DIPLOMA IN MECHANICAL 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:								
ME-101	English	3	-	90	3			100
ME-102	Engineering Mathematics - I	5	-	150	3			100
ME-103	Engineering Physics	4	-	120	3			100
ME-104	Engineering Chemistry &Environmental Studies	4	-	120	3			100
ME-105	Engineering Mechanics	4	-	120	3			100
ME-106	Workshop Technology	4	-	120	3			100
PRACTICAL:								
ME-107	Engineering Drawing practice	-	6	180	3			100
ME-108	Basic Work shop practice	-	6	180	3			100
ME-109	109-A Engineering Physics Lab practice 109-B Engineering Chemistry Lab practice	-	3	90	3 (1.5+1.5)			100 (50+50)
ME-110	Computer fundamentals Lab practice	-	3	90	3			100
	TOTAL	24	18	1260				1000

ENGLISH

(Common to all Branches)

Subject Title : English
Subject Code : ME - 101
Periods per Week : 03
Periods per Year : 90

Time Schedule

Sl 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
		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.

Upon 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
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
(Common to all Branches)

Subject Title : Engineering Mathematics-I
Subject Code : ME-102
Periods per week : 04
Periods per Semester : 60

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	½
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

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
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	½
19	Physical Applications	2	2	5	0	0	0	0	0	½
20	Maxima and Minima	3	4	5	0	0	0	0	0	½
21	Errors and Approximations	2	0	5	0	0	0	0	0	½
	Total	92	58	110	7	3	0	2	2 1/2	3 ½
				Marks	21	9	0	20	25	35

R: Remembering type 41 marks
U: Understanding 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:

1. Rational,
2. Proper and
3. 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 $\sin 15^0$, $\cos 15^0$, $\sin 75^0$, $\cos 75^0$, $\tan 15^0$, $\tan 75^0$ 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 $\sin A = (1 - \cos 2A)/2$ etc.,

6.3 Solve simple problems using the above formulae

7.0 Apply Transformations for solving the problems in Trigonometry

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

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

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

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

16.2 Mention the Standard limits $\lim_{x\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to 0}\frac{\tan x}{x}$, $\lim_{x\to 0}\frac{a^x-1}{x}$, $\lim_{x\to 0}\frac{e^x-1}{x}$, $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$, $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x$ (All without proof).

16.3 Solve the problems using the above standard limits

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

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

17.0 Appreciate Differentiation and its meaning in engineering situations

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

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

17.3 Find the derivatives of elementary functions like x^n , a^x, e^x, log x, sin x, cos x, 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) $\sqrt{t^2+\frac{2}{t}}$ **(ii)** $x^2 \sin 2x$ **(iii)** $\frac{x}{\sqrt{x^2+1}}$ **(iv)** $\log\left(\sin(\cos x)\right)$.

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:

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

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

Matrices:

3. Definition of matrix, types of matrices-examples, algebra of matrices-equality of two matrices, sum, scalar multiplication and product of matrices. Transpose of a matrix-Symmetric, skew symmetric matrices-Minor, cofactor of an element-Determinant of a

square matrix-Laplace's expansion, properties of determinants. Singular and non singular matrices-Adjoint and multiplicative inverse of a square matrix- examples-System of linear equations in 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-II

Trigonometry:

4.Trigonometric ratios: definition of trigonometric ratios of any angle, values of trigonometric ratios at specified values, draw graphs of trigonometric functions, periodicity of trigonometric functions.

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

6. Multiple and sub multiple angles: 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.

Reference Books :

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

ENGINEERING PHYSICS
(Common to all Branches)

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

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type	Essay Type
1.	Units and Dimensions	08	03	1	-
2.	Elements of Vectors	12	13	1	1
3.	Kinematics	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**	**103**	**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 Recapitulate the equations of motion in a straight line
3.2 Define acceleration due to gravity
3.3 Derive expressions for
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of
3.4 Derive height of a tower when a body projected vertically upwards from the top of a tower.
3.5 Define 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
a)Horizontal Range, b)Maximum range of a projectile in oblique projection
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 an expressions for acceleration of a body on a smooth inclined plane (up

and down)
4.11 Derive an 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 work
5.2 State SI units and dimensional formula for work
5.3 Define power
5.4 State SI units and dimensional formula for power
5.5 Define energy
5.6 State SI units and dimensional formula for energy
5.7 Define potential energy
5.8 Derive the expression for Potential energy with examples
5.9 Define kinetic energy
5.10 Derive the expression for kinetic energy with examples
5.11 State the Work- Energy theorem
5.12 Explain the relation between Kinetic energy and momentum
5.13 State the law of conservation of energy
5.14 Verify the law of conversion of energy in the case of a freely falling body
5.15 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 State the laws of Seconds pendulum
6.13 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 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 Derive Magnetic induction field strength at a point on the axial line
10.16 Describe the moment of couple on a bar magnet placed in a uniform magnetic field
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 Hormonic 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- 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

((Common to all Branches)

Subject Title : Engineering Chemistry & Environmental Studies
Subject Code : ME -104
Total periods per year : 120

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	
A. ENGINEERING CHEMISTRY										
1	Fundamentals of Chemistry	18	16	1	0	1	0	1	0	
2	Solutions	10	8	1	0	0	0	0	1/2	5 mark
3	Acids and bases	10	8	0	0	1	0	1/2	0	5 mark
4	Principles of Metallurgy	10	10	0	0	0	1	0	0	
5	Electrochemistry	14	13	0	1	0	0	0	1	
6	Corrosion	8	10	0	0	0	0	1	0	
7	Water Technology	14	13	1	0	0	1	0	0	
8	Polymers	12	13	1	0	0	1	0	0	
9	Fuels	6	3	1	0	0	0	0	0	
B. ENVIRONMENTAL STUDIES		18	16	1	1	0	0	1	0	
	Total	120	110	6	2	2	3	3 1/2	1 1/2	
				18	6	6	30	35	15	

OBJECTIVES

Upon completion of the course the student shall be able to

A. ENGINEERING CHEMISTRY

1.0 Understand the concept of Atomic structure

1.1 Explain the 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. Froth

Floatation

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

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. Corrosion

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

ENGINEERING MECHANICS

Subject Title : Engineering Mechanics
Subject Code : ME-105
Periods/Week : 04
Periods per year : 120

TIME SCHEDULE

S No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Statics	22	21	02	1 ½
2	Friction	18	16	02	01
3	Geometrical properties of sections	22	18	01	1 ½
4	Dynamics	28	26	02	02
5	Simple machines	20	21	02	1 ½
6	Basic Link Mechanisms	10	08	01	½
	Total	**120**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Statics

1.1 Explain the meaning of mechanics in engineering.
1.2 State the importance of mechanics in engineering.
1.3 Review the system of units used.
1.4 Explain the concept of force
1.5 List the types of forces
1.6 Explain the force system
a) Co-planar and Non-Coplanar,
b) Parallel and Non-Parallel,
c) Like and Un like, d) Concurrent and Non-concurrent
1.7 Explain the concept of equilibrium
1.8 State the parallelogram law of forces
1.9 State the triangle law of forces
1.10 State the polygon law of forces
1.11 State the Lami's theorem.
1.12 Explain the concept of free body diagram
1.13 Solve the problems involving concurrent coplanar forces
1.14 Solve simple problems involving non-concurrent coplanar forces
1.15 Solve simple problems using Lami's theorem
1.16 Define the term couple and moment of couple with legible sketch.
1.17 Explain the properties of a couple
1.18 State the condition of equilibrium of a body acted upon by co-planar forces.

2.0 Understand the concept of Friction

2.1 Explain the concept of friction
2.2 State the laws of friction
2.3 Identify the machine members in which friction exists and desirable
2.4 Resolve the forces acting on bodies moving on horizontal plane.
2.5 Resolve the forces acting on bodies moving along the inclined planes.
2.6 Solve the related numerical problems

3.0 Understand the Geometric Properties of Sections

3.1 Define the terms Centre of Gravity, Centre of Mass and Centroid.
3.2 State the need for finding the Centroid and Centre of gravity for various engineering applications
3.3 Locate the C.G. of a given section.
3.4 Explain the method of determining the Centroid by 'Method of moments'
3.5 Determine the position of Centroid of standard sections-T, L, I, Channel section, Z section, unsymmetrical I section
3.6 Determine the position of Centroid of built up sections consisting of RSJ'S and flange plates and Plane figures having hollow portions
3.7 Explain the meaning of the term moment of Inertia.
3.8 Define the term polar moment of inertia
3.9 Explain the term radius of gyration
3.10 State the necessity of finding Moment of Inertia for various engineering applications
3.11 Determine Moment of Inertia and Radius of gyration for regular geometrical sections like T, L, I, Channel section, Z section, unsymmetrical I section
3.12 State Parallel axis theorem and perpendicular axis theorem
3.13 Determine MI of standard sections by applying parallel axes theorem
3.14 Determine MI of standard sections by applying parallel axes theorem
3.15 Calculate the moment of Inertia of composite sections.
3.16 Calculate radius of gyration of standard sections.
3.17 Determine the polar M.I for solid and hollow circular section applying perpendicular axes theorem.
3.18 Solve the related numerical problems

4.0 Understand the concept of Dynamics

4.1 Define the terms Kinematics and Kinetics
4.2 Classify the motion types
4.3 Define the terms displacement, velocity and acceleration
4.4 State the Newton's Laws of motion (without derivation)
4.5 Solve the problems related to the rectilinear motion of a particle
4.6 Explain the Motion of projectile
4.7 Solve the numerical problems
4.8 State the D'Alembert's principle
4.9 Define the Law of conservation of energy
4.10 Explain the Work-Energy principle
4.11 Define the Law of conservation of momentum
4.12 Explain the Impulse –momentum equation
4.13 Solve the problems using the above principles
4.14 Explain the Rotary motion of particle
4.15 Define Centripetal force.
4.16 Define Centrifugal force.

4.17 Differentiate Centripetal and Centrifugal forces
4.18 Describe simple harmonic motion.
4.19 Explain the application of simple harmonic motion in engineering.

5.0 Comprehend the Principles involved in Simple Machines

5.1 Define the important terms of simple machines
a) Machine, b) Mechanical Advantage, c) Velocity Ratio, d) Efficiency.
5.2 Illustrate the use of three classes of simple lever.
5.3 Show that an inclined plane is a simple machine to reduce the effort in lifting loads.
5.4 Derive expression for VR in cases of wheel & axle, Weston Differential pulley blocks, pulleys, Worm & Worm wheel crabs, screw jack, rack & pinion.
5.5 Compute the efficiency of a given machine.
5.6 Compute effort required to raise or lower the load under given conditions.
5.7 Interpret the law of machine.
5.8 State the conditions for self-locking and reversibility.
5.9 Calculate effort lost in friction and load equivalent of friction.
5.10 Evaluate the conditions for maximum M.A.& Maximum efficiency.

6.0 Understand the concept of Basic Link mechanism

6.1 Define important terms of Basic link mechanism
a) Link, b) kinematics pair, c) Kinematic chain, d) Mechanism & machine
6.2 Explain kinematic pair and kinematic chain with the help of legible sketch
6.2 List examples for Lower and Higher pairs.
6.3 List examples of inversion.

COURSE CONTENT

1.0 Statics

1.1 The meaning of word mechanics.
1.2 Application of Mechanics to Engineering.
1.3 System of Units.
1.4 Definition and specification of force
1.5 System of forces
1.6 Resolution of force
1.7 Equilibrium and Equilibrant.
1.8 Statement of Parallelogram law of forces, triangle law of forces, polygon law of forces and Lami's theorem
1.9 Drawing the free body diagram
1.10 Numerical problems related to concurrent coplanar forces
1.11 Couple and moment of a couple
1.12 Condition for equilibrium of a rigid body subjected to number of coplanar non-concurrent forces.
1.13 Related Numerical problems

2.0 Friction

2.1 Definition of static friction, dynamic friction and impending friction
2.2 laws of solid and liquid friction
2.3 Derivation of limiting angle of friction and angle of repose
2.4 Resolution of Forces considering Friction when a body moves on horizontal plane.

2.5 Resolution of Forces considering Friction when a body moves on inclined plane.
2.6 Numerical examples on the above cases

3.0 Geometric Properties of Sections

3.1 Definition and explanation of the terms Centre of Gravity, Centre of Mass and centroid
3.2 Centroid of square, rectangle, triangle, semi-circle and trapezium (formulae only without derivations)
3.3 Centre of gravity of composite sections by analytical method `only (T-Section, L-Section I-section and channel section).
3.4 Moment of Inertia.
a) Definition and Explanation, b) Theorems of Moment of Inertia.
`i) Parallel axes theorem, ii) Perpendicular axes theorem.
c) Moment of Inertia for simple Geometrical Sections, Rectangular, circular and triangular section and Radius of Gyration.
3.5 Calculation of Moment of Inertia and Radius of Gyration of
a) I – Section, b) Channel Section, c) T – Section.
d) L – Section (Equal & unequal lengths), e) Z - section
f) Built up Sections (Simple cases only)

4.0 Dynamics

4.1 Defination of Kinematics and Kinetics
4.2 Classification of motion
4.3 Defination of displacement, velocity and acceleration
4.4 Laws of motion (without derivation)
4.5 Solving the problems related to the rectilinear motion of a particle
4.6 Motion of projectile and solving the numerical problems
4.7 Newton's laws of motion.
4.8 D'Alembert's principle
4.9 Defination Law of conservation of energy
4.10 Work-Energy principle
4.11 Law of conservation of momentum
4.12 Impulse –momentum equation
4.13 Solving the kinetic problems using the above principles
4.14 Rotary motion of particle and laws of motion
4.15 Definition and Differentiate Centripetal and Centrifugal forces.
4.16 Simple harmonic motion.
4.17 Definition of the terms frequency, time period, amplitude and circular frequency
4.18 SHM equation, natural frequency
4.19 Simple problems on SHM

5.0 Simple Machines

5.1 Definition of Simple machine, and uses of simple machine, levers and inclined plane.
5.2 Fundamental terms like mechanical advantage, velocity ratio and efficiency.
5.3 Expressions for VR in case of Simple/Differential pulley/pulleys of 3 systems, Worms and Worm wheel, Rack and pinion, Winch crabs, &Screw jack.
5.4 Conditions for reversibility and self locking.
5.5 Law of Simple Machine.
5.6 Effort lost in friction, Load Equivalent of Friction Max. M.A. and Max. efficiency.

6.0 Basic Link Mechanism

6.1 Definition of terms: link, kinematic pair, kinematic chain, Mechanism, structure and machine.

6.2 Quadric cycle chain and its inversions.

6.3 Slider Crank chain and its inversion.

REFERENCE BOOKS:

1	Engineering Mechanics	by	Singer	B.S.Publications
2	Engineering Mechanics	by	Basudeb Bhattacharya – Oxford Publishers	
3	Engineering Mechanics	by	A Nelson	Mc Graw Hill Publishers
4	Engineering Mechanics	by	I.B.Prasad	
5	Engineering Mechanics	by	R.S.Khurmi	S.Chand & Comp
6	Theory of Machines	by	S.S.Rathan	TMH P

WORKSHOP TECHNOLOGY

Subject Title : Workshop Technology
Subject Code : ME-106
Periods per Week : 04
Periods per Year : 120

TIME SCHEDULE

S. No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Basic Workshop tools & operations				
	(1) Carpentry	20	16	2	1
	(2) Fitting	25	26	2	2
	(3) Forging	15	13	1	1
	(4) Sheet metal	12	13	1	1
2	Drilling	10	13	1	1
3	Foundry	22	16	2	1
4	Mechanical working of metals	16	13	1	1
	Total	120	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the use of Basic workshop tools and its operation

a. State the importance of workshop processes.
b. List the various workshop processes and explain briefly about each.

1.1 Carpentry

a. Identify various carpentry tools.
b. Distinguish between marking tools, measuring tools and cutting tools.
c. List work holding devices.
d. Explain wood working processes viz., sawing, chiselling and planning.
e. Explain the use of carpentry joints such as lap joint, dovetail joint, mortise and tenon joint with legible sketch
f. Explain the working of wood working machines.

1.2 Fitting

a. List various fitting tools.
b. Distinguish between marking and measuring tools.
c. List cutting tools.
d. List various work holding devices.
e. List various checking and measuring instruments.
f. Explain fitting operations such as marking, sawing, chipping, filing, grinding, drilling and tapping with legible sketch

1.3 Forging

a. List various tools used in black-smithy.
b. List equipment used in a forging shop.
c. Explain the important smithy operations
d. Explain the working principle of machine forging
e. Explain machine forgoing operations such as upsetting, drawing down and punching with legible sketch
f. Explain the working principle of forging press with legible sketch.
g. List the forging defects

1.4 Sheet Metal

a. List various marking tools in sheet metal work
b. List various stakes
c. List various measuring tools used in sheet metal work
d. List various sheet metal joints.
e. Describe sheet metal operations such as shearing, bending drawing and squeezing
f. Differentiate between riveting, soldering & brazing

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2.0 Understand the concept of drilling

2.1 State the working principle of drilling.
2.2 List out different types of drilling machines.
2.3 Draw the line diagrams of the sensitive and radial drilling machines.
2.4 Identify the parts of these machines.
2.5 Describe the functions of each part.
2.6 Write the Specications of drilling machines.
2.7 Write the nomenclature of the drill bit.
2.8 Write the geometry of twist drill.
2.9 List the functions of twist drill elements.
2.10 List the different operations on drilling machine.

3.0 Understand the concept of Foundry

3.1 Acquaint with foundry as a manufacturing process.
3.2 State the advantages of casting over other process.
3.3 State the limitations of the process.
3.4 List the various hand moulding tools.
3.5 State the properties of good moulding sand.
3.6 State the types of moulding sands.
3.7 List the ingredients in foundry sand.
3.8 List the various types of patterns.
3.9 State the sequence of pattern making operations.
3.10 Identify the colour codes.
3.11 List the various moulding processes.
3.12 State the need and types of cores.
3.13 Describe the casting processes.
3.14 Identify the defects in casting.
3.15 Describe special casting processes.

4.0 Mechanical working of metals

4.1 Define mechanical working of metals.
4.2 Differentiate cold working with hot working.

4.3 Illustrate the working principle of hot rolling, piercing, spinning, extrusion and drawing.
4.4 State advantages and limitations of hot working.
4.5 Identify various cold working processes such as rolling, bending and squeezing.
4.6 State advantages and limitations of cold working.

COURSE CONTENT

1 **Introduction**

Methods of manufacturing processes - casting, forming, metal removal processes, joining processes, surface finishing processes, basic workshop processes - carpentry, fitting, hand forging, machine forging, sheet metal work, cold and hot working of metals.

1.1 **Carpentry**

1.1.1 **Marking & measuring tools**: scales, rules, fourfold wooden rule, flexible measuring rule (tape), straight edge, try square, bevel square, combination square, marking knife, marking gauge, mortise gauge, cutting gauge, wing compass, trammel, divider, outside calliper, inside calliper, odd leg calliper, spirit level, plum bob, specifications- uses.

1.1.2 **Cutting Tools**

Saws: ripsaw, cross cut saw (hand saw), panel saw, tenon or back saw, dovetail saw, bow saw, coping saw, compass saw, pad or keyhole saw, specifications & uses.

Chisels: Firmer chisel, bevelled edge firmer chisel, parting chisel, mortise chisel, inside and outside gauges, specifications and uses.

Planes: Jack plane (wooden jack plane, metal jack plane), rough plane, smoothing plane, rebate plane, plough plane, router, spoke shave, special planes and their specifications and uses.

Boring Tools:

Gimlet, braces- wheel brace, ratchet brace, bit-shell bit, twist bit (auger bit), expansive bit, centre bit, router bit, countersink bit, drill, reamer their specifications & uses.

1.1.2 **Striking tools:**

Hammers - Warrington hammer, claw hammer, mallet, specifications &uses.

1.1.3 **Holding devices**

Bench vice, bench stop, bench hold fast, sash cramp (bar cramp) G- cramp, Hand screw, specifications & uses.

1.1.4 **Miscellaneous tools**

Rasps and files, scraper, oilstone, glass paper, pincer, screw driver, cabinet screw driver, ratchet-screw driver, saw set, oil stone slip. specifications and uses.

1.1.5 **Carpentry Processes**

Marking, measuring, sawing,chiselling,planning,boring,grooving, rebating & moulding.

1.1.6 **Carpentry joints**

Halving Joint, mortise and tenon joint, bridle joint, butt joint.

dowel joint, tongue & groove joint, screw & slot joint, dovetail joint, corner joint.

1.1.7 **Wood working machines**

Wood working lathe (wood turning lathe), circular saw, band saw, wood planer, sanding machine, belt sander, spindle sander, disc sander and grinder, specifications and uses.

1.2 **Fitting**

1.2.1 **Cutting tools**

Chisels: Flat chisel, cross cut chisel, half round chisel, diamond point chisel, side chisel, specifications and uses.

Files: Different parts of a file – sizes and shapes - flat file, hand file, square file ,piller file ,round file, triangular file, half round files, knife edge file, needle file – specifications and uses.

Scrapers: Flat, triangular, half round scrapers, specifications & uses.

Saws: Hand hacksaw - solid frame, adjustable frame, specifications & uses, hand hacksaw blades. Power hack saw –description(horizontal reciprocating type), power hacksaw blade, specifications and uses, teeth set - saw material.

Drill bits: Flat drill, straight fluted drill, twist drill, parallel shank, tapered shank, specifications & uses.

Reamer: Hand reamer, machine reamer, straight and spiral flutes reamers, specifications and uses.

Taps: Hand taps - taper tap, plug tap and bottoming tap, specifications and uses.

Dies & Sockets: Dies- solid, adjustable - specifications and uses.

1.2.2 **Striking Tools**

Hammers: Parts, ball peen, cross peen, straight peen hammers, soft hammer, sizes, specifications and uses.

1.2.3 **Holding Devices**

Vices: Bench vice, leg-vice, hand vice, pin vice, tool maker's vice, pipe vice, care of vices, specifications and uses.

1.2.4 **Marking Tools**

Surface plate, V-block, angle plate, try square, scriber, punch, prick punch, centre punch, number punch, letter punch, specifications and uses.

1.2.5 **Miscellaneous Tools**

Screw drivers, spanners, single ended & double ended, box type, adjustable spanners, cutting pliers, nose pliers, allen keys, specifications and uses.

1.2.6 **Checking and measuring instruments**

Checking instruments.

Callipers: Outside&Inside callipers, hermaphrodite (odd leg) calliper with firm joint, spring callipers, transfer calliper sizes & uses, dividers - sizes & uses**.**

Measuring instruments:
Combination square, bevel protractor, universal bevel protractor, sine bar, universal surface gauge, engineer's parallels, slip gauges, plane gauge, feeler gauge, angle gauge, radius & template gauge, screw pitch gauge, telescopic gauges, plate & wire gauge, ring and plug gauges, snap gauges specifications & uses, vernier callipers, vernier height gauge, vernier depth gauge, micrometer - outside & inside, stick micrometer, depth micrometer, vernier micrometer, screw thread micrometer specifications and uses.

1.2.7 **Fitting Operations**
Marking, sawing, chipping, filing, scrapping, grinding, drilling, reaming, tapping and dieing.

1.3 Forging

1.3.1 **Hand forging tools:** Anvil, swage block, hand hammers - types; sledge hammer, specifications and uses, tongs - types, specifications & uses, chisel - hot & cold chisels specifications & uses. swages - types and sizes, fullers, flatters, set hammer, punch and drift - sizes and uses.

1.3.2 **Equipment:** Open and closed hearth heating furnaces, hand and power driven blowers, open and stock fire, fuels-charcoal, coal, oil gaseous fuels.

1.3.3 **Smith Operations:** Upsetting, drawing down, setting down, punching, drifting, bending, welding, cutting, swaging, fullering and flattering.

1.3.4 **Machine Forging:** Need of machine forging, forging hammers - spring hammer, pneumatic hammer, drop hammer, forging press, hydraulic press - line diagram, machine forging operations - drawing, upsetting, punching, tools used in machine forging.

1.3.5 **Forging defects:** Types and remedies.

1.4 Sheet Metal Work

1.4.1 Metals used for sheet metal work.

1.4.2 **Sheet metal hand tools**:
Measuring tools - steel rule, circumference rule, thickness gauge, sheet metal gauge, straight edge, scriber, divider, trammel points, punches, chisels, hammers, snips or shears, straight snip, double cutting shear, squaring shear, circular shear, bench & block shears.
Stakes: Double seaming stake, beak horn stake, bevel edged square stake, Hatches stake, needle stake, blow Horn stake, hollow mandrel stake, pliers (flat nose and round nose), grocers and rivet sets, soldering iron, specifications & uses.

1.4.3 **Sheet Metal Operations**
Shearing: Cutting off, parting, blanking, punching, piercing, notching, slitting, lancing, nibbling and trimming.
Bending: Single bend, double bend, straight flange, edge hem, Embossing, beading, double hem or lock seam.
Drawing: Deep drawing, shallow or box drawing.
Squeezing: Sizing, coining, hobbing, ironing, riveting.

1.4.4 **Sheet Metal Joints**

Hem Joint: single hem, double hem & wired edge, seam joint -lap seam, grooved seam, single seam, double seam, dovetail seam, burred bottom seam or flanged seam.

1.4.5 **Fastening Methods**

Rivetting, soldering, brazing & spot welding.

2 **Drilling**

2.1 **Type of drilling machines:** sensitive & radial and their constructional detail and specifications.

2.2 **Drill bits**: Terminology - geometry of twist drill - functions of drill elements.

2.3 **Operations:** Drilling, reaming, boring, counter boring, counter sinking, tapping, spot facing and trepanning.

3 **Foundry.**

3.1 **Introduction:** Development of foundry as a manufacturing process, advantages and limitations of casting over other manufacturing processes.

3.2 **Foundry equipment:**

Hand moulding tools: shovel, riddle, rammers, trowels, slicks, lifter, strike - off bar, spruepin bellow, swab, gate cutter, mallet, vent rod, draw spike, rapping plate or lifting plate, pouring weight, gagger, clamps, spirit level, moulding boxes, snap box & flash box.

3.3 **Sands:** Properties of moulding sand - porosity, flowability, collapsibility, adhesiveness, cohesiveness and refractoriness.

3.4 **Types of moulding sand** : green sand, dry sand, loam sand, facing sand, backing sand, parting sand, core sand, system sand their ingredients and uses.

3.5 **Pattern making:** Materials such as wood, cast Iron, aluminium, brass, plastics their uses and relative advantages, classification of patterns such as solid (one piece), two piece and three pieces, split patterns, gate patterns and shell patterns, sequence in pattern making, pattern allowances and colour codes.

3.6 **Cores:** Need of cores, types of cores.

3.7 Casting: green sand and dry sand moulding, cement bonded moulding, shell moulding, ceramic moulding, defects in castings and their remedies.

3.8 Special casting processes: (Principles and applications only) die casting – hot chamber and cold chamber, centrifugal casting, CO_2 process, investment casting

4 **Mechanical working of metals**

4.1 **Introduction:** Hot working and cold working

4.2 **Hot working processes:** rolling - types of rolling, two high mill, three high mills, four high mills, piercing or seamless tubing, drawing or cupping, spinning, extrusion - direct or forward extrusion, indirect or backward extrusion, tube extrusion, Impact extrusion.

4.3 Effects of hot working of metals**,** advantages & limitations of hot working of metals.

4.4 **Cold working process:**

Rolling, drawing - wire drawing, tube drawing, bending, roll forming, angle bending, spinning, extrusion, squeezing, cold heading, thread rolling, peening.

4.5 Effects of cold working of metals, advantages & limitations of cold working.

REFERENCE BOOKS

1.	Production Technology	by	Jain & Gupta (Khanna Publiahers)
2.	Elementary Workshop Technology	by	Hazra Chowdary & Bhattacharya (Media Promotors)
3.	Manufacturing Technology (Vol I)	by	P N Rao (Mc Graw Hill)
3.	Workshop Technology Vol I & II	by	Raghuvamshi

ENGINEERING DRAWING

Subject Title : Engineering Drawing
Subject Code : ME–107
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 and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Importance of Engineering Drawing	• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
2.	Engineering Drawing Instruments	• Select the correct instruments to draw various entities in different orientation
3.	Free hand lettering & Numbering	• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
4.	Dimensioning Practice	• Dimension a given drawing using standard notations and desired system of dimensioning
5.	Geometrical construction	• Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.
6.	Projection of points, Lines, Planes & Solids	• Draw the 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.
(a) Parallel to both the planes.
(b) Perpendicular to one of the planes.
(c) inclined to one plane and parallel to other planes
Projection of regular planes
(a) Plane perpendicular to HP and parallel to VP and vice versa.
(c) Plane perpendicular to HP and inclined to VP and vice versa.

Projection of regular solids
(a) Axis perpendicular to one of the planes
(b) 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.

REFERENCE BOOKS

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

BASIC WORKSHOP PRACTICE

Subject Title : Workshop Practice
Subject Code : ME -108
Periods/Week : 06
Periods Per Year : 180

TIME SCHEDULE

S.No	Major Title	No of Periods
1.	Fitting shop	36
2.	Forging shop	39
3.	Carpentry shop	51
4.	Sheet metal work	51
	Test	03
	Total	180

OBJECTIVES

Upon completion of the course the student shall be able to

- **Practice the required operations in Fitting Shop**
- **Practice the required operations in Forging Shop**
- **Practice the required operations in Carpentry Shop**
- **Practice the required operations in Sheet metal Shop**

Competencies and Key competencies to be achieved by the student.

Title of the Job	Competencies	Key Competencies
Fitting shop 1.Marking and Chipping on Mild steel flat of 12 mm thick (12)	– Identify appropriate measuring tool – Handle appropriate marking tool – Handle appropriate chipping tool – Mark the dimensions – Remove the material by chipping from MS flats	• Mark the dimensions • Remove the material by chipping from MS flats
2.Cutting with hack saw of MS flats of 6mm thick (06)	– Check the raw material for size – Fix the work piece in vice – Mark the work as per given dimensions – Perform dot punching – Load and unload hack saw blade from its frame – Use the hack saw to perform cutting operation	• Load and unload hack saw blade from its frame • cut the work as per marked dimensions using Hack saw
3.Drilling, chamfering and on a MS flat of 2 mm thick (06)	– Check the raw material for size – Apply the chalk on the surface and on all sides of the flat – Layout the dimensions and mark the lines using dot punch – Chamfer the edges through filing – Locate the hole centres using odd leg callipers and centre punching – Identify appropriate drill bit – Load and unload drill bit from the machine	• Load and unload drill bit from the machine • Identify appropriate taps • Tap the hole

4.Tapping and Dieing on a MS flat of 2 mm thick (06)	– Check the raw material for size – Identify appropriate tap and die – Secure the tap in the wrench – Tap the hole – Hold the bar in bench vice – Fix the die in die stock – Cut external threads using a Die – Check the fit for accuracy	• Secure the tap in the wrench • Tap the hole • Fix the die in die stock • Cut external threads using a Die
5.Assembling of two pieces, matching by filing (06)	– Cut the pieces to size using hack saw – File surface of flat for trueness – Mark the surfaces as per dimensions – Dot punch the marked lines – Cut with hack saw as per marked lines – Smoot the surfaces with file – Assemble the two pieces	• Identify appropriate file • File the specimen • Assemble two pieces

Title of the Job	Competencies	Key Competencies
Forging shop 6.Conversion of Round to Square (09)	– Identify the holding and striking tools – Heat the specimen to the appropriate temperature – Remove the specimen and hold it on the anvil – Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
7.Conversion of Round to Hexagon (09)	– Identify the holding and striking tools – Heat the specimen to the appropriate temperature – Remove the specimen and hold it on the anvil – Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
8.Preparation of a Chisel from round rod (09)	– Identify the holding and striking tools – Heat the specimen to the appropriate temperature – Remove the specimen and hold it on the anvil – Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
9.Preparation of a ring and hook from M.S round (06)	– Identify the holding and striking tools – Heat the specimen to the appropriate temperature – Remove the specimen and hold it on the anvil – Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape
10.Preparation of a hexagonal bolt and nut (06)	– Identify the holding and striking tools – Heat the specimen to the appropriate temperature – Remove the specimen and hold it on the anvil – Hammer the specimen to the required shape	• Heat the specimen to the appropriate temperature • Hammer the specimen to the required shape

Title of the Job	Competencies	Key Competencies
Carpentry Shop 11.Cutting of wood with hand saw (06)	– Identify the orientation of grains – Select appropriate saw for cutting in each of the directions viz. across and along the grains – Select appropriate work holding device – Handle appropriate measuring and marking tools(Steel rule, Try square, Marking gauge) – Mark dimensions on work using Marking gauge – Fix the work in the vice – Perform cutting along the grains using Rip saw – Change the position of work in the vice – Perform cutting perpendicular the grains using cross cut saw	• Identify the orientation of grains • Mark dimensions on work using marking gauge • Perform cutting along and perpendicular the grains using appropriate saw
12.Planning of wood(06)	– Identify the direction for planning wood stock – Select appropriate jack plane – Prepare the jack plane for planning (Load and unload the blade of a jack plane – Select appropriate work holding device – Perform marking on work using appropriate tool – Fix the work in the vice – Plane the surfaces on all four sides using jack plane	• Identify the direction for planning wood stock • Prepare the jack plane for planning • Plane the surfaces on all four sides using jack plane

Title of the Job	Competencies	Key Competencies
Contd.,,, 13.Chiselling of wood (06)	– Select appropriate chisels and saw – Select appropriate work holding device – Select appropriate measuring and marking tools – Fix the work in the vice – Mark the position of grooves on work using marking gauge – Cut sides of grooves by hand saw – Chip the material using firmer chisel by applying pressure with mallet – Finish the grooves with rasp file	• Select appropriate chisels and saw • Mark the position of grooves on work using marking gauge • Cut sides of grooves by hand saw • Chip the material using firmer chisel by applying pressure with mallet
14.Preparation of a Dove tail joint (09)	- Select the appropriate cutting tools and work holding devices - Plane the wooden pieces on all sides - Mark at an angle of 75^0 with bevel square - Trim the dovetail by chisel to exact size - Cutt the dovetail groove on second piece - Finish the groove - Assemble the two pieces to prepare dovetail halving joint by using mallet	• Trim the dovetail by chisel to exact size • Mark at an angle of 75^0 with bevel square • Cutt the dovetail groove on second piece • Assemble the two pieces to prepare dovetail halving joint by using mallet
15.Preparation of Mortise and Tenon joint (09)	- Select the appropriate cutting tools and work holding devices - Plane the two pieces to the required size using jack plane - Mark the dimensions to make Tenon using mortise gauge - Cut tenon with tenon saw along the marked lines	• Mark the dimensions to make Tenon and mortise on two pieces using mortise gauge • Cut tenon with tenon saw along the marked lines

Title of the Job	Competencies	Key Competencies
Contd.,,, Preparation of Mortise and Tenon joint	– Use firmer chisel to remove the excess material to set finished tenon – Mark the dimension to make mortise on the second piece with mortise gauge – Use mortise chisel to provide recess in the second piece to accommodate tenon – Assemble the two pieces by fitting the tenon into mortise	• Use mortise chisel to provide recess in the second piece to accommodate tenon • Assemble the two pieces by fitting the tenon into mortise
16.Wood turning on lathe (06)	– Select appropriate tools – Plane the four corners of the work piece using jack plane – Mark the centres of the work on either side – Mount the work between head stock & tailstock centres – Fix the tool in the tool post & Position it in appropriate height – Start the lathe to make the work piece to revolve at desired speed – Feed the bevel gauge against the rotating work to get the required size and shape – Use outside callipers to check the diameter of the pin – Use parting off tool to reduce the diameter on either ends of the pin – Remove the rolling pin between centres and cut off excess material on either sides	• Mark the centres of the work on either side • Fix the tool in the tool post & Position it in appropriate height • Start the lathe to make the work piece to revolve at desired speed • Feed the bevel gauge against the rotating work to get the required size and shape

Title of the Job	Competencies	Key Competencies
Contd.,,, 17.Preparation of any household article (ex: stool) (09)	– Prepare the drawings of a stool required for a particular drawing table – State the specifications of the wood stock required – Identify the type of joints to be made – Identify the operations to be made and their sequence – Perform operations to produce pieces of joint – Assemble all joints as per the drawing	• Prepare the drawings of a stool required for a particular drawing table • Identify the operations to be made and their sequence • Perform operations to produce pieces of joint • Assemble all joints as per the drawing

Title of the Job	Competencies	Key Competency
Sheet metal Work 18.Practice on cutting of sheet (06)	– Cutt the required sheet from the stock using snip – Mark the dimensions on the sheet using scriber & steel rule – Draw the circular shapes using divider – Perform rough cutting of the curved shapes using chisel and finish cutting using snips – Cut the straight edges using straight snips	• Identify the marking and cutting tools • Cut the sheet of different shapes using appropriate tools
19.Formation of joints like grooved joint, locked groove joint (06)	– Cut the sheet in to two halves – Form the flange on the sheet by folding the sheet along scribed lines using mallet & stakes – Perform bending edges of sheets applying moderate pressure using mallet – Inter lock the bent edges and apply pressure with mallet to make required joint	• Identify the marking and cutting tools • Cut the sheet • Perform bending along the marked lines.

Title of the Job	Competencies	Key Competency
20.Preparation of a rectangular open type tray (09)	– Draw the development of the object to be made – Place the pattern on the sheet – Mark the dimensions using scriber – Shear the required piece from the stock using straight snips – Mark the lines on the sheet to form bends – Strengthen the sides of sheet by singe hem using hatchet stake – Form the sheet in to desired shape using stakes – Seam the corners by inserting laps of the adjacent sides with single hem	• Drawing development of objects • Cut the sheet • Seam the corners by inserting laps of the adjacent sides with single hem
21.Preparation of hollow cylinder (06)	– Draw the development of the object to be made – Place the pattern on the sheet – Mark the dimensions using scriber – Shear the required piece from the stock using straight snips – Mark the lines on the sheet to form bends – Strengthen the sides of sheet by singe hem on top & bottom side using hatchet stake – Form the flat sheet into cylindrical shape by cylindrical stake and apply pressure using mallet – Prepare single hem on to longitudinal sides in opposite directions – Inter lock the sides and apply pressure to make a strong joint	• Identify the marking and cutting tools • Drawing development of objects • Cut the sheet • Inter lock the sides and apply pressure using mallet to make a strong joint

Title of the Job	Competencies	Key Competency
22.Preparation of pipe elbow (09)	– Draw the development of a cylindrical pipe truncated at an angle of 45^0 on one side – Scribe the lines on the sheet by placing the pattern on it – Cutt the sheet over the marked dimensions using curved snips – Hem the straight side of the sheet and flange the curved side – Fold the edges of joining sides – Form the sheet into cylindrical shape using stakes – Seam the sides using mallet – Repeat the similar operation for making the second pipe – Butt the treated portions of the cylindrical pipes at rectangles – Seam the two pipes – Solder the joint to make leak proof	• Draw the development of a cylindrical pipe truncated at an angle of 45^0 on one side • Cutt the sheet over the marked dimensions using curved snips • Form the sheet into cylindrical shape using stakes

Title of the Job	Competencies	Key Competency
23.Preparation of funnel (09)	– Draw the development of upper conical part – Place the pattern on the sheet and cut to required size – Hem the upper side of the sheet – Flange out the bottom side of the sheet – Fold the edges of the joining sides – form the sheet into conical shape using appropriate stake and mallet – Repeat the similar operation for making the bottom part – Seam the top conical part and bottom conical part to obtain required funnel	• Draw the development of upper and bottom conical parts • Place the pattern on the sheet and cut to required size • form the sheet into conical shape using appropriate stake and mallet • Seam the top conical part and bottom conical part to obtain required funnel
24.Preparation of utility articles such as dust pan, kerosene hand pump (06)	– Draw the development of given dust pan – Scribe the lines on the sheet and cut to required size – Hem all the four sides to strengthen the edges – Form the sheet into designed shape using suitable stakes and mallet – Solder the corner lap joints to make the required dust pan	• Identify the marking and cutting tools • Drawing development of objects • Cut the sheet • Perform bending along the marked lines and to form the article

COURSE CONTENT

FITTING SHOP

1. Marking and chipping on Mild – steel flat 12 mm thick.
2. Cutting with hack saw, M.S. Flats of 6 mm thick.
3. Marking, cutting, drilling, Chamfering and tapping on a M.S. Flat 12 mm thick.
4. Assembling of two pieces, Matching by filing (6 mm thick M.S. Plate)

FORGING SHOP

1. Conversion of round to square.
2. Conversion of round to Hexagon.
3. Preparation of chisel from round rod.
4. Preparation of ring and hook from M.S. round.
5. Preparation of a hexagonal bolt and nut.

CARPENTRY SHOP

1. Cutting of wood with hand saw.
2. Planning of wood.
3. Planning and chiseling of wood.
4. Orientation of wood grain.
5. Preparation of dovetail joint.
6. Mortise and tenon joint.
7. Wood turning on a lathe.
8. Preparation of one household article.

SHEET METAL WORK

1. Practice on cutting of sheet
2. Formation of joints like grooved joints, locked groove joint
3. Preparation of a rectangular open type tray
4. Preparation of hollow cylinder
5. Preparation of pipe elbow
6. Preparation of mug.
7. Preparation of funnel
8. Preparation of utility articles such as dustpan, kerosene hand pump.

REFERENCE BOOKS

1. Manufacturing Technology (Vol I) by P N Rao (Mc Graw Hill)
2. Principles of Foundry Technology by P L Jain (Mc Graw Hill)

ENGINEERING PHYSICS LAB PRACTICE
(Common to all Branches)

Subject Title : Engineering Physics Lab Practice
Subject Code : ME-109 A
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	Competencies	Key competencies
1. Hands on practice on Vernier Calipers	• 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	• 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	• 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 angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length
4. Simple pendulum	• 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	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound • Calculate velocity of

Name of the Experiment	Competencies	Key competencies
6. Focal length and Focal power of convex lens (Separate & Combination)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex lenses	• 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	• 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	• 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	• 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

Name of the Experiment	Competencies	Key competencies
10. Boyle's law verification	• 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	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance
12. Mapping of magnet lines of Force	• 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

ENGINEERING CHEMISTRY LAB PRACTICE
(Common to all Branches)

Subject Title : Engineering Chemistry Lab Practice
Subject Code : ME -109 B
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 $Na_2 CO_3$ and making different diluted solution.	03
3.	Estimation of HCl solution using Std. $Na_2 CO_3$ 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	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. $Na_2 CO_3$ 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	Competencies	Key competencies
Familiarization of methods for Volumetric analysis	--	--
Preparation of Std Na_2CO_3 and making different diluted solution	▪ 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

Name of the Experiment	Competencies	Key competencies
Estimation of HCl solution using Std. Na_2CO_3 solution	▪ Cleaning the glassware and rinsing with appropriate solutions ▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Filling the burette with titrant ▪ Fixing the burette to the stand ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations ▪ Calculating the results	▪ Making standard solutions ▪ Measuring accurately the standard solutions and titrants ▪ Effectively Controlling the flow of the titrant ▪ Identifying the end point ▪ Making accurate observations
Estimation of NaOH using Std. HCl solution		
Estimation of H_2SO_4 using Std. NaOH solution		
Estimation of Mohr's Salt using Std. $KMnO_4$		
Determination of acidity of water sample		
Determination of alkalinity of water sample		
Determination of total hardness of water using Std. EDTA solution		
Estimation of Chlorides present in water sample		
Estimation of Dissolved Oxygen (D.O) in water sample (By titration method)		
Estimation of Dissolved Oxygen (D.O) in water sample (By electrometric method)	▪ 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		
Determination of conductivity of water and adjusting ionic strength to required level		
Determination of turbidity of water		

Name of the Experiment	Competencies	Key competencies
Estimation of total solids present in water sample	▪ 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
(Common to all Branches)

Subject Title : Computer Fundamentals Laboratory Practice
Subject Code : ME-110
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	a. Create files and folders Rename , arrange and search for the required folder/file

Exp No.	Name of the Experiment	Competencies	Key Competencies
	Working with Files and Folders Continued....	c. Arrange icons – name wise, size, type, Modified d. Search a file or folder and find its path e. Create shortcut to files and folders (in other folders) on Desktop f. Familiarize with the use of My Documents g. Familiarize with the use of Recycle Bin	b. Restore deleted files from Recycle bin
5.	To use Windows Accessories: Calculator – Notepad – WordPad – MS Paint	a. Familiarize with the use of Calculator b. Access Calculator using Run command c. Create Text Files using Notepad and WordPad and observe the difference in file size d. Use MS paint and create .jpeg, .bmp files using MS Paint	a. Use windows accessories and select correct text editor based on the situation. b. Use MS pain to create /Edit pictures and save in the required format.
6.	To familiarize with Ribbon layout of MS word. – Home – Insert- page layout- References-Review-View	a. Create/Open a document b. Use Save and Save as features c. Work on two 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

Exp No.	Name of the Experiment	Competencies	Key Competencies
9.	To insert a table of required number of rows and columns	a. Edit the table by adding the fields – Deleting rows and columns –inserting sub table – marking borders. Merging and splitting of cells in a Table b. Changing the background colour of the table c. Use table design tools d. Use auto fit – fixed row/ column height/length – Even distribution of rows / columns features e. Convert Text to table and Table to Text f. Use Sort feature of the Table to arrange data in ascending/descending order	a. Insert table in the word document and edit b. Use sort option for arranging data.
10.	To Insert objects, clipart and Hyperlinks	a. Create a 2-page document. &Insert hyperlinks and t Bookmarks. b. Create an organization chart c. Practice examples like preparing an Examination schedule notice with a hyperlink to Exam schedule table.	a. Insert hyperlinks &Bookmarks b. Create organization charts/flow charts
11.	To Use Mail merge feature of MS Word	a. Use mail merge to prepare individually addressed letters b. Use mail merge to print envelopes.	Use Mail merge feature
12.	To use Equations and symbols features.	a. Explore various symbols available in MS Word b. Insert a symbol in the text c. Insert mathematical equations in the document	Enter Mathematical symbols and Equations in the word document
13.	To Practice with MS-EXCEL	a. Open /create an MS Excel spreadsheet and familiarize with MS Excel 2007 layout like MS office Button- b. Use Quick Access Toolbar- Title Bar- Ribbon-Worksheets-Formula Bar-Status Bar	a. Familiarize with excel layout and use b. Use various features available in toolbar
14.	To access and Enter data in the cells	a. Move Around a Worksheets-Quick access -Select Cells b. Enter Data-Edit a Cell-Wrap Text-Delete a Cell Entry-Save a File-Close Excel	a. Access and select the required cells by various addressing methods b. Enter data and edit

Exp No.	Name of the Experiment	Competencies	Key Competencies
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

Exp No.	Name of the Experiment	Competencies	Key Competencies
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 e. Format a Chart Background	Create charts and Bar graphs, Pie Charts and format.

Exp No.	Name of the Experiment	Competencies	Key Competencies
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 MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
III Semester

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:								
ME- 301	Engineering Mathematics - II	4	-	60	3			100
ME -302	Engineering Materials	5	-	75	3			100
ME -303	Basic Electrical& Electronics Engineering	4	-	60	3			100
ME-304	Basic Thermodynamics	4	-	60	3			100
ME-305	Strength of Materials	5	-	75	3			100
ME-306	Production Technology-I	4	-	60	3			100
PRACTICAL:								
ME-307	Machine Drawing Practice	-	7	105	3			100
ME-308	Fuels Lab Practice	-	3	45	3			100
ME-309	Electrical Engineering Lab Practice	-	3	45	3			100
ME-310	Manufacturing & Fabrication Engg.Lab Practice -I	-	3	45	3			100
	TOTAL	26	16	630				1000

ENGINEERING MATHEMATICS – II
(Common to all Branches)

Subject Title : Engineering Mathematics-II
Subject Code : ME-301
Periods per week : 04
Periods per Semester : 60

Blue print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
	Unit - I			R	U	App	R	U	App
1	**Indefinite Integration**	18	34	2	1	0	1	1	1/2
	Unit - II								
2	**Definite Integration and its applications**	17	31	0	1	1	0	1	1 1/2
	Unit - III								
3	**Differential Equations of first order**	15	29	2	1	0	1/2	1/2	1
	Unit - IV								
4	**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: Understanding type 37 marks
App: Application type 33 marks

OBJECTIVES

Upon completion of the subject the student shall be able to

Unit-I

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 $\int (u + v)\,dx$ and $\int ku\,dx$ where k is constant and u, v are functions of x.

1.3 Solve integration problems involving standard functions using the above rules.

1.4 Evaluate integrals involving simple functions of the following type by the method of substitution.

i) $\int f(ax + b)\,dx$ where $f(x)\,dx$ is in standard form.

ii) $\int [f(x)]^n f'(x)\,dx$

iii) $\int f'(x)/[f(x)]\,dx$

iv) $\int f\{g(x)\}\, g'(x)\,dx$

1.5 Find the Integrals of *tan x, cot x, sec x* and *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 $\int u.v dx$.

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

Unit-II

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 given interval.

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

Unit -III

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

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 CONTENT

Unit-I

Indefinite Integration:

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

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

ENGINEERING MATERIALS

Subject Title : Engineering Materials
Subject Code : ME-302
Periods per week : 05
Periods per Semester : 75

TIME SCHEDULE

Sl. No	Major Topics	No. of Periods	Weightage of Marks	Short answer Questions	Essay Type Questions
1	Introduction & Mechanical properties of engineering materials	04	05	--	½
2	Testing of materials	08	13	01	01
3	Structure of Materials	08	13	01	01
4	Production of Iron and Steel	10	13	01	01
5	Iron Carbon Equilibrium Diagram	12	16	02	01
6	Heat treatment of Steel	12	16	02	01
7	Ferrous, Non Ferrous Metals and their alloys	14	21	02	1 ½
8	Powder Metallurgy	07	13	01	01
	Total	**75**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the Mechanical properties of engineering materials

1.1 State the importance of various Engineering Materials used in Mechanical processes / industries.
1.2 List the various engineering materials and their applications.
1.3 Define the following Properties.
i) Tensile, compressive and shear strength
ii) Ductility iii) Hardness iv) Toughness v) Brittleness
vi) Impact strength vii) Fatigue and Creep strength

2.0 Understand the procedures of Testing of Materials

2.1 Differentiate between destructive and non-destructive tests.
2.2 Describe the testing procedure for tensile strength, compression strength, shear strength, Impact strength, and hardness of metals.
2.3 Describe the procedure for Testing Materials by X- Ray, gamma – Ray, Magnaflux, Ultrasonic and penetrate test.

3.0 Indentify the Structure of materials

3.1 State the meaning of space lattice.
3.2 Define unit cell.
3.3 Describe the three main types of space lattice with legible sketch.
3.4 State the formation of grains by dendrite growth.
3.5 State the effect of rate of cooling on grain formation.
3.6 State the effect of grain size on mechanical properties.
3.7 Identify the factors promoting grain size.
3.8 Identify important stages in the phenomenon of recrystallisation.

4.0 Understand the Production of Iron and Steel

4.1 Name the various raw materials required for production of iron.
4.2 Describe the Blast furnace to produce Pig Iron in with legible sketch
4.3 Describe the puddling furnace to produce wrought iron with legible sketch.
4.4 Explain the process of manufacturing cast iron in Cupola with legible sketch.
4.5 Describe the steps in manufacturing steel by Bessemer process, L.D. process, Open Hearth and Electric Process.

5.0 Understand the phases of Iron - Carbon Equilibrium Diagram

5.1 Explain the cooling curves of pure metal with legible sketch.
5.2 Identify the allotropic forms of pure iron with temperatures, their crystal structures.
5.3 Draw the iron carbon diagram and identify various structures of the iron carbon system.
5.4 Locate Eutectic, Peritectic and Eutectoid points from the Iron Carbon diagram.
5.5 Obtain the composition of phases in a steel/cast Iron from the iron carbon diagram.

6.0 Understand the Heat Treatment Processes of Steel.

6.1 State the importance of heat treatment for steels.
6.2 Describe the main features of the various heat treatment operations.
6.3 Differentiate between annealing and normalizing.
6.4 Describe the effect of cooling rate in hardening.
6.5 State the importance of tempering.
6.6 Explain the use of case hardening processes like; carburizing, nitriding and cyaniding
6.7 Describe TTT curves with legible sketch
6.8 Explain the processes Sub Zero treatment and Vacuum Hardening

7.0 Use the Ferrous, Non-Ferrous Metals and their alloys

7.1 Classify of Cast Iron – Grey, White, Malleable, Spheroidal – composition, properties and applications.
7.2 State the basis of classification of plain carbon steels.
7.3 List the application of these steels.
7.4 Describe the need for alloying the steel with other elements.
7.5 State the composition and properties of alloy steels.
7.6 List industrial applications of alloy steels.
7.7 Identify the need for non-ferrous metals and their alloys in engineering application.

7.8 Describe the properties of –Copper, Aluminum, Tin, Zinc, lead, Nickel, Magnesium and Chromium.
7.9 Indicate the composition, properties, and industrial application of the important – non-ferrous alloys.
7.10 Identify the properties of bearing metals.

8.0 Understand the processes and methods in Powder Metallurgy.
8.1 Explain the applications of powder metallurgy as a primary manufacturing process.
8.2 State the important characteristics of metal Powders.
8.3 Explain the methods of producing powders.
8.4 Explain the following processes of forming to shape
i) Pressing, ii) Centrifugal compacting, iii) Extruding,
iv) Gravity sintering, v) Rolling, vi) isostatic moulding,
vii) Explosive compacting, viii) Hot pressing, ix) spark sintering.
8.5 Explain the finishing operations.
8.6 State the advantages and limitations of powder metallurgy.

COURSE CONTENT

1.0 Introduction, Mechanical properties of engineering materials
1.1 A few Mechanical Engineering Materials, Importance of their study with applications.
1.2 Various mechanical properties of engineering materials – Tensile strength, Compressive strength, Ductility, Malleability, Hardness, Toughness, Brittleness, Impact strength, Fatigue, Creep resistance

2.0 Testing of materials
2.1 Destructive testing tests on UTM to determine tensile, compressive and shear strengths – Tests on Brinell & Rock Well hardness test – Impact test on Izod & Charpy tester.
2.2 on destructive testing – Procedure for testing materials by X-ray, gamma ray, magnetic flux and ultrasonic testing.

3.0 Structure of Materials
3.1 Crystals of metals, Space lattices, Unit cell, three main types of metallic space lattices, namely Face Centered Cubic, Body Centered Cubic, Hexagonal Close Packed.
3.2 Crystallisation of metal, formation of grains by dendrite growth, grain boundary, grain size control, effect of grain size on properties – factors

4.0 Production of Iron and Steel.
4.1 Raw materials, iron ores, Lime stone, Coal-their availability in India. General Survey of Iron and steel making in India.
4.2 Manufacturing of pig iron from blast furnace.
4.3 Wrought iron by pudding furnace and Cast Iron from cupola.
4.5 Production of steel by Bessemer, L.D. process; Open hearth and Electric processes.

5.0 Iron - Carbon Equilibrium Diagram.
5.1 Cooling curve for pure metal.
5.2 Allotropic forms of pure Iron.
5.3 Iron carbon equilibrium diagram.

6.0 Heat Treatment of Steels.

6.1 Importance of heat treatment.

6.2 Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding with specific examples of engineering applications of the above.

6.3 Sub Zero treatment – its importance.

6.4 Vacuum hardening – its importance.

7.0 Ferrous, Non- Ferrous metals and their alloys.

7.1 Classification of Cast Iron – Grey, White, Malleable, Spheroidal – Composition, properties and applications.

7.2 Plain Carbon Steels: Effect of carbon in steels, Soft, Mild, Medium and High carbon and also their properties and applications.

7.3 Alloy Steels: Nickel Steels, Chromium steels, 18/8 stainless steel, High Speed Steels, Manganese Steel.

7.4 Properties and uses of Copper, Aluminium, Tin, Zinc, Lead, Nickel, Magnesium and Chromium.

7.5 Muntz metal, Admiral metal, Phosphour Bronze, Gun Metal.

7.6 Aluminum Bronze, Constantan, Monel Metal.

7.7 Properties of Bearing metals, Babbit metals.

8.0 Powder Metallurgy.

8.1 Primary manufacturing process – definition, important characteristic of metal powders,

8.2 Methods of producing powders.

8.3 Forming to shape – pressing, centrifugal compacting., Extruding, Gravity sintering, Rolling, isostatic moulding explosive compacting, , sintering, Hot pressing, spark sintering,

8.4 Finishing operation.

8.5 Advantages and limitations of powder metallurgy.

REFERENCE BOOKS

1.	Powder Metallrgy	by	TTTI,ECH
2.	Material Science	by	Raghavan
3.	Physical Metallurgy	by	Avner
4.	Introduction to Engineering Materials	by	B.K Agarwak (McGraw-Hill)

ELECTRICAL ENGINEERING & BASIC ELECTRONICS

Subject Title : Basic Electrical & Electronics Engineering
Subject Code : ME-303
Periods/Week : 04
Periods per semester : 60

TIME SCHEDULE

S. No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1.	Electrical engineering fundamentals	12	29	03	2
2.	D.C. Machines	12	18	01	1½
3.	A.C. Fundamentals & A.C. Machines	20	34	03	2 ½
4.	Semi Conductors	08	13	01	1
5.	Electrical measuring instruments & Safety procedures	08	16	02	1
Total		**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of course the student shall be able to

1.0 Comprehend Basic Electrical Fundamentals.

1.1 Define Ohm's Law.
1.2 State the Laws of Resistance.
1.3 State work, power and energy, with units.
1.4 State Kirchoff ' s laws.
1.5 Explain Kirchoff ' s laws.
1.6 Solve simple Problems on the above.
1.7 Define
a) Magnetic field strength, b) Flux, c) Permeability, d) Reluctance
1.8 Define
a) Electric field, b) Electric field intensity, c) Permittivity
1.9 State capacitance.
1.9 State Faradays laws of Electro Magnetic Induction. (no problems)
1.10 Explain dynamically and statistically induced E.M.F. (no problems)
1.11 State Lenz's Law. (no problems)
1.12 Explain Fleming's right hand rule. (No problems)
1.13 Explain inductance
a) Self inductance, b) Mutual inductance, c) Coefficient of coupling
1.14 Solve problems on self and mutual inductances.
1.15 Explain energy stored in a magnetic field.
1.16 Derive an expression for lifting power of a magnet.

2.0 Understand D.C. Machines.

2.1 Explain the working principle of D.C. Generator.
2.2 Explain Constructional features of D.C. Generator and materials used.

2.3 (a) List the types of D.C. Generators.
(b) Draw schematic diagram of each type.
2.4 (a) Write formula for E.M.F equation of a D.C.Generator [No derivation]
(b) State the relation between currents and voltages for different types of D.C generators.
2.5 Label the terminals of a D.C. Generator for armature, field and inter pole windings.
2.6 Draw power flow diagram of D.C. Generator. (no problems on above)
2.7 Draw the connection diagram of welding generator
2.8 Explain the principle of operation of D.C. Motor.
2.9 (a) List types of motors.
(b) Draw Schematic diagram of each type.
2.10 (a) Explain back e.m.f.
(b) State the relation between currents and voltages.
2.11 Write formula for speed of D.C. Motor in terms of supply voltage, current and flux.
2.12 Explain necessity of starters.
2.13 Describe with a legible sketch the connection diagram of D.C. 3 point Starter.
2.14 Explain speed control of D.C. Motors.
a). Field control b). Armature control
2.15 List the applications of D.C. motors

3.0 Understand A.C. Fundamentals and A.C.Machines

3.1 Explain
i) Alternating current, ii) Amplitude (Peak Value), iii) Time Period
iv) Frequency, v) Instantaneous value, vi) Average value
vii) R.M.S Value, viii) Form Factor
3.2 Explain graphical and vector representation of alternating quantities.
3.3 Explain phase, phase difference.
3.4 State power in an A.C. circuit and power factor [No derivation]
i) Pure resistance, ii) Pure inductance, iii) Capacitance
3.5 Explain single phase circuit
a) Simple series circuit consisting R-L, R-C, and R-L-C.
b) Simple parallel circuit R-L-C.
3.6 Calculate the impedance, current, PF, Power and Voltage drops in a given (R-L-C) circuit.
3.7 Solve simple problems on series circuits.
3.8 Explain poly phase and 3 phase system.
3.9 Explain phase difference in 3 phase system.
3.10 Explain Star-Delta connections.
3.11 Explain working principle of alternator.
3.12 Explain constructional features of Alternators.
3.13 Derive frequency and speed relations.
3.14 Explain working principle of transformer and rating of transformer.
3.15 Write relation between turns ratio, Voltage ratio and current ratios
3.16 Describe with a legible sketch a welding Transformer.
3.17 Explain three phase induction motor working Principle.

3.18 Explain constructional features of – 3 phase Induction motors with legible Sketch
a) Squirrel cage induction motor, b) Wound rotor induction motor.
3.19 Describe with a legible sketch
a)D.O.L Starter, b) Star – Delta Starter, c) Rotor resistance starter
3.20 Explain forward and reverse running of Induction motor.
3.21 State the application of 3 phase induction Motor.
3.22 Explain the working principle of single Phase induction motor.
3.23 List types of single phase induction Motors.
3.24 Draw circuit diagram for single phase Induction motors.
3.25 Explain forward and reverse running of Single phase induction motor.
3.26 List the Applications of single phase induction Motors.

4.0 Understand the Principles of Semi-Conductor Devices.

4.1 Classify materials as conductor, semi-conductors and insulators.
4.2 Distinguish between intrinsic and extrinsic semiconductors.
4.3 Describe the formation of P- type and N- type materials.
4.4 Identify majority and minority carries in P&N type materials.
4.5 Explain the formation of PN Junction diode.
4.6 Describe the working of PN junction diodes with forward bias & reverse bias with the help of legible sketch.
4.7 Understand the working of PNP & NPN transistors
4.8 Draw the different transistor configuration.
4.9 Draw the input & output characteristics of C.B., C.E & C.C. configuration.
4.10 Describe the operation of Zener diode with the help of legible sketch.
4.11 Distinguish between Zener & Avalanche break – down.
4.12 Explain the operation of LED, LCD & the materials used.

5.0 Understand Electrical Measuring Instruments and Safety Procedures.

5.1 Explain construction details and working principle of moving Coil ammeter and volt meter.
5.2 Explain construction details and working principle of moving iron ammeter and voltmeter.
5.3 Explain construction details working principle of dynamometer type wattmeter.
5.4 Explain construction details and working principle of A.C. single phase induction type energy meters.
5.5 Draw the connection diagram of single phase energy meter with load.
5.6 Explain effect of electrical shock and burn.
5.7 State procedure to be adopted in case of electric shocks.
5.8 State purpose of earthling of electrical equipment and machinery.
5.9 Describe the procedure for pipe earthling with the help of legible sketch

COURSE CONTENT

1.0 Basic Concepts and Electro Magnetic Induction

1.1 Definitions: Ohm' Law, Laws of resistance work, power, energy with units.
1.2 Kirchoff's Laws – Simple problems.
1.3 Definitions and units magnetic field strength, flux, flux density, permeability, reluctance.
1.4 Definitions and units electric field, field strength, permittivity, capacitance.

1.5 Faraday's laws of Electro – magnetic induction.
1.6 Dynamically and statically induced e.m.f.
1.7 Lenz's Law, Fleming's right hand rule.
1.8 Problems on above.
1.9 Inductance – self and mutual – coefficient of coupling.
1.10 Energy stored in a magnetic field.
1.11 Lifting power of magnet.

2.0 D.C. Machines

2.1 **D.C. Generators**

a) Principle of operation.b) Parts of generator and materials use.
c) Types of generators and schematic diagrams.
d) E.M.F equation (No derivation) and voltage current relations.
e)Nomenclature used for determining armature, field and interpole windings etc.
f) Power flow diagram,g) Welding Generator.

2.2 **D.C. Motors**

a) Principle of operation, b)Types of motors and schematic diagrams
c) Back e.m.f and speed equation and relation between voltages and currents.
d) Starters necessity and connection diagram of 3 point starter.
e) Speed control – field and armature control, f) Applications of motors.

3.0 A.C. Fundamentals and Machines

3.1 Definition – alternating current, voltage amplitude, time period frequency, instantaneous value, Average value, r.m.s. value, form factor.
3.2 Graphical and vector representation of Alternating quantities.
3.3 Phase difference.
3.4 Power in A.C. Circuits and power factor (No Derivation).
3.5 Nature of current when alternating voltage is applied to pure resistance, inductance and capacitance – magnitude of current, power factor, power factor angle and power.
3.6 A.C. Circuits.
3.7 Single phase series circuits – calculation of impedance, current , power factor, power and voltage drops.
3.8 3 – phase circuits
a) Definition of poly – phase and 3 Ø circuits.,b) Phase difference in 3 Ø
c) Star and delta connections, definitions of phase values and line values.
3.9 Alternators – principle of working.
3.10 Constructional features of alternators.
3.11 Speed and frequency relations.
3.12 Transformers working principle.
3.13 Single phase transformers.
a) Voltage ratio b) Current ratio ,c) Turns ration.
3.14 Welding transformer.
3.15 Phase Induction Motor
a) Working principle of induction motor.
b) Construction of induction motor
i) Squirrel cage induction,ii) Wound Rotor induction motor.
c) Starters.

i) D.O.L, ii) Star/Delta starter, iii) Rotor resistance starter.
d) Forward and reverse running of Induction motors.

3.16 Single phase induction motors.
a) Types of single phase induction motors.
b) Circuit diagram of each type of single Phase induction motor.
c) Forward and reverse running of single Phase induction motors.
d) Applications of single phase induction Motors.

4.0 Semi – Conductors.

4.1 Semi – conductors – N-Type, P-type.
4.2 Behaviour of PN Junction diode
4.3 Introduction of PNP, NPN Transistors.
4.4 Transistor configuration – Zener diodes.
4.5 LED, LCD, Seven segment display.

5.0 Electrical Measuring Instruments & Safety Procedures

5.1 Construction and principle of operation of moving coil permanent magnet type ammeter and voltmeter and moving iron ammeter and voltmeter.

5.2 Construction and working principle of
a) Dynamometer and wattmeter.
b) A. C. Single phase induction type Energy meter.
c) Connection diagram of single phase energy meters with load

5.3 Safety Procedures.
a) Effects of shock and burns.
b) Procedures to be adopted in case of electrical shocks.
c) Earthing of electrical equipment and machine.

REFERENCE BOOKS

1.	Theraja B.L.	-	A Text Book of Electrical Engg. and Electronics.
2.	Mehtha.V.K	-	Principles of Electronics
3.	Gupta	-	Fundamentals of Elec. Engg.
4.	Uppal	-	A Text Book of Elec.Engg & Electronics.

BASIC THERMODYNAMICS

Subject Title : Basic Thermodynamics
Subject Code : ME-304
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Fundamentals and laws of thermo-dynamics	12	24	03	1 ½
2	Laws of perfect gases	10	21	02	1 ½
3	Thermodynamic processes in gases	22	36	02	03
4	Fuels and combustion	16	29	03	02
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the Fundamentals and laws of Thermodynamics.

1.1 Define the various terms associated with the thermodynamic system.
1.2 Name the types of thermodynamic systems.
1.4 Explain the closed system with examples.
1.5 Explain the open system with examples
1.6 Explain the isolated system with examples.
1.7 List the thermodynamic properties of system.
1.8 Define the various thermodynamic properties.
1.9 Write examples for each property and its units of measurement.
1.10 State the number of properties required to define the state of a system.
1.11 Define the modes of energy transfer to and from a system.
1.12 Represent the state of a system on a graph.
1.13 State the Zeroth law of thermodynamics.
1.14 State the first law of thermodynamics.
1.15 State the second law of thermodynamics.
1.16 Solve problems dealing with conversion of heat into work and vice – versa.
1.17 Write non-flow energy equation.
1.18 Write steady flow energy equation
1.19 Solve simple problems on energy equation.

2.0 Understand the laws of perfect gases.

2.1 Define the term 'Perfect Gas'.
2.2 State "Boyle's law".
2.3 State "Charle's law".
2.4 State "Avagadro's law".
2.5 State "Regnault's law".
2.6 State "Joule's law".
2.7 Derive characteristic gas equation.
2.8 Write the universal gas equation.
2.9 State relationship between characteristic gas constant (R), universal gas constant (G) and molecular weight (M).
2.10 Define specific heat at constant pressure (C_p).
2.11 Define specific heat at constant volume (Cv).
2.12 Infer why C_p is more than C_v?
2.13 Derive the relationship connecting the two specific heats and characteristic gas constant (R).
2.14 Solve simple problems using gas laws.

3.0 Understand Thermodynamic Processes on gases.

3.1 List the different thermodynamic processes on gases.
3.2 Derive an expression for work done in Iso-choric process.
3.3 Derive an expression for work done in Iso-baric process.
3.4 Derive an expression for work done in hyperbolic process.
3.5 Infer that Isothermal process is the same as hyperbolic process for gases.
3.6 Derive an expression for work done in polytropic process.
3.7 Derive an expression for work done in isentropic process.
3.8 Justify that work done in throttling process is zero.
3.9 Explain the concept of entropy.
3.10 Derive the expression for change of Entropy for the above processes.
3.11 Compute the change in internal energy of gas during a process.
3.12 Write the relationship between heat supplied, internal energy and work done.
3.13 Draw pressure- volume and temperature - Entropy diagram for the above processes.
3.14 Solve simple problems on the above processes.

4.0 Understand the concept of fuels and combustion.

4.1 Define the term fuel.
4.2 Name different types of fuels with examples.
4.3 List the applications of different fuels.
4.4 Define higher calorific value of a fuel.
4.5 Define lower calorific value of a fuel.
4.6 Re-write Du long's formula for calorific value from chemical composition of a fuel.
4.7 Estimate the calorific value using the above formula.
4.8 Compare solid, liquid and gaseous fuels.
4.9 Explain with line diagram the components of a Bomb-calorimeter.
4.10 Narrate the sequence of procedure for the determination of calorific value using Bomb calorimeter.
4.11 Compute the calorific value using the test data on a bomb calorimeter unit.
4.12 Explain the working principle of Junker's gas calorimeter with a line diagram.

4.13 Narrate the sequence of procedure in the determination of C.V. of a gaseous fuel with Junker's calorimeter.
4.14 Calculate the C.V. of a fuel with the help of test data.
4.15 Write the balance of chemical equation for the composition of Unit mass/unit volume of a given fuel.
4.16 Estimate the minimum air required for complete combustion of unit mass / unit volume of a fuel of given composition.
4.17 Estimate the percentage composition of flue gases during combustion with or without excess air.
4.18 Estimate the weight of exhaust gases obtained by complete combustion of unit weight of a fuel of given composition.
4.19 Explain with a line diagram the working of Orsat's apparatus.
4.20 Narrate the sequential procedure in conducting flue gas analysis by using Orsat's apparatus.
4.21 Explain with the help of line diagram the working of mechanical type of CO_2 recorder.

COURSE CONTENT

1.0 Fundamentals and laws of Thermodynamics.

1.1 Definitions for system - boundary, surroundings, working fluid and state of a system.
1.2 Types of thermodynamic systems – closed, open and isolated systems with examples.
1.3 Properties of system- Intrinsic and Extrinsic properties with examples.
1.4 Definitions for properties like pressure (p), Volume (v), Temperature (T), Enthalpy (H), Internal energy (U) and their units.
1.5 Definitions for quasi-static work, flow- work, specific heat.
1.6 Zeroth, first, second laws of thermodynamics, simple problems on conversion of Heat into Work and vice versa.
1.7 Steady flow energy equation (without proof), simple problems.

2.0 Laws of perfect gases.

2.1 Brief explanation of perfect Gas Laws – Boyle's law, Charle's Law – Avagadro's Joule's law and Regnault's law.
2.2 Derivation of characteristic gas equation - universal gas equation, universal gas constant and their relationship with molecular weight of gas.
2.3 Specific heat at constant pressure, specific heat at constant volume for a gas. Derivation for an expression showing the relationship between the two specific heats and characteristic gas constant.
2.4 Simple problems on gas equation.

3.0 Thermodynamic processes on gases.

3.1 Types of thermodynamic processes, Isochoric, Isobaric, Isothermal, Hyperbolic, Isentropic, Polytrophic and Throttling processes. Equations representing the above processes.
3.2 Concept of Entropy.
3.3 Derivation for work done, change in internal energy and Entropy for the above processes.
3.4 Calculation of heat supplied or rejected during the above processes.
3.5 Simple problems on the above processes.

4.0 Fuels and Combustion.

4.1 Definition of fuel. Types – solid, liquid and gaseous fuels, examples and uses of different types of fuels.

4.2 Calorific values (Higher and lower) of fuels, Dulong's formula for calorific value. Calculation of calorific value of a fuel with given chemical composition.

4.3 Bomb calorimeter unit-description-procedure for determination of C.V. of solid or liquid fuel using Bomb calorimeters, calculation of C.V. with test data.

4.4 Junker's Gas calorimeter unit – description – determination of calorific value of gas using Junker's calorimeter.

4.5 Problems on C.V. determination with Junker's calorimeter test data.

4.6 Balance chemical equations for the combustion of carbon, Hydrogen, sulphur, Methane, Ethane etc.

4.7 Calculation of minimum air required for the complete combustion of unit mass/unit volume of fuel having a given composition. Conversion of volumetric analysis to gravimetric analysis, and vice-versa. Calculation of percentage composition (by weight and volume) of flue gases. Calculation of weight of flue gases obtained by combustion of fuel with and without excess air, simple problems.

4.8 Brief description of Orsat's Apparatus & use, procedure for determination of flue gas analysis, chemicals used for absorption of different gases in flue gases.

4.9 Brief description and working of a mechanical type of CO_2 recorder.

REFERENCE BOOKS

1.0 Engineering Thermodynamics by P. K. Nag TMH Publishers

2.0 Engineering Thermodynamics by C. P. Arora

3.0 Thermal Engineering by Mahesh M Rathore TMH Publishers

3.0 Thermal Engineering - R. S. Khurmi S.Chand & Company

STRENGTH OF MATERIALS

Subject Title : Strength of Materials
Subject Code : ME-305
Periods/Week : 05
Periods per Semester : 75

TIME SCHEDULE

S No.	Major Topics	No. of Periods	Weightage of Marks	Short answer Questions	Essay type Questions
1	Simple Stresses and Strains	16	21	02	1½
2	Strain energy	08	13	01	01
3	Shear Force and Bending moment	14	21	02	1½
4	Theory of Simple bending & Deflection of Beams	14	21	02	1½
5	Torsion in Shafts & Springs	15	21	02	1½
6	Thin Cylinders	08	13	01	01
	Total	**75**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the concept of Simple Stresses and Strains

1.1 Define the term strength,
1.2 Define the Mechanical properties of commonly used engineering materials.
1.3 Explain the nature and effect of tensile, compressive and shear forces.
1.4 Define the terms stress, strain, Poisson's ratio and elastic modulii
1.5 Draw the typical stress - strain curve for ductile and brittle materials under tension indicating salient points on it.
1.6 State the significance of Factor of Safety.
1.7 Write down the relation between elastic constants E, N, K, & 1/m.
1.8 Compute stress and strain values in bodies of uniform section and of composite section under the influence of normal forces.
1.9 Calculate thermal stresses, in bodies of uniform section and composite sections.
1.10 Compute changes in axial, lateral and volumetric dimensions of bodies of uniform sections under the action of normal forces.

2.0 Understand the concept of Strain Energy

2.1 Define resilience, proof – resilience and modulus of resilience.
2.2 Derive an expression for the strain energy.
2.3 Obtain expressions for instantaneous stress developed in bodies subjected to –
i) Gradually applied load,ii) Suddenly applied load, iii) Impact/shock load.
2.4 Compare of proof resilience in bodies subjected to the above loads.

3.0 Understand the concept of Shear Force and Bending Moment Diagrams

3.1 List the types of beams.
3.2 List the types of loading
3.3 Explain the terms shear force and bending moment.
3.4 Compute shear force and bending moment at any section of beam (for UDL and Point loads)
3.5 Practice the diagrams of S.F. & B.M for UDL and Point loads

4.0 Understand the concept of Theory of Simple Bending and Deflection of Beams

4.1 State the theory and terms of simple bending.
4.2 List the assumptions in theory of simple bending
4.3 Derive the bending equation $M / I = \sigma / y = E / R$
4.4 Calculate Bending stress, Modulus of section and Moment of resistance.
4.5 Calculate the safe load, safe span and dimensions of cross section.
4.6 Explain the term deflection
4.7 State the formulae for deflection in cantilever and simply supported beams
4.8 Calculate the values of deflection in the given beams.

5.0 Understand the concept of Torsion in Shafts and Springs

5.1 Function of Shaft
5.2 Explain Polar M.I. of solid and hollow shaft
5.3 List the assumptions in theory of Simple Torsion
5.4 Derive the torque equation $T / J = fs / R = G\theta / L$
5.5 Design solid and hollow shafts
5.6 Compare strength and weight of solid and hollow shafts of the same length and material
5.7 State the function of spring
5.8 List the types of springs
5.9 List all the applications of springs
5.10 Define the terms related to closed coil helical spring
5.11 State the formulae for the stress and deflection of closed coil helical spring
5.12 Compute the stress and deflection of the closed coil helical spring

6.0 Understand the concept of Thin Cylindrical Shells

6.1 Define cylindrical shell
6.1 Define longitudinal and hoop stress
6.2 Derive the expression for longitudinal and hoop stress for seamless and seam shells.
6.3 Design thin cylindrical shells.

COURSE CONTENT

1 Simple Stresses and Strains

1.1 Types of forces.
1.2 Stress, Strain and their nature.
1.3 Mechanical properties of common engineering materials.
1.4 Significance of various points on stress – strain diagram for M.S. and C.I. specimens
1.5 Significance of factor of safety
1.6 Relation between elastic constants.

1.7 Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces.
1.8 Thermal stresses in bodies of uniform section and composite sections.
1.9 Related numerical problems on the above topics

2 Strain Energy

2.1 Strain energy or resilience, proof resilience and modulus of resilience.
2.2 Derivation of strain energy for the following cases
i) Gradually applied load, ii) Suddenly applied load, iii) Impact/shock load.
2.3 Related numerical problems.

3 Shear Force & Bending Moment Diagrams

3.1 Types of beams with examples.
a) Cantilever beam, b) Simply supported beam, c) Over hanging beam,
d) Continuous beam, e) Fixed beam.
3.2 Types of Loads – Point load, UDL and UVL.
3.3 Definition and explanation of shear force and bending moment.
3.4 Calculation of shear force and bending moment and drawing the diagrams by the analytical method only for the following cases.
a) Cantilever with point loads, b)Cantilever with uniformly distributed load.
b) Simply supported beam with point loads.
c) Simply supported beam with uniformly distributed load.
d) Over –hanging beam with point loads, at the centre and at free ends.
e) Over – hanging beam with uniformly distributed load throughout.
f) Combination of point and UDL.for the above and problems there upon.

4 Theory of Simple Bending and Deflection of Beams

4.1 Explanation of terms
a) Neutral layer, b) Neutral Axis, c) Modulus of Section,
d) Moment of Resistance, e) Bending stress, f) Radius of curvature.
4.2 Assumptions in theory of simple bending.
4.3 Bending Equation $M / I = \sigma / Y = E / R$ with derivation.
4.4 Problems involving calculations of bending stress modulus of section and moment of resistance.
4.5 Calculation of safe loads and safe span and dimensions of cross- section.
4.6 Definition and explanation of deflection as applied to beams.
4.7 Deflection formulae without proof for cantilever and simply supported beams with point load and uniformly distributed load only (Standard cases only).
4.8 Related numerical problems.

5 Torsion in Shafts and Springs

5.1 Definition and function of shaft
5.2 Calculation of polar M.I. for solid and hollow shaft.
5.3 Assumptions in simple torsion
5.4 Derivation of formula $T / J = fs / R = G\theta / L$
5.5 Problems on design of shaft based on strength and rigidity
5.6 Numerical Problems related to comparison of strength and weight of solid and hollow shafts.
5.7 Explanation about spring
5.8 Classification of springs

5.9 Nomenclature of closed coil helical spring
5.10 Deflection formula for closed coil helical spring (without derivation)
5.11 Explanation about stiffness of spring
5.12 Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils

6 Thin Cylindrical Shells

6.1 Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell.
6.2 Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells.
6.2 Related numerical Problems for safe thickness and safe working pressure.

REFERENCE BOOKS:

1. Strength of Materials by B.C.Punmia
2. Strength of Materials by R.S. Khurmi S & Chand Company
3. Strength of Materials by Ramamrutham

PRODUCTION TECHNOLOGY - I

Subject Title : Production Technology - I
Subject Code : ME–306
Periods per Week : 04
Periods per Semester : 60

TIME SHEDULE

S.No	Major Topics	Number of Periods	Weightage of Marks	Short answer Questions	Essay type Questions
1	Lathe & Lathe Work	20	29	03	02
2	Shaper, Slotter, Planner	14	29	03	02
3	Broaching Machine	04	10	--	01
4	Cutting Fluids, Coolants and Lubricants	06	13	01	01
5	Welding	16	29	03	02
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall be able to

1. **Understand the construction details of Lathe & Lathe Work**
   - 1.1 State the working principle of lathe.
   - 1.2 Classify lathes.
   - 1.3 Draw the line diagram of engine lathe.
   - 1.4 List the parts of lathe.
   - 1.5 Describe the functions of each part in lathe.
   - 1.6 Indicate the specifications of a lathe.
   - 1.7 List the various operations performed on lathe including special operations.
   - 1.8 Explain methods of taper turning with line diagrams.
   - 1.9 Calculate the included angle for taper turning.
   - 1.10 List different work holding devices.
   - 1.11 Explain the Nomenclature of Lathe (single point) tool with the help of legible sketch
   - 1.12 Explain the Significance of various angles.
   - 1.13 List the various types of production lathes.
   - 1.14 Illustrate the working principle of turret lathe, Capstan, Automatic and Semi-automatic lathes & copying lathes.
   - 1.15 Distinguish between automatic and semi-automatic lathes.
   - 1.16 Explain the need of copying lathes.
   - 1.17 State the advantages and applications of production lathes.

2.0 Understand the construction details and working principle of Shaper, Slotter and Planer

2.1 Illustrate the working principles of shaper, slotter, and planer.
2.2 Illustrate the constructional details of the above machines.
2.3 Explain the functions of important parts of the above machines.
2.4 List the operations performed on these machines.
2.5 State the specifications of each machine.
2.6 Explain the principle of quick-return mechanism as applied to shaper/planer.
2.7 Describe the different methods of obtaining quick return motion.
2.8 Explain the principle of hydraulic drive with the help of a line diagram applied to shaper.

3.0 Understand the construction details and working principle of Broaching machine

3.1 Define Broaching.
3.2 Classify broaching machines.
3.3 Illustrate the working principles of broaching machines.
3.4 Illustrate the constructional details of the broaching machines.
3.5 State the advantages & limitations of broaching.

4.0 Understand the concept of Cutting Fluids, Coolants & Lubricants.

4.1 State the properties of cutting fluids and coolants.
4.2 Mention the types of fluids.
4.3 State the composition of cutting fluids and coolants.
4.4 List the relative merits of the cutting fluids and coolants.
4.5 Select the proper cutting fluids and coolants for various machining operations.
4.6 Classify the lubricants.
4.7 List all the properties of lubricants.

5.0 Understand the joining process of Welding.

5.1 State the necessity of welding.
5.2 Classify the welding processes.
5.3 State the advantages and limitations of welding.
5.4 Explain the principle of arc welding.
5.5 List the tools and equipment of arc welding.
5.6 Name the proper electrodes for given metals.
5.7 Explain the principle of gas welding.
5.8 List the tools and equipment of oxy-acetylene welding.
5.9 Explain different welding procedures in arc and gas welding.
5.10 Define the terms soldering & brazing.
5.11 Differentiate soldering from brazing.
5.12 Explain the principles of soldering & brazing.
5.13 Select correct soldering materials for a given job.
5.14 Explain soldering / brazing techniques.
5.15 List the gas cutting equipment.
5.16 State the principle of flame cutting.
5.17 State the relative advantages of flame cutting over other types of cutting.
5.18 List the various defects in welds.

5.19 List the reasons for the above.
5.20 Explain non-destructive testing of welds.
5.21 List various (special) modern welding techniques.
5.22 State the principle of at least four modern welding techniques.
5.23 Explain the principle of TIG and MIG welding.

COURSE CONTENT

1.0 Lathe and Lathe Work

1.1 Working Principle of Lathe
1.2 Types of Lathes - Engine lathe – construction details–specifications.
1.3 Nomenclature of single point cutting tool, geometry , tool signature, functions of tool angles.
1.4 General and special operations – (Turning, facing, taper turning thread cutting, knurling, forming, drilling, boring, reaming, key way cutting.)
1.5 Methods of taper turning – explanation
1.6 Lathe accessories viz., work holding devices and tool holding devices
1.7 Turret lathe: sketch – operation – advantages.
1.8 Capstan lathe: sketch – operation – advantages.
1.9 Comparison of engine (centre lathe) – turret – capstan lathe.
1.10 Semi automatic lathe – features.
1.11 Automatic lathe – features.
1.12 Copying lathe – applications.

2.0 Shaping, Slotting, and Planning

2.1 Introduction to shaper, slotter, planer.
2.2 Constructional details and specifications of shaper, slotter and planer.
2.3 Operations on these machines.
2.4 Tools and materials.
2.5 Driving mechanisms - quick return arrangement - crank & slotted lever mechanism, whit worth mechanism, hydraulic drive.

3.0 Broaching Machines

3.1 Introduction to broaching.
3.2 Types of broaching machines – horizontal type (single ram & duplex ram) vertical type, pull up, pull down, and push down.
3.3 Elements of broach tool, broach teeth details – nomenclature – types – tool material.

4.0 Cutting Fluids, Coolants & Lubricants

4.1 Introduction.
4.2 Types of cutting fluids.
4.3 Properties and functions of fluids and coolants.
4.4 Fluids and coolants required in turning, drilling, shaping, sawing & Broaching.
4.5 Selection of cutting fluids, methods of application of cutting fluid.
4.6 Classification of lubricants (solid, liquid, gaseous)
4.7 Properties and applications of lubricants.

5.0 Welding

5.1 Introduction.
5.2 Classification of welding processes.
5.3 Advantages and limitations of welding.
5.4 Principles of arc welding.
5.5 Arc welding equipment.
5.6 Choice of electrodes for different metals.
5.7 Principle of gas (oxy – acetylene) welding.
5.8 Equipment of gas welding.
5.9 Welding procedures (arc & gas)
5.10 Soldering and Brazing techniques.
5.11 Types and applications of solders & fluxes.
5.12 Various flame cutting processes.
5.13 Advantages and limitations of flame cutting.
5.14 Defects in welding.
5.15 Testing and inspection.
5.16 Modern welding methods, (Submerged, CO_2, Atomic – Hydrogen, ultrasonic welding),
5.17 Brief description of MIG & TIG Welding.

REFERENCE BOOKS

1.	Welding Technology	by	Little.
2.	Elements of Work Shop Technology vol. I & II	by	Hazra Choudry
3.	Engineering Metrology	by	Jain
4.	Welding Technology	by	Parmar
5.	Manufacturing Technology (volume-1)	by	P.N.Rao (MGH Pub)

MACHINE DRAWING PRACTICE

Subject Title : Machine Drawing Practice
Subject Code : ME-307
Periods/ Week : 07
Periods/Semester : 105

TIME SCHEDULE

S.No	Major Topics	Periods	Weightage of Marks	Short answer Questions	Essay type Questions
1	Introduction	12	-	-	-
2	Fastening Devices	21	10	02	-
3	Assembly Drawings	42	80	-	02
4	Piping Layouts and Joints	18	05	01	-
5	Welding Fabrication Drawings	12	05	01	-
	Total	**105**	**100**	**04**	**02**

Note:- Candidate has to answer all questions in part- A and one question out of two in part- B

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the importance of machine drawing

1.1. Explain the importance of Machine drawing.
1.2. Review of 1st angle and 3rd angle Projections
1.3. Review of Orthographic Projections and Sectional Views.

2.0 Practice the drawing of fastening devices

2.1. Draw the standard thread profiles.
2.2. Draw bolted connections to standard proportions.
2.3. Draw different types of screws.
2.4. Draw different types of rivets and riveted connections.
2.5. Draw different types of keys and cotters.

3.0 Understand the assembly drawing practice and procedure

3.1. List the sequence of steps for preparing assembly drawing.
3.2. Practice the assembly drawing for the given components drawing.
3.3. Prepare the list of parts.

4.0 Practice the construction piping layouts

4.1. State the distinction between pipes and tubes.
4.2. Identify the common components of a piping layout.
4.3. Identify the conventional symbols used for the various components of piping layout.
4.4. Prepare single line and double line diagrams of piping layouts.
4.5. Draw the assembly drawing and sectioned views of pipe joint.
4.6. Explain the use of packing material in joint.

5.0 Appreciate the welded fabrication drawing.

5.1. Identify the different types of welds and their symbolic representation as per B.I.S., SP-46-1988.
5.2. Identify the elements of welding symbol and their standard location on the symbol.
5.3. State welding process to be used, surface contour and finish of weld when given in symbolic form.
5.4. Practice the Preparation of working drawing of welded fabrications.

Key competencies to be achieved by the student

Topic	Key competency
Introduction	• Understand the difference between I & III angle projections • Appraise the importance of sectional views in Mechanical Engineering
Fastening devices	• Differentiate the temporary and permanent joints and their applications • Draw the bolts, screws, nuts, rivets, keys and cotters with standard proportions
Assembly drawing	• Read the external and internal features of each part • Prepare the table of parts giving part number, its name, material and quantity
Piping layouts	• Acquaint with the symbols used for the various components of piping layout • Understand the importance and use of all the valves and packing material used in pipe fittings
Welded fabrication drawing	• Specify the weld joint • Prepare the working drawing of welded fabrications.

COURSE CONTENT

1.0 Introduction

1.1. Importance of Machine Drawing.
1.2. Brief revision of 1st and 3rd angle projections
1.3. Understand the concepts of Orthographic projections and Sectional views.

2.0 Fastening Devices

2.1. Temporary and Permanent fastenings and their areas of application-thread nomenclature, forms of screw thread profiles, metric, B.A., Acme, Knuckle, etc.
2.2. Bolts and Nuts: Specification of bolts and nuts, Different types of bolted joints (like using through bolts, studs, screws etc.,) in different applications. Purpose of lock nuts and their Types.
2.3. Keys and cotters: Types of keys and cotters: Difference between key and cotter uses.
2.4. Rivets and Riveted joints: Types and proportions and specification of rivets: Different types of riveted joints: Lap, butt-single row, double row etc., chain and zigzag riveting – calculation of diameter of rivet: Pitch and arrangement of rivets in row – use – of standard proportions.

Drawing Plate: 1

1. Exercise on Orthographic projections and Sectional views.
2. Thread Nomenclature and forms of screw thread profiles.
3. Exercises in drawing – bolted connections using standard proportions.
4. Drawing of various types of lock nuts & types of keys indicating their proportionate dimensions.
5. Exercise in drawing riveted joints using standard proportions: Single row, double row (chain and zigzag) in lap and butt joints (single & double strap).

3.0 Assembly Drawings

3.1. Need and functions of assembly and detailed drawings.
3.2. Steps in preparing assembly drawings.
3.3. Bill of materials and parts list.
3.4. Exercises in preparing assembly drawings of commonly available engineering components.

Drawing Plate: 2

Draw the views / sectional views of

1. Jib and cotter joint assembly
2. Knuckle joint assembly
3. Assembly of muffs coupling (sold & split) coupling
4. Screw jack assembly,
5. Stuffing box.
6. Bearings.

NOTE: **With the knowledge gained by the above exercises the students shall be able to draw exercises on Socