project duration.
7.4   Explain the concept of Break Even Analysis
7.5   Define Quality.
7.6   State the concept of Quality.
7.7   Describe the various Quality Management systems.
7.8   Explain the importance of Quality policy, Quality control, Quality Circle.
7.9   State the principles of Quality Assurance.
7.10   State the concepts of TQM , Kaizen 5's and 6 sigma.
7.11   State the constituents of ISO 9000 series standards.

Course contents :
1.0   Overview of Business:
Business - types of business in various sectors- service, manufacturing & trade- Industrial sectors – Engineering, process, Textile, Chemical, Agro industries – Globalization and effect of globalization – advantages and Disadvantages- Intellectual Property Rights (I.P.R.)
2.0   Management process
Concept of management – levels of management – Scientific management – by FW Taylor – Principles of management- functions of management – Administration – management.
3.0   Organization management
Organization – types of organization(line, line & staff, staff & project) – Departmentation – Classification (centralized, decentralized, Authority, Responsibility, and span of control – Forms of Ownership – Proprietorship – Partnership – Joint stock – Co-operative society and Government sectors.
4.0   Human resource Management
Personal Management – Staffing – Introduction to HR planning – Recruitment procedures – Types of Trainings –Personal training – skill development training – Leaderships – types – Motivation – Maslows theory – Causes of accidents – safety precautions – Factory Act – Workmen compensation Act – Industrial disputes Act- ESI Act.
5.0   Finance Management
Introduction – Objectives of Financial Management – Types of capitals – sources of raising capital – Types of budgets – production budgets – labour budgets – Concept of Profit loss Account – Concept of balance sheet – proforma – types of taxes – brief concepts of – Excise Tax, Service Tax, Income Tax, VAT and custom duty.
6.0   Material Management
Inventory Management – objectives of Inventory Management – ABC Analysis – Economic order Quality – Purchasing – Objectives of purchasing – Functions – Procedures – Material Management - JIT / SAP / ERP.
7.0   Project Management

Introduction – CPM & PERT – concept of Break event Analysis – quality system - Definition of Quality , concept of Quality , Quality policy, Quality control, Quality Circle, Quality Assurance, Introduction to TQM- Kaizen 5's and 6 sigma concepts, ISO 9000 series standards.

REFERENCES

1. Dr. O.P. Khanna - Industrial Engg &Management-Dhanpath Rai & sons New Delhi
2. Dr. S.C. Saxena & W.H. Newman& E.Kirby Warren-Business Administration &Management -Sahitya Bhavan Agra
3. Andrew R. McGill -The process of Management-Prentice- Hall
4. Rustom S. Davar -Industrial Management-Khanna Publication
5. Banga & Sharma -Industrial Organization &Management -Khanna Publication
6. Jhamb & Bokil -Industrial Management -Everest Publication, Pune.

ELECTRIC TRACTION

Subject Title	:	**ELECTRIC TRACTION**
Subject Code	:	**EE-602**
Periods/Week	:	**04**
Periods/semester	:	**60**

TIME SCHEDULE

Sl. No.	Major Topics	Periods	Weightage of marks	Short questions	Essay questions
1.	Electric Traction - Properties	20	39	3	3
2.	Traction system Equipment	20	39	3	3
3.	Constituents of Supply systems in traction	12	26	2	2
4.	Train lighting systems	08	06	2	
	Total	60	110	10	8

OBJECTIVES

On completion of the course the student shall be able to

1.0 Explain the Properties of Electric Traction

1.1   Describe single-phase A.C. and Composite systems
1.2   List the types of services (main line, suburban , Metro and urban)
1.3   Sketch the speed-time curves for the above services
1.4   State each stage of the speed-time curve with appropriate speeds.
1.5   State the importance of speed-time curves
1.6   Define Maximum speed, average speed and scheduled speed
1.7   List the factors affecting the scheduled speed
1.8   Sketch the simplified speed-time curves
1.9   Explain the practical importance of the above curves
1.10   Derive the expression for   i)maximum speed   ii) acceleration and
          retardation
           for   a)Trapezoidal speed time curve   &   b)Quadrilateral speed time
          curve.
1.11   Solve numerical examples on above speed time curves
1.12   Explain the tractive effort
1.13   Derive the expression for tractive effort for acceleration to over come gravity pull
          and train resistance.
1.14   Calculate the tractive effort under given conditions
1.15   Explain the mechanics of transfer of power from motor to driving wheel
1.16   Define `Coefficient of adhesion'
1.17   List the factors affecting the coefficient of adhesion
1.18   solve problems on calculation of number of axels required.
1.19   State the methods of improving the coefficient of adhesion
1.20   Explain the term specific energy consumption

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1.21 Derive the formulae for energy output of drive to
      i)   Accelerate
      ii)   To overcome friction
      iii)   To overcome gradient
1.22 List the factors affecting specific energy consumption
1.23 Solve simple problems on specific energy calculation under given conditions.

2.0 Explain the function of the various Traction system Equipment
2.1 List the various Overhead Equipments (OHE).
2.2 State the Principles of Design of OHE like
      i)   Composition of OHE.
      ii)   Height of Contact Wire.
      iii)   Contact Wire Gradient.
      iv)   Encumbrances.
      v)   Span Length.
2.3 Explain Automatic Weight Tension and Temp. compensation.
2.4 Distinguish between Un insulated Overlaps and Insulated Overlaps.
2.5 State the importance of Neutral Section.
2,6 State the importance of Section Insulator.
2.7 State the importance of an Isolator.
2.8 Describe the Polygonal OHE:
      i)   Single Catenary Construction.
      ii)   Compound Catenary Construction.
      iii)   Switched Catenary Construction.
      iv)   Modified Y Compound Catenary.
2.9 State the effect of Speed on OHE.
2.10 Describe the need for OHE Supporting Structure.
2.11 List the different types of signal boards of OHE.
2.12 Describe the OHE Maintenance Schedule. (No Derivation and No Numerical)
2.13 State the important requirements of traction motor
2.14 Explain the suitability of different motors D.C,1-ϕA.C, 3-ϕ A.C. ,Composite & Kando systems for traction
2.15 Explain with legible sketch the control of traction motor by autotransformer method in
single phase 25 kv system
2.16 Explain the purpose and material used for
      i)   Catenary
      ii)   droppers
      iii)   trolley wires
      iv)   bow collector
      v)   pantograph collector
2.17 Explain with legible sketch the construction of
      i)   Diamond Pentograph
      ii)   Faiveley Pentograph
2.18 State the methods of Raising and Lowering of Pentograph.
2.18 Describe the maintenance of pantograph.
2.19 State the need for Booster Transformer.

3.0 Explain the Constituents of Supply systems in traction
3.1 List the various constituents of Supply systems in traction Substations.

3.2   Describe the various constituents of Supply systems
    i)   Feeding Posts.
    ii)   Feeding and Sectioning Arrangements.
    iii)   Sectioning and Paralleling Post.
    iv)   Sub sectioning and Paralleling Post.
    v)   Sub sectioning Post.
    vi)   Elementary Section.
    vii)   Miscellaneous Equipments at Control Post or Switching Stations.
3.3   Describe the Major Equipment at traction Substation.
    i)   Transformer.
    ii)   Circuit Breaker.
    iii)   Interrupter.
3.5   Describe the Protective System for AC Traction – Transformer Protection and 25
 KV
        Centenary Protection.
3.6   Explain the importance of Location and Spacing of Substations.
3.7   Explain End on Generation.
3.8   Explain Mid on Generation

4.0   Explain the various Train lighting systems
4.1   State the requirements of Train lighting.
4.2   Describe the method of obtaining Unidirectional polarity.
4.3   Describe the method of obtaining constant output.
4.4   Explain   i) single battery system
                        ii) Double battery parallel block system
4.5   Mention the requirements of railway coach air conditioning.

Course contents

1.0   Electric Traction properties

Single-phase A.C. and Composite systems -Types of services (main line, suburban , Metro and urban) - speed-time curves for the above services- importance of speed-time curves - Maximum speed, average speed and scheduled speed- Factors affecting the scheduled speed -Simplified speed-time curves & practical importance -Expression for maximum speed, acceleration and retardation for Trapezoidal & Quadrilateral speed time curves.- numerical examples - tractive effort & derivation - Coefficient of adhesion-factors affecting the coefficient of adhesion - problems on calculation of number of axels required.-methods of improving the coefficient of adhesion- specific energy consumption- factors affecting specific energy consumption-simple problems on specific energy calculation under given conditions.

2.0   Traction system Equipment
Overhead Equipments (OHE).- Principles of Design of OHE:- Automatic Weight Tension and Temp. compensation.- Un insulated Overlaps.-Insulated Overlaps - Neutral Section - Section Insulator.- Isolator - Polygonal OHE -Single Catenary Construction - Compound Catenary Construction - Switched Catenary Construction - Modified Y Compound Catenary - Effect of Speed on OHE - OHE Supporting Structure. - Different types of signal boards of OHE.- Maintenance of OHE - OHE Maintenance Schedule- State the important requirements of traction

motor - suitability of different motors D.C,1-ϕA.C, 3-ϕ A.C. ,Composite & Kando systems for traction - Control of traction motor by autotransformer method in single phase 25 kv system - purpose and material used for
Catenary, droppers, trolley wires, bow collector, pantograph collector- Need of Booster Transformer.

3.0   Constituents of Supply systems in traction
Substations - Feeding Post – types - Miscellaneous Equipments at Control Post or Switching Stations.- Major Equipments at traction Substation. - Protective System for AC Traction – Transformer Protection and 25 KV Catenary Protection - Location and Spacing of Substations - End on Generation- Mid on Generation.

4.0   Train lighting systems
Requirements of Train lighting- Unidirectional polarity - single battery system - Double battery parallel block system- requirements of railway coach air conditioning.

REFERENCES

1. S.K.Pillai -A first course on Electric Drives-.
2 . M.V.Deshpande -Electrical Motors applications and control
4. S.L.Uppal -Electrical power
5. J.B.Gupta -Electrical power
6. H.Pratab – Modern Electric Traction –Dhanpat Rai & sons
7. J.Upadhyay , S.N.Mahendra – Electric Traction _ Allied Publishers Ltd.

POWER SYSTEMS –III

Subject Title : **POWER SYSTEMS-III (SWITCHGEAR AND PROTECTION)**

Subject Code : **EE – 603**
Periods / Week : **04**
Periods /Semester : **60**

TIME SCHEDULE

Sl. No	Major Topics	*Periods*	Weightage of marks	Short questions	Essay questions
1.	Switch Gear and Circuit Breakers	9	16	2	1
2.	Fuses and Reactors	7	13	1	1
3.	Protective Relays	12	21	2	1 ½
4.	Protection of Alternators and Transformers	12	23	1	2
5.	Protection of Transmission Lines and feeders	11	21	2	1 ½
6.	Lighting Arrestors and Neutral Grounding	9	16	2	1
	Total	**60**	**110**	**10**	**8**

OBJECTIVES
On completion of the course the student shall be able to

1.0   Comprehend Switch Gear and Circuit Breakers.
1.1   State the types of faults in power system and their effects.
1.2   Define switch gear
1.3   Classify switch gear
1.4   State the purpose of isolators, air break switches and knife switches.
1.5   Give the Classification of the switches,
1.6   List the uses and limitations of the different types of switches.
1.7   Explain the phenomenon of arc, arc voltage, arc current and its effects.
1.8   State factors responsible for arc formation.
1.9   Describe the methods of arc quenching.
1.10   Classify the circuit breakers based upon medium of arc quenching.
1.11   State the principle of Bulk oil circuit breaker(B.O.C.B)
1.12   List the types of BOCB.
1.13   Explain the working of each type of B.O.C.B.
1.14   State the principle of Minimum oil circuit breaker M.O.C.B
1.15   Explain the working of MOCB.
1.16   Compare B.O.C.B and M.O.C.B
1.17   State the properties of SF_6 gas

1.18   State the principle of working of SF$_6$ circuit breakers.
1.19   Explain the working of SF$_6$ CB .
1.20   Explain the principle and working of Air break circuit breaker(A.B.C.B.)
1.21   Compare OCB, SF$_6$CB and A.B.C.B.

2.0   Comprehend Fuses and Reactors
2.1   Explain fuse as protective device
2.2   List various types of fuses.
2.3   Define the following :
       i) Rated current   ii) Fusing current   and   iii) Fusing factor.
2.4   List different fuse materials.
2.5   State the importance of current limiting reactors.
2.6   List the types of reactors
2.7   Describe the construction of the different types of reactors.
2.8   Draw the schematic diagram of reactor connections.
2.9   State the importance of short circuit KVA
2.10   Solve simple problems

3.0   Comprehend Protective Relays.
3.1   State the basic requirements of relays.
3.2   State the important features of relays.
3.3   Classify the relays based upon
       i) Principle of Operation   ii) Time of operation.
3.4   Explain the working of thermal relay.
3.5   List the uses of thermal relay.
3.6   List the merits and demerits of thermal relay.
3.7   Describe the working of solenoid plunger
3.8   Describe the working of attracted armature relays
3.9   List the uses of attracted armature relays
3.10   Describe the construction of induction type over current relay.
3.11   Explain the working of induction type over current relay.
3.12   Describe the current setting, time setting and application of above relay.
3.13   Explain the principle of obtaining directional property in induction relays.
3.14   Describe the working of directional over current induction relay
3.15   List the applications of directional over current induction relay.
3.16   Explain the principle of working of impedance relay.
3.17   Describe the construction of impedance relay.
3.18   List the applications of impedance relay.
3.19   Explain distance relay.
3.20   List the uses of distance relay.
3.21   Describe the two types differential protection.

4.0   Understand the Protection of Alternators and Transformer.
4.1   List the probable faults in Alternator Stator and Rotor
4.2   State the effects of faults on Alternator Stator and Rotor.
4.3   Describe the scheme of protection against excessive heating of stator
       and rotor.
4.4   Explain the differential protection for alternator stator.
4.5   Explain the earth fault protection for rotor.
4.6   Explain the split phase protection of alternator against inter-turn short
       circuits.

4.7   Explain the need and working of field suppression protection.
4.8   List the possible faults in a transformer by mentioning their effects.
4.9   List the precautions to be taken for applying differential protection to
       transformers.
4.10   Explain differential protection of transformer.
4.11   Explain the working of Buchholz relay and its protection scheme for
transformer.

5.0   Understand the Protection of Transmission Lines and feeders
5.1   Explain the different schemes of protection for single and duplicate bus
bars.
5.2   Describe the transmission line protection and feeder protection.
5.3   Explain pilot wires and their effects.
5.4   Explain the protection of transmission lines using distance and
       impedance relays.
5.5   Explain the combined protection by using definite distance and time
       distance relays.
5.6   Explain protection of radial feeders using time graded fuses.
5.7   Explain protection of parallel feeders using directional relays.
5.8   Explain protection of ring main feeder using directional relays.
5.9   Derive a relation between number of sections and minimum relay time.
5.10   Explain differential protection for parallel feeders of transmission lines.

6.0   Understand the Lightning Arrestors and Neutral Grounding.
6.1   Define surge.
6.2   List the types of surges.
6.3   Give reasons for the cause of surges..
6.4   Explain the scheme of surge protection with diagram.
6.5   Explain the types of lightning arrestors or surge diverters.
6.6   List the six types of lightning arrestors
6.7   Describe the construction of following types of lightning arrestors.
       i)Rod gap ii) Sphere gap iii) Horn gap iv) Valve type v) Thyrite type
       iv) Lead oxide.
6.8   Explain the , working of the above lightning arrestors
6.9   List the applications of the above lightning arrestors.
6.10   Explain the necessity of neutral grounding
6.11   Give the merits and demerits of neutral grounding.
6.12   Describe the following methods of neutral grounding
       i)solid grounding   ii)Resistance grounding
       iii)Reactance grounding   iv)voltage transformer grounding
       v)Zig-zag transformer grounding.
6.13   Compare the different methods of neutral grounding .

COURSE CONTENT

1.   **Switch Gear and Circuit Breakers**

       Switch gear and their classification – Isolators, air break switches and knife

       switches – Explain the phenomenon of arc, arc voltage, arc current and their

       effects – Factors responsible for arc and arc quenching. Circuit breakers and

their classification based on the medium of arc quenching – B.O.C.B, M.O.C.B their comparison – Properties of SF_6 gas and principles of SF_6 circuit breakers – Working of A.B.C.B, O.C.B, SF_6 CB and their comparisons.

2. **Fuses and Reactors**

Fuse as protective device and different types of fuses based on rated current, fusing current, fusing factor – Current limiting reactors and their necessity. Types of reactors and their construction – Equation for short circuit KVA and solve problems.

3. **Protective Relays.**

Requirements, activities of relays – Classifications based on duty, principle of operation and time of operation – Thermal, Solenoid plunger and attracted armature relays – Their uses merits and demerits. Construction and working of induction type over current type relays – Directional Over current relay Principle, construction working of impedance, distance relay.

4. **Protection of Alternators ,Transformer**

Protection of Alternators Scheme of protection probable faults in alternators against excessive heating of stator and rotor. Earth fault protection for stator and rotor – Split phase protection for alternator against short circuits. Field suppression protection . Protection of Transformer, Possible faults and their types in the transformer – Precautions required for protection – Differential protections of Buchholz relay, protection against excessive heating of transformed oil.

5. **Protection of Transmission Lines and Feeders,**

Transmission line and feeder protection – Pilot wires, protection of transmission lines using distance and impedance relays. Combined protection using definite distance and time distance relays – Protection of radial feeders, parallel feeders, ring main feeders using time graded fuses directional relays. Surge Protection Surge types and causes for production – Scheme of surge protection with diagram. Types of lightning arrestors – Working and applications of rod gap, sphere gap, horn gap, valve type, Thyrite type and lead oxide.

6. **Lightning Arrestors and Neutral grounding**

Need for Surge Protection and its methods – Various types of LA's , Horn gap – Sphere Gap – Valve type, Thyrite type and Lead Oxide type, Necessity of neutral grounding, Its merits and demerits- Methods of Grounding the neutral.

Reference Books

8.   V.K. Mehta -Principle of Power systems
9.   S.L. Uppal -Electrical power
10.   Sony,Gupta and Bhatnagar -Text book of Electrical. Power
11.   JB Gupta-Electrical Power
12.   CL Wadhwa- Electrical power Systems-Wiley Eastern
13.   Hand book of Switch gear (BHEL) Tata Mc Graw Hill
14.   B.Ravindranath &M.Chander-Power system Protection and Switch gear-New
      Age
                                                    International.

POWER ELECTRONICS

Subject Title : **Power Electronics**
Subject Code : **EE-604**
Periods/Week : **04**
Periods/Semester : **60**

TIME SCHEDULE

S. no	Major Topics	No. of periods	Weightage of marks	Short questions	Essay questions
1	Power Electronic Devices	20	39	3	3
2	Converters, AC Regulators & Choppers	15	26	2	2
3	Inverters and Cyclo-converters	8	16	2	1
4	Speed control of AC / DC Motors	9	16	2	1
5	Application of Power Electronic circuits	8	13	1	1
	Total	60	110	10	8

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the construction and working of Power Electronic Devices
1.1 List different thyristor family devices.
1.2 Draw the ISI circuit symbols for each device.
1.3 Describe constructional details of SCR
1.4 Explain the Operartion of SCR.
1.5 Describe thetwo transistor analogy of SCR.
1.6 Explain the Volt – Ampere characteristics of SCR with the help of a diagram.
1.7 Draw the Gate characteristics of SCR
1.8 Mention the ratings of SCR.
1.9 Give the advantages of SCR as a switch.
1.10 List ten applications of SCR.
1.11 Explain the construction of GTO SCR
1.12 Compare the characteristics of GTO SCR and SCR.
1.13 Explain the Volt-ampere characteristics of Diac under forward / Reverse bias.
1.14 Explain the Volt-ampere characteristics of Triac under forward / Reverse bias.
1.15 State the four modes of Triac triggering.
1.16 Distinguish between SUS, SBS, SCS & LASCR
1.17 Explain SCR circuit triggered by UJT.
1.18 Explain power control circuits of the following
    i)Diacs   ii) Triacs   and   iii) SCR's.
1.19 Explain the working of the following

i)Reverse conducting thyristor (RCT)   ii)Asymmetrical SCR (ASCR)
iii)Power BJT   iv)Insulated gate Bipolar transistor (IGBT)
v)MOS-controlled thyristors (MCT)
by giving theirV-I characteristics.

1.20   State the necessity of Commutation in SCR's
1.21   Explain various methods of Commutation.
1.22   Describe the mechanism of protecting power devices.

2.0   Understand the working of Converters, AC regulators and Choppers.
2.1   Classify converters.
2.2   Explain the working of single-phase half wave controlled converter with Resistive and R-L loads.
2.3   Understand need of freewheeling diode.
2.4   Explain the working of single phase fully controlled converter with resistive and
     R- L loads.
2.5   Explain the working of three-phase half wave controlled converter with Resistive load
2.6   Explain the working of three phase fully controlled converter with resistive load.
2.7   Explain the working of single phase AC regulator.
2.8   Explain the working principle of chopper.
2.9   Describe the control modes of chopper
2.10   Explain the operation of chopper in all four quadrants.

3.0   Understand the Inverters and Cyclo-converters
3.1   Classify inverters.
3.2   Explain the working of series inverter .
3.3   Explain the working of parallel inverter
3.4   Explain the working of single-phase bridge inverter.
3.5   Explain the working of three-phase inverter.
3.6   Explain the basic principle of Cyclo-converter.
3.7   Explain the working of single-phase centre tapped Cyclo-converter.
3.8   Applications of Cyclo-converter.

4.0   Understand speed control of DC / AC Motors
4.1   Mention the factors affecting the speed of DC Motors.
4.2   Describe speed control for DC Shunt motor using converter.
4.3   Describe speed control for DC Shunt motor using chopper.
4.4   List the factors affecting speed of the AC Motors.
4.5   Explain the speed control of Induction Motor by using AC voltage regulator.
4.6   Explain the speed control of induction motor by using converters and inverters (V/F control)

5.0   Understand the Applications of power electronic circuits
5.1   List any six applications of power electronic circuits.
5.2   Explain the Light dimmer circuit using DIAC/TRIAC with the help of a diagram.
5.3   Explain the Burglar alarm circuit using SCR with the help of a diagram.
5.4   Explain the Emergency lamp circuit using SCR with the help of a diagram.

5.5   Explain the Battery charger circuit using SCR with the help of a diagram.

COURSE CONTENTS

1.   Power Electronic Devices
Types of power semiconductor devices – SCR, Triac, Power BJT, IGBT-
Construction, Working principle of all devices, symbol. Two transistor analogy for
SCR – V-I & Gate characteristics, Forward break over voltage, latching current,
holding current, turn on triggering time, turn off time - triggering of SCR using
UJT- Necessity of Commutation- various methods of Commutation-pprotection of
power devices.

2.   Converters AC Regulators & Choppers
Classification of converters, single phase half wave fully controlled converter,
freewheeling diode, single phase fully controlled converter, three phase half
wave, three phase half wave andfull wave controlled converter , single phase ac
regulator, choppers- Four quadrant operation –different modes of operation.

3.   Inverters&Cyclo-converters
Classification of Inverters-basic series Inverter- parallel Inverter- single - phase
bridge Inverter– Three phase bridge Inverter. Cyclo-converter – basic principle of
operation- single-phase center tapped Cyclo-converter- applications of Cyclo-
converters.

4.   Speed Control   of   DC/AC Motors
DC Motor control- Introduction-Speed control of DC shunt Motor by using
converters and choppers
 AC Motor Controls: speed control of induction Motor by using AC voltage
controllers - V/F control (Converters and invertors control).

5.   Application   of   Power Electronic   Circuits
 Light dimmer Circuit- Burglar alarm Circuit- Emergency lamp and Battery
charger Circuit using SCR- Advantages of the above circuits.

REFERENCES
1   Jamil Asghar -Power Electronics– PHI, New Delhi.
2.   Chute -Industrial Electronics
1   Mithal- Industrial Electronics
2   P.C.Sen.-Industrial Electronics
3   Berde-Industrial Electronics
4   P.C.Sen.-Advanced Power Electronics
5   Harish Rai -Industrial & Power Electronics.
6   R.K.Sugandhi & KK Sugandhi -Thyristor (theory & applications)

MICRO CONTROLLERS & APPLICATIONS

Subject title : **Micro controllers & Applications**
Subject code : **EE- 605**
Periods/week : **04**
Periods/semester : **60**

TIME SCHEDULE

Sl. No.	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Micro processors & Micro controllers	14	19	3	1
2	Architecture of 8051	08	19	3	1
3	Addressing modes & Instruction set of 8051	14	26	2	2
4	Programming concepts of 8051	14	26	2	2
5	Applications of 8051	10	20	-	2
	Total	**60**	**110**	**10**	**8**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Differentiate between Micro processors & Micro controllers
  1.1 Define the terms used in Micro processor literature.
  1.2 Describe the Evolution of Micro processor.
  1.3 Explain the basic fundamental blocks of Micro processor.
  1.4 Explain the Micro processor-based system.
  1.5 Distinguish between Micro, Mini and Large computers.
  1.6 Describe the features of Intel 8085.
  1.7 Explain the concept of Peripheral interfacing.
  1.8 Draw the functional block diagram, interface with 8085 and write Command word of 8255, 8279 & 8237.
  1.9 State RS-232 standards.
  1.10 Explain the concept of Micro controllers.
  1.11 Compare Embedded with External memory devices.
  1.12 Differentiate between CISC and RISC processors.
  1.13 Differentiate between Harvard and Von Neumann architectures.
  1.14 List the three commonly used Commercial Microcontroller Device families.

2.0 Appreciate the Architecture of 8051
  2.1 Draw the block diagram of a microcontroller and explain the function of each block.
  2.2 Explain the features of micro controllers.
  2.3 Draw the functional block diagram of 8051 microcontroller
  2.4 Describe the register structure of 8051.

2.5   Explain the functions of various special function registers.
2.6   Draw the pin diagram of 8051 micro controller and specify the purpose of each pin.
2.7   Describe internal memory, external memory and ports of 8051.
2.8   Describe counters & timers in 8051
2.9   Explain serial input/output of 8051
2.10   Explain interrupts in 8051.
2.11   Describe the four timer modes in 8051.

3.0   Explain the Instruction set and Addressing modes of 8051
3.1   State the need for an instruction set.
3.2   Describe the instruction format of 8051.
3.3   Explain fetch cycle, execution cycle and instruction cycle.
3.4   Distinguish between machine cycle and T-state.
3.5   Draw the timing diagram for memory write, memory read operations of 8051.
3.6   Define the terms machine language, assembly language, and mnemonics.
3.7   Give the difference between machine level and assembly level programming.
3.8   List the major groups in the instruction set along with examples.
3.9   Explain the terms operation code, operand and illustrate these terms by writing an instruction.
3.10   Explain the data manipulation functions data transfer, arithmetic, logic and branching.
3.11   Classify the 8051 instructions into one byte, two byte and three byte instructions.
3.12   Describe the five addressing modes of 8051.
3.13   Explain data transfer instructions of 8051.
3.14   Explain the arithmetic instructions and recognise the flags that are set or reset for given data conditions.
3.15   Explain the logic instructions and recognize the flags that are set or reset for given data conditions.
3.16   Illustrate the logic operations and explain their use in making, setting and resetting of individual bits.
3.17   Explain unconditional and conditional jump and how flags are used to change the sequence of program.

4.0   Appreciate the Programming concepts of 8051
4.1   List the various symbols used in drawing flow charts.
4.2   Draw flow charts for some simple problems.
4.3   Write programs in mnemonics to illustrate the application of data copy instructions and translate these mnemonics into hex codes.
4.4   Write programs of instructions to perform single byte, double byte and multi byte addition and subtraction.
4.5   Illustrate the application of jump instruction in the program.
4.6   Write a program using counter techniques.
4.7   Define a subroutine and explain its use.
4.8   Explain the sequence of program when subroutine is called and executed.

4.9   Explain how information is exchanged between the program counter and the stack and identify the stack pointer register when a subroutine is called.
4.10   Write program to perform Single byte & Multi byte addition.
4.11   Write program to sum up given 'N' numbers.
4.12   Write program to sum up given 1st 'N' natural numbers.
4.13   Write program to multiply two 8-bit numbers using 'MUL' instruction.
4.14   Write program to find biggest data value in given Data array.
4.15   Write program to convert a given 'HEX' number to 'BCD' number.

5.0   Appreciate the applications of 8051.
5.1   Explain the working of 8051 Microcontroller in Traffic light controller.
5.2   Explain the working of 8051 Microcontroller in Clock program using the kit.
5.3   Explain the working of 8051 Microcontroller as Dot matrix display interface.
5.4   Explain the working of 8051 Microcontroller as Printer interface.
5.5   Explain the working of 8051 Microcontroller in Stepper motor control.
5.6   Explain the working of 8051 Microcontroller as Keyboard interface.
5.7   Explain the working of 8051 Microcontroller as a Seven segment display interface.

COURSE CONTENTS

1.0   Micro processors & Micro controllers:
Terms used, History, interfacing,commercially used microcontrollers.

2.0   Architectureof8051:

Block diagram of microcomputer, Block diagram of 8051, Pin out diagram of

8051, registers, timers, interrupts, modes of operation.

3.0   Instruction set and Addressing modes 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,

operand.

4.0   Programming concepts of 8051:

Flow charts, Data transfer, subroutines, single and multi byte addition and

subtraction, multiplication, conversion

5.0   Applications of 8051:
Traffic lights, clock program, dot matrix display interface, printer interface,
stepper motor control, keyboard interface, seven-segment display interface.

TEXT BOOKS :

1. Mazidi and Mazidi -8051 Micro controller.
2. Kenneth J.Ayala. -8051 Micro controller
3. Myke Predko -Programming customizing the 8051 Microcontroller - TMH

4. Douglas Hall -Microprocessors and interfacing -McGraw Hill.
5. Ramesh S Gaonkar-Micro Processors

REFERENCES:

1. Barry Brey-Intel Microprocessors -Prentice-Hall.
2. Ghosh & Sridhar-0000 to 8085: Introduction to microprocessors for engineers and scientists Prentice-Hall.
3. Ajay V Deshmukh -Microcontrollers (Theory and applications)- TMH

INDUSTRIAL AUTOMATION

Subject Title : **INDUSTRIAL AUTOMATION**
Subject code : **EE-606**
Periods/Week : **04**
Periods/Semester : **60**

TIME SCHEDULE

Sl. No	Major Topics	Periods	Weightage	Short Questions	Essay Questions
1.	Basic Concepts of Control Systems	10	21	02	1 &1/2
2.	Components of control systems	08	13	01	01
3.	Electrical Actuators and Controllers	12	26	02	02
4.	Block Diagram Reduction Techniques	10	16	02	01
5.	Control Procedures in Control systems	5	08	01	1/2
6.	PLC and its applications	15	26	02	02
	Total	60	110	10	08

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

3.0   Basic Concepts of Control Systems
1.1   State the need for Automation.
1.2   List the advantages of Automation
1.3   Mention the requirements of Automation.
1.4   Explain the importance of control Engineering in day to day life and industry
1.5   State the concept of control systems like Automobile control system, Speed control of AC/DC motor, Water level Controller.
1.6   Define the following terms using the above ideas
                (i)Input of a control system
                (ii)Output of a Control system
                (iii)Control Elements
1.7   Explain the Open loop and Closed loop control systems with examples like water level controller, Temperature Controller etc
1.8   Describe how the temperature of a room is controlled with setup
1.9   State the need for feedback in a control system
1.10   Understand concepts of types of feed back
1.11   Draw a generalized block diagram of a feed back control system and give the terminology
1.12   Define transfer function and derive it
1.13   State the equivalence of physical system components into electrical System elements

4.0   Components of control systems

2.1   Explain the contact types(Normally open and Normally closed)
2.2   Describe AC and DC Solenoids
2.3   Explain the different Input devices-Push button, Selector switch, Photo electric, Level
        Control, Pressure sensing device
2.4   Explain the different output devices-contactors, valves, Pilot lamps
2.5   Explain the working of Electromagnetic relay and Reed Relay

3.0   Electrical Actuators and Controllers
3.1   Explain the working of Potentiometers and their use as error detector
3.2   State the working principle of AC & DC Servomotors
3.3   Explain the working of Synchros - transmitter, control transformer and their use as error
        detector
3.4   State the concept and purpose of a Tacho – generator
3.5   State the concept of Electric controller
3.6   List the 4 types of controllers (Hydraulic, Pneumatic, Electrical and Electronic and
        Digital)
3.7   List the advantages and disadvantages of Hydraulic controllers
3.8   Differentiate between Hydraulic and Pneumatic controllers.
3.9   Give the concept of Electrical and Electronic controller
3.10   Give the concept of Digital controller

4.0   Block Diagram Reduction Techniques
4.1   Explain how a given system is characterized
4.2   Explain the use of transfer function in characterizing a system equation
4.3   State the properties, limitations of transfer functions of systems
4.4   Obtain the impulse response of a system
4.5   Convert the Electrical systems like R, L and C in Laplace transform domain
4.6   Solve simple problems to obtain the transfer function relating to Electrical
systems
4.7   Solving simple problems on reduction of block diagram

5.0   Control Procedures in Control systems
5.1   Obtain the concepts of the following systems:
                (i) Linear and Non-Linear control system
                (ii) Time Variant and Time invariant system
                (iii) Continuous data and sampled data system
                (iv) Digital Control system
5.2   Obtain the concepts of the following control actions:
                (i)   P- Controller   (ii)   I- Controller
                (iii) PI Controller   (iv) PD Controller   (v) PID Controller

6.0   PLC and its applications
6.1   State the need of Automation
6.2   State the advantages and requirements of Automation
6.3   Define Programmable Logic Controller(PLC)
6.4   State the advantages of PLC
6.5   Explain the different parts of PLC by drawing the Block diagram.
6.6   State the purpose of each part of PLC.
6.7   State the applications of PLC

6.8   Explain Ladder diagram
6.9   Explain contacts and coils in the following states
       i)Normally open   ii) Normally closed   iii) Energized output
       iv)latched Output   v) branching
6.10   Draw ladder diagrams for   i)AND gate   ii) OR gate   and iii)NOT gate.
6.11   Draw ladder diagrams for combination circuits using NAND,NOR, AND, OR and NOT
6.12   Explain the following Timers-i)T ON   ii) T OFF   and   iii)Retentive timer
6.13   Explain Counters-CTU, CTD
6.14   Draw ladder diagrams using Timers and counters
6.15   Explain PLC Instruction set
6.16   Explain ladder diagrams for following
               (i) DOL starter and STAR-DELTA starter
               (ii) Stair case lighting
               (iii) Traffic light control
               (iv) Temperature Controller
6.17   Explain the Hardware and software used in following special control systems
               (i) Distributed Control system(DCS)   (ii) SCADA

COURSE CONTENT

1.0 Basic Concepts of Control Systems
Basic concepts-Definition of open loop and closed loop system, examples with block diagrams. Terms used in the control systems-Types of feedback-Transfer function-Definition &derivation control systems- Equivalence of physical system components into electrical System elements

2.0 Components of control systems
Contact types-Normally open & Normally closed, Solenoids-AC/DC, Input devices-

Push button, Selector switch, Photo electric, Level Control, Pressure sensing
   device,
Output devices- contactors, valves, Pilot lamps, Relays-Electromagnetic and Reed
   Relay

3.0 Electrical Actuators and Controllers
Potentiometers –working principle, AC & DC Servomotors-working principle, working of Synchros - transmitter, control transformer, concept and purpose of a Tacho – generator

4.0 Block Diagram Reduction Techniques
Transfer function –Purpose and properties- limitations of transfer functions of systems- Impulse response of system-Conversion of Electrical systems like R, L and C in Laplace transform domain- simple problems to obtain the transfer functions-Block diagram reduction Technique-Solving Simple problems using reduction technique

5.0 Control Procedures in Control systems

Types of control systems-Time Variant/ Invariant systems, Continuous data and sampled data system, Linear and Non-Linear control system, Digital Control system-Concept of controllers- P Controller, I Controller, PI Controller, PD Controller, PID Controller

6.0 PLC and its applications

PLC Definition-advantages-Block diagram-Ladder diagrams for AND, OR, NOT, NAND, NOR-Instruction set-Ladder diagram for DOL starter, Star-Delta Starter, Stair case lighting, Traffic light control, Temperature controller-Special control systems-DCS, SCADA

REFERENCES

1. Nagarath & Gopal- Control Systems
2. Ogata- Control systems
3. S.K.Bhattacharya -Control of Electrical Machines
4. Jacob -Industrial control engineering
5. Jon Sterenson-Industrial automation and process control –
6. John W.Webb -Programmable Logic controllers
7. Gary Dunning- Introduction to PLC - Delmar Cengage learning.
8. B.C. Kuo – Automatic Control Systems –John Wiley and Sons
9. NISE-Control Systems Engineering John Wiley Publishers.
10. N. K. Sinha -Control Systems-New age international (P) limited

ELECTRICAL CAD AND PROJECT MANAGEMENT PRACTICE

Subject Title   *: Electrical CAD and Project Management Practice*
Subject Code   **: EE-607**
Periods/Week   **: 06**
Periods/Year   **: 90 (30 sessions each of 3 periods duration)**
TIME SCHEDULE

S. No.	Major Topics	No. of Sessions
1.	Study the Auto cad screen, various tool bars menus	2
2.	Exercise on standard commands	1
3.	Exercise on 2D drawing commands	1
4	Exercise on modify 2D commands	2
5.	Exercise on dimensioning commands	1
6	Exercise on formatting commands	1
7	Exercise on Insert commands	1
8	Exercise on view commands	1
9	Exercise on isometric drawings in 2D	3
10	Exercise on Electrical drawings	7
11	Exercise on shading of 3D models	2
12	Study of Project Management Software tools	3
13	Practising of Project Management Software	5
	TOTAL SESSIONS	30

OBJECTIVES

Upon completion of the practice the student shall be able to

1.0   Study the Auto cad screen components.
1.1   Study components in menu bar
1.2   Customise and arrange tool bar
1.3   Display the drawing created in the working area.
1.4   Study user coordinate system(UCS)
1.5   Increase or decrease layouts
1.6   Give the inputs in the command bar
1.7   Display name and purpose of the tools
1.8   Study cross hair to locate the cursor
1.9   Invoke the commands
1.10   Getting started with AutoCAD

2.0   Practice Exercises on Standard commands.
2.1   Create a new file by NEW command
2.2   Open a file by OPEN command
2.3   Save a file by SAVE command
2.4   Close a file by CLOSE command
2.5   Delete the object or text using CUT command
2.6   Copy the object or text using COPY command
2.7   Paste entities copied by using PASTE command

2.8   Zoom an object by using ZOOM command.

5.1   Practice Exercises on 2D drawing commands.
5.2   Draw a line using LINE command
5.3   Create a multiple parallel lines by using MLINE command
5.4   Create a poly line using POLYLINE command
5.5   Add arc segments to a poly line using ARC command
5.6   Draw a circle using CIRCLE command, with centre point and radius.
5.7   Draw a polygon using POLYGON command
5.8   Draw a helix using HELIX command
5.9   Draw a rectangular, Triangular and quadrilateral areas filled with a solid colour with the help of plane tool
5.10   Draw a smooth curve to a series of points using SPLINE command
5.11   Draw an elliptical curve using ELLIPSE command
5.12   Divide a object into specified segments using DIV command
5.13   Insert a block into the current drawing using INSERT command000
5.14   Fill an enclosed area or an object using HATCH command

4.0   Practice Exercises on modifying 2D commands
**4.1   **Create a mirror image of an entity using MIRROR command
**4.2   **Create multiple images of an entity using ARRAY command
**4.3   **Change the size of an object by using STRETCH command
**4.4   **Trim the edges of an object at the edges of another object using TRIM command
**4.5   **Break a line or an object between two points using BREAK command
**4.6   **Join two similar objects to form a single using JOINT command
**4.7   **Create a fillet round the edges of two arcs using FILLET command
**4.8   **Chamfer on lines which are crossed, radiating or unlimited long using CHAMFER command
**4.9   **Break a compound object into its component objects using EXPLODE command
4.10   Form a group of selected entities by using GROUP command

4.0   Practice Exercises on dimensioning commands.
**5.1   **Create and modify quickly a series of dimensions using QDIM command
5.2   Practice LINEAR ,ALIGNED ,and COORDINATE dimensions
5.3   Indicate radii and diameters of arcs and circles using RADIUS or DIAMETER commands
5.4   Measure angle between two lines using ANGLUR dimension command
5.5   Measure length of arc using ARC LENGTH command
5.6   Create a base line dimension from a specified baseline using BASELINE command
5.7   Mark a centre of an arc or circle using CENTREMARK command

6.0   Practice Exercises on formatting commands.
6.1   Create layers using LAYER command.
6.2   Control the visibility of objects and assigned properties to objects.
6.3   Practice the locking unlocking of layers.
6.4   Write a text to drawing, change font size and style.
6.5   Create a standard naming convention to a text styles, table styles, layer styles, dimension styles etc.

7.0   Practice Exercises on insert commands.
7.0   Insert blocks into current drawing file using INSERT command
7.0   Attach an image to a drawing image using ATTACH RASTER IMAGE command
7.0   Add an attribute to a drawing by defining it and save it by using DEFINE ATTRIBUTE
7.0   Define attribute by specifying the characteristics of the attribute, including its name,
prompt and default values

8.0   Practice Exercises on view commands.
8.1   Redraw or refresh a display by using REDRAW command
8.2   Regenerate or reproduce the current viewports of all entities by using Regen command
8.3   Show the orthographic views (side view, top view, front view) of any object
8.4   Show the isometric views of any object
8.5   Shade a given object with solid colour using SHADE command
8.6   Create a hidden line view of a model using HIDE command
8.7   Create wire frame model using WIRE FRAME command

9.0   Practice Exercises on isometric drawings in 2D.
9.1   Visualise the isometric view of a box from top or bottom and left or right corners like SW,NE isometric views
9.2   Create two dimensional isometric drawings by using Isometric SNAP and GRID
9.3   Visualise the boundary of drawing and distances between entities by using
 reference grid
9.4   Use set snap spacing ensure accuracy of drawing
9.5   Change the default axis colours, size of the crosshair display by using crosshair
 tab
9.6   Create an isometric circle on the current isometric plane using Ellipse Isocircle

10.0   **Practice Exercises on Electrical drawings**
10.1   Draw Electrical symbols
10.2   Draw core section of transformer
10.3   Draw electrical poles and towers
10.4   Draw pipe earthing with dimensions
10.5   Draw plate earthing with dimensions
10.6   Draw simple electronic circuits
10.7   Draw the views of electrical machines like DC and AC machines

11.0   **Practice Exercises on shading of 3D models**
11.1   Draw and shade 3D models of box, pyramid, cone, cylinder, sphere
11.2   Create a torus.
11.3   Make the 3D model Revolve.

 12.0   Understanding Project Management Software Open Project(free open
 source

 software)

12.1 State the features and applications of Project management software
12.2 Understand the Various Menus used in Open Project Software.
12.3 Determine project costs

13.0 Practice tools in Open Project Management software
13.1 Study the components of input data.
13.2 Study the various commands to execute the given input data.
13.3 Create a new project file.
13.4 Create tasks in a project.
13.5 Create relationships between tasks.
13.6 Create a pool of resources for a project
13.7 Assign resources to tasks.
13.8 Prepare schedules for resource allocation.

13.9 Prepare modules for execution of projects.
13.10 Report the progress of a project.

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S.No	Name of the experiment	Competencies	Key competencies
1.	Study the Auto cad screen, various tool bars menus	▪ Study the Auto cad screen components. ▪ Study components in menu bar ▪ Customise and arrange tool bar ▪ Study user coordinate system(UCS) ▪ Give the inputs in the command bar ▪ Invoke the commands	▪ Study the Auto cad screen components. ▪ Study components in menu bar ▪ Customise and arrange tool bar ▪ Study user coordinate system(UCS) ▪ Give the inputs in the command bar ▪ Invoke the commands
2.	Exercise on standard commands	▪ Create a new file by NEW command ▪ Open a file by OPEN command ▪ Save a file by SAVE command ▪ Close a file by CLOSE command ▪ Zoom an object by using ZOOM command.	▪ Study Menu Commands thoroughly
3.	Exercise on 2D drawing commands	▪ Draw a line using LINE command ▪ Add arc segments to a poly line using ARC command ▪ Draw a circle using CIRCLE command, with centre point and radius. ▪ With plane tool draw a rectangular, Triangular and quadrilateral areas filled with a solid colour. ▪ Draw a elliptical curve using ELLIPSE command ▪ Divide a object into specified segments using DIV command ▪ Insert a block into the current drawing using INSERT command ▪ Fill an enclosed area or an object using HATCH command	▪ Study 2D Draw Commands thoroughly
4	Exercise on modifying 2D commands	▪ Create a mirror image of an entity using MIRROR command ▪ Change the size of an object by using STRETCH command ▪ Trim the edges of an object at the edges of another object using TRIM command ▪ Break a line or an object between two points using BREAK command ▪ Join two similar objects to form a single using JOINT command ▪ Create a fillet round the edges of two arcs using FILLET command ▪ Chamfer on lines which are crossed, radiating or unlimited long using CHAMFER command ▪ Break a compound object into its component objects using EXPLODE command ▪ Form a group of selected entities by using GROUP command	▪ Study Edit Commands thoroughly

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Competencies & Key competencies to be achieved by the student

5	Exercise on dimensioning commands	▪ Create and modify quickly a series of dimensions using QDIM command ▪ Indicate radii and diameters of arcs and circles using RADIUS or DIAMETER commands ▪ Measure angle between two lines using ANGLUR dimension command ▪ Mark a centre of an arc or circle using CENTREMARK command	▪ Practice Dimension Commands Thoroughly
6	Exercise on formatting commands	▪ Create layers using LAYER command. ▪ Control the visibility of objects and assigned properties to objects. ▪ Write a text to drawing, change font size and style.	▪ Practice Formatting Commands Thoroughly
7	Exercise on insert commands	▪ Inserts blocks into current drawing file using INSERT command ▪ Define attribute by specifying the characteristics of the attribute, including its name, prompt and default values	▪ Practice Insert Commands Thoroughly
8	Exercise on view commands	▪ Show the orthographic views (side view, top view, front view) of any object ▪ Show the isometric views of any object ▪ Shade a given object with solid colour using SHADE command ▪ Create a hidden line view of a model using HIDE command ▪ Create wire frame model using WIRE FRAME command	▪ Practice View Commands Thoroughly
9	Exercise on isometric drawings in 2D	▪ Look down the isometric view of a box from top or bottom and left or right corners like SW,NE isometric views ▪ Change the default axis colours, size of the crosshair display by using crosshair tab ▪ Create an isometric circle on the current isometric plane using Ellipse, Isocircle	▪ Practice on Isometric drawings in 2DThoroughly
10	Exercise on Electrical drawings	▪ Draw electrical symbols ▪ Draw the views of electrical machines like dc and ac machines	▪ Practice Commands Thoroughly

Sl. No.	Name of the experiment	Competencies	Key competencies
11	Exercise on shading of 3D models	▪ Draw and shade 3D models of box, pyramid, cone, cylinder, sphere ▪ Revolve the 3D model	▪ Practice shading of 3D models Thoroughly
12	Study the Project Management Software Open Project	▪ Study the features and applications of Project management software Understand the Various Menus used in Open Project Software	▪ Understand the Project Management software Open-Project
13	Practicing on Project Management Software MS-Project/Primavera	▪ Understands the input data. ▪ Understands various commands to execute the given input data. ▪ Prepare schedules for resource allocation. ▪ Prepare modules for execution of projects.	▪ Prepares and executes the Various Management projects

REFERENCES

1. An introduction to Auto CAD-Dayanithi (NITTTR)
2. CAD Software by 4M CAD,Intelly CAD
3. Auto CAD-S.Vishal.
4. Project Management Practice software: Open Project

DIGITAL ELECTRONICS & MICROCONTROLLERSLAB PRACTICE

Subject Title: **Digital Electronics & Microcontrollers Lab Practice**
Subject Code **:** **EE-608**
Periods/Week **:** **03**
Periods/Semester **:** **45**

TIME SCHEDULE

S.No.	Major Topics	No. Of Periods
1.	Logic Gates	09
2.	Combinational Logic Circuits	12
3.	Sequential Logic Circuits	12
4.	Micro Controllers	12
	Total	45

LIST OF EXPERIMENTS
1.(a) Identify the given digital ICs from the number by referring to data sheets
    i) logic gate type(AND,OR,NOT)
    ii) Logic family
    iii) Operating Voltage
1.(b) Draw the pin diagrams of the above digital ICs.
1 (c) Verify the truth tables of basic gates and universal gates.
2. Show NAND gate and NOR gate as Universal gates.
3. Realize a given Boolean function after simplification and obtain its truth table.
4. Construct half adder and full adder and verify the truth tables.
5. Verify the function of 74138 decoder IC.

6. Verify the working of Multiplexer (Using IC 74153)
7. Verify the functional table of 4-bit magnitude comparator 7485IC.

8. Construct and verify the truth tables of NAND & NOR latches
9(a) Construct clocked RS FF using NAND gates and Verify its truth table.
9(b) Verify the table of JK FF using 7476 IC.
9(c) Construct D and T flip flops using 7476 and verify the truth tables.
10. Working with microcontroller kits and Simulators
    a) Familiarization of 8051 Microcontroller Kit
    b) Familiarization of 8051 simulator EDSIM 51 (or similar)
    c) Write small ALP to demonstrate different register addressing techniques
11. Practicing **Arithmetic instructions of 8051**
    a) Write an ALP to demonstrate Addition, subtraction, division and multiplication
  of 8 bit
      numbers using immediate data access.
    b) Write an ALP to Add and Subtract 16 bit numbers
    c) Write an ALP to Square and Cube program
    d) Write an ALP to find LCM of given numbers
    e) Write an ALP To find HCF of given numbers
12. Interfacing Switches and LEDS to 8051
    a) To make an LED connected to port 1.5, light up for specific time on pressing a
    switch connected to port 2.3

b) Write a Program to make an LED connected to pin 1.7 to blink at a specific rate

c) Connect a Relay in place of LED to control a AC 230 V Lamp

Competencies & Key Competencies to be achieved by the student

S.No	Experiment Name (Periods)	Competencies	Key Competencies
1.	Identify the given digital ICs and draw their pin diagrams (3)	• Read the IC numbers. • Identify the importance of numbering on the ICs • Identify the no. of pins of each IC • Identify the type of IC package. • Draw the pin diagram of each IC from the data sheets • Identify the no. of gates present in each IC. • Identify the input and output pins • Note down the important specifications from the data sheets • Identify the power supply pins. • Observe the layout on a bread board. • Measure the output of the given dc power supply. • Read the logic diagram for Each Gate • Read the truth table of each gate. • Apply inputs as per the truth table and observe the outputs. • Identify basic gates and universal gates.	▪ Draw the pin diagram of each IC from the data sheets ▪ Remove an IC from the bread board using IC remover.
2.	Show NAND and NOR gates as universal gates. (3)	• Identify two input NAND and NOR gate ICs • Mount the NAND and NOR ICs properly on bread board. • Read the pin diagrams of ICS. • Find the input pins, out pins, power supply pins. • Read the circuit diagrams. • Rig up the circuit diagrams one by one • Apply different input combinations as per truth table and observe the corresponding outputs. • Show that NAND gate and NOR gate are universal gates.	▪ Rig up the circuit diagram. ▪ Apply the inputs and observing the outputs.
3.	Realize a given Boolean function after simplification and obtain its truth table (3)	• Identify the no. of literals present in the given Boolean expression. • Find the form of expression(SOP or POS) • Simplify the Boolean expression • Identify the logic gates required • Find the sourcing and sinking characteristics of logic gates from the data sheets. • Draw the logic diagram. • Find the Required logic ICS. • Rig up the circuit. • Apply different input combinations as per truth table and	▪ Apply different input combinations as per truth table

		note down the observations.	
4.	Construct half adder and full adder and verify the truth tables. (3)	• Identify the no. of inputs and outputs of half adder and full adder. • Determine the truth tables of Half adder and full adder. • Write Boolean expressions for the output variables from the truth tables. • Simplify the Boolean expressions. • Draw the logic diagrams of half adder and full adder. • Identify the logic gates required. • Rig up the circuits. • Verify the truth tables of half adder and full adder by applying different input combinations. • Show that construction of full adder can be done using two half adders. • Identify a 4-bit parallel adder IC	▪ Write the Boolean expressions. ▪ Simplify the Boolean expressions. ▪ Determine the logic gates required.
5.	Verify the function of 74138 decoder IC. (3)	• Draw the pin diagram of 74138 IC from the data manual. • Identify the significance of numbering. • Identify the input and output pins • Identify the enable pins. • Note down the active low and active high pins. • Read the truth table. • Read the logic diagram. • Rig up the circuit • Apply the inputs to the enable inputs properly. • Check the effect of enable inputs. • Apply the inputs as per the truth table and observe the outputs.	▪ Identify the enable pins. ▪ Note down the active low and active high pins ▪ Check the effect of enable inputs.
6.	Verify the working of Multiplexer (Using IC 74153) (3)	• Draw the pin diagram of 74153 IC from the data manual. • Identify the input and output pins • Identify the enable pins. • Note down the active low and active high pins. • Read the truth table. • Read the logic diagram. • Rig up the circuit • Apply the inputs to the enable inputs properly. • Check the effect of enable inputs. • Apply different inputs as per the truth table and observe the outputs. • Find applications of MUX • Identify different multiplexers. • Construct and test simple circuit using a multiplexer.	▪ Identify the enable pins. ▪ Note down the active low and active high pins ▪ Checking the effect of enable inputs. ▪ Identifying different multiplexers.
7.	Verify the functional table of 4-bit magnitude comparator 7485IC. (3)	• Determine the function of magnitude comparator. • Draw the pin diagram of 7485 IC from the data manual. • Identify the pins to which one 4-bit no. is to be applied. • Identify the pins to second 4-bit no. is to be applied • Identify the output pins and note down their significance. • Identify the cascading pins and note down their significance.	▪ Identify the pins to which one 4-bit no. is to be applied. ▪ Connect two 7485 ICs in cascade and observe the working of 8-bit magnitude comparator

		- Read the functional table of 7485 from the manual - Observe the difference between functional table and truth table. - Rig up the circuit - Apply the inputs and verify the functional table. - Connect two 7485 ICs in cascade and observing the working of 8-bit magnitude comparator.	
8.	Construct and verify the truth tables of NAND & NOR latches (3)	- Identifying the two input NAND and NOR ICs. - Drawing the pin diagram of NAND and NOR ICs. - Mounting the ICS on the bread board properly. - Reading the logic diagram - Rigging up the circuit diagram - Applying inputs as per truth table and observe the outputs. - Visualizing a latch can store one bit of data. - Comparing truth tables of NAND and NOR latches. - Observing the forbidden state in each latch.	- Visualizing a latch - Observing the forbidden state in each latch.
9.	Construct clocked RS FF using NAND gates and Verify its truth table (3)	- Identify the required digital ICs on the digital trainer kit - Observe the clock circuitry on the trainer kits. - Draw the pin diagrams of required ICs from the data manual - Read the circuit diagrams - Construct clocked RS FF - Apply inputs and observe the outputs. - Observe the effect of clock - Identify the no. of FFs present in 7476 IC - Observe the preset and clear inputs of 7476 - Apply the inputs and clock to the 7476 and verifying the truth table - Observe the effect of Pr and CLR inputs of 7476. - Construct T and D FF using 7476. - Observe the outputs for the inputs as per the truth table. - Apply continuous clock to T flip flop and observe the output.	- Observe the preset and clear inputs of 7476 - Apply continuous clock to T flip flop.
10.	Working with Microcontroller Kits and Simulators (3)	- Familiarization of 8051 Microcontroller Kit - Familiarization of 8051 simulator EDSIM 51 - Write small ALP to demonstrate different register addressing techniques	▪
11.	Practicing Arithmetic instructions of 8051 (3)	- Write an ALP to demonstrate Addition, subtraction, division and multiplication of 8 bit numbers using immediate data access. - Write an ALP to Add and Subtract 16 bit numbers - Write an ALP to Square and Cube program - Write an ALP to find LCM of given numbers - Write an ALP To find HCF of given numbers	
1	Interfacing	Draw the practice diagrams	▪ Identify leads of led

| 2. | Switches and LEDS to 8051 (3) | • List the tools required
• List different LEDS
• Identify the leads of LED
• Check the working of switch using DMM
• Check the continuity of Relay using DMM
• Implement of key de-bouncing (hardware). | with observation
▪ Identify color of LED,
▪ Note R value for current limiting
▪ Make relay connections |

POWER ELECTRONICS AND PLC LABORATORY PRACTICE

Subject Title : **Power Electronics and PLC Laboratory Practice**
Subject Code : **EE-609**
Periods/Week : **03**
Periods/Year : **45**

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1.	**Characteristics of different Power Electronic Devices**	**06**
2.	**Study the working of different Power Electronic circuits**	**06**
3.	**Speed control of the DC motor using the Power Electronic Devices**	**06**
4.	**Speed control of the single phase motor using SCR**	**03**
5	**Execution of the different Ladder Diagrams**	**09**
6	**Execution of the Ladder Diagrams with model applications**	**15**
	Total	**45**

LIST OF EXPERIMENTS

1.0 Plot the Characteristics of the different Power Electronic Devices
(a) Plot the Characteristics of SCR

(b) Plot the Characteristics of IGBT, GTO

2.0 Study the working of different Power Electronic circuits
(a) Study of the working of single phase half wave converter

(b) Study of the working of single phase full wave converter

3.0 Speed control of the DC motor using the Power Electronic Devices
(a) Speed Control of DC motor using single phase full converter

(b) Speed Control of DC motor using Chopper

4.0 Speed control of the 1- phase AC motor using the Power Electronic Devices
(a) Speed Control of 1-phase AC motor using SCR

5.0 Execute the different Ladder Diagrams
(a)Demonstrate PLC and Ladder diagram-Preparation , downloading and running

(b)Execute Ladder diagrams for different Logical Gates

(c)Execute Ladder diagrams using timers & counters

6.0 Execute the Ladder Diagrams with model applications
(a)Execute Ladder diagrams with model applications (i) DOL starter (ii)Star-Delta

starter

(b)Execute Ladder diagrams with model applications (i) Stair case lighting

.(ii) Traffic light controller

Competencies & Key competencies to be achieved by the student

S.No	Experiment title	competencies	Key competencies
1	Characteristics of i) SCR ii) IGBT and iii) GTO (6)	• Identify the different Power electronic devices available in the laboratory like SCR, IGBT,GTO • Draw the symbols of the above devices. • Identify the different terminals. • Draw the necessary circuit diagram and identify the apparatus required • Make the connections of the circuit as per the circuit diagram of forward bias • Record the different values of voltage and current in forward bias • Change the connections of the circuit as per the circuit diagram of Reverse bias • Record the different values of voltage and current in reverse bias • Plot the forward and reverse characteristics on a graph sheet • Repeat the experiment for IGBT, GTO and plot the V-I characteristics.	▪ Identify the different terminals ▪ Make the connections of the circuit as per the circuit diagram of forward bias ad reverse bias.
2	i) Working of single phase half wave converter ii) working of single phase full wave converter (6)	• Draw the circuit diagram for the single phase half wave converter • Identify the different components and apparatus required for the circuit • Make the necessary connections as per the circuit diagram with resistive load. • Verify the waveforms in the CRO at different gate current pulses • Change the R- load with R-L load and observe the waveforms at different gate current pulses • Study the working of the single phase full wave converter with R load and R-L load in similar way as above • Draw the circuit diagram for the single phase full wave converter using SCR's • Identify the different components and apparatus required for the circuit • Make the necessary connections as per the circuit diagram • Verify the waveform in the CRO for different gate pulses	▪ Verify the waveforms in the CRO at different gate current pulses

3	i) Speed Control of DC motor using single phase full converter ii) Speed Control of DC motor using Chopper. (6)	• Draw the circuit diagram for the speed control of the DC motor using the single phase full wave convertor • Identify the different apparatus required from the circuit diagram • Make the necessary connections according to the circuit • Change the triggering angles and Noting down the readings of the speed of the DC motor • Plot the graph Speed Vs Triggering Angles • Perform another experiment in similar way on speed control of the DC motor using a single phase chopper • Change the duty cycle • Note down the readings of the speed of the DC motor • Plot the graph : Speed Vs Duty cycle	▪ Change the triggering angles ▪ Change the duty cycle
4	Speed control of single phase AC motor using SCR. (3)	• Draw the circuit diagram for the speed control of the single phase AC motor using the Silicon controlled Rectifier • Identify the different apparatus required from the circuit • Make the necessary connections according to the given circuit diagram • Note down the readings of the speed of the DC motor by changing the triggering angles • Draw the graph between Speed Vs Triggering Angles	▪ change the triggering angles ▪ Draw the graph between Speed Vs Triggering Angles
5	a) Demonstrate PLC and Ladder diagram b) Execute Ladder diagrams for different Logical Gates c) Execute Ladder diagrams using timers & counters (9)	• Identify the PLC trainer kit, the Personal Computer and Loaded PLC software • Observe the input and output ports of the PLC • Make the interfacing between the PC and the PLC. • Prepare the appropriate ladder diagrams for different logical gates(AND, OR, NOT, NOR,NAND) • Save the ladder diagram with relevant file names • Execute each ladder diagram program and checking for errors • Rectify errors if any then save and again executing the program • Download the LD program into the PLC • Run each program and checking its output logic with relevant inputs. • Prepare simple ladder diagrams using "timers and counters" instructions	▪ Modify the existing program and design new programs ▪ Test the ladder logic with logic GATES examples ▪ Test the ladder logic with Timer/Counter instructions in ladder diagrams

		• Execute ,Run and check the output logic for each program	
6	Execute Ladder diagrams with model applications (i)DOL starter (ii)Star-Delta starter (iii) Stair case lighting (iv) Traffic light controller (15)	• Identify the different available model application kits in the lab ▪ Draw the ladder diagrams for the DOL starter and star/delta starter • Prepare the ladder diagrams in the Computer ,saving and executing the program • Make proper connections of the model application at the output port of PLC and downloading its relevant LD program in PLC • Run the LD program and observing the outputs with the model applications • Execute the Ladder diagrams for other model applications like "Stair case lighting and Traffic signal control model" in the same way as above	▪ Execute the LD programs and observe the performance of starters ▪ Design Ladder Logic for the stair case lighting , Traffic light controller

PROJECT WORK

Subject Title	:	**Project Work**
Subject Code	:	**EE- 610**
Periods / Week	:	**06**
Periods / Semester	:	**90**

OBJECTIVES

Upon completion of the Project work the student shall be able to

1.0   Project work
1.1   Identify different works to be carried out in the Project.
1.2   Collect data relevant to the project work.
1.3   Carry out need survey.
1.4   Select the most efficient method from the available choices based on preliminary investigation.
1.5   Design the required elements of the project work as per standard practices.
1.6   Prepare the working modules / equipments required for the project work.
1.7   Estimate the cost of project, technological need, computer skills, materials and other equipments.
1.8   Prepare the plan and schedule of starting time and sequence of operations to be carried out at the various stages of the project work in detail.
1.9   Prepare of critical activities at the various stages of the project work.
1.10   Test for various conditions with different electrical input parameter if required.
1.11   Implement the given project work and record the results at various places.
1.12.   Collect necessary information to procure necessary finance, and equipment.
1.13   Prepare a chart or model for the project.
1.14   Preparation of project report.

2.0   Report on observations in Industrial visits
Visit nearby Traction Sub-station / Loco shed and submit a report.

COURSE CONTENT

Project work is intended to provide training in the solution of various fields of engineering problems relating to
Rural Electrification Systems: Solar Lamps, Solar Cooker, Solar Water pumping systems etc.
Energy Saving Equipments: Replacing of Tungsten filament lamps with effective Implementation of LED, CFL Lamps   at various applications.
Automobile Field: Solar Operated Vehicles, Battery Operated Vehicles, Remote Operated electrical Devices, Usage of advanced Tubular Batteries for improving the efficiency.
Energy Management Techniques: Energy auditing at various reputed Industries.
Electrical Power Systems: Working Models of Hydel, Thermal and Non Conventional Power Generation Systems. Transmission and distribution system analysis.
 Power Devices: Inverter, SCR based applications, UPS and Automatic switching DG Sets etc.
Electric traction : Metro-line projects .
Industrial Visit nearby Power Station

Project work will also include the implementation of Innovative Ideas which improves the nation growth and preparation of the feasibility report for any one type of enterprise under self – employment schemes also.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.

Exercises:
  a) Planning of a Electrical Power Distribution Lines inside the Institution premises.
  b) Wirings of existing system.
  c) Industrial complex wiring designs.
  d) Rural electrification supply Scheme.
  e) Energy efficient management systems.
  f) Power Saving systems.
  g) Design of Substations.
  h) Set up of a small enterprise under self employment scheme.

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of power point presentation and Viva-voce test which is to be assessed by a panel of examiners comprising of an External examiner.The Head of Section, and member of staff who guided the project as Internal examiner.

Scheme of assessment
  1) Seminar   -   20 Marks
  2) Internal assessment   -   20 Marks
  3) Power point presentation,   -   60 Marks
      Report & Viva-Voce(3x20)

                      Total Marks   100

Safety Precautions

1. Care less use of Electricity is dangerous.
2. The person working on live part should not come into touch with wet ground.
3. Always use insulated tools and instruments.
4. Don't use fuse in neutral
5. Switch off mains before replacing a blown fuse
6. Always use correct rating fuse wire
7. All the equipment should be properly earthed.
8. Always use glouses and wear rubber shoes when working
9. Do not disconnect a plug by pulling the cable.
10. Never touch an overhead line unless it is made dead and earthed.
11. When fire occurs on live equipment do not through water on it. Use sand or fire extinguisher.
12. Place danger board and caution notice boards near the work place of switching .
13. Keep sand buckets and fire extinguishers in the work place.
14. Never wear silk, nylon, polyester clothing while dong electrical work.
15. Use proper insulated rubber mats at the work places.
16. Work with concentration at all times.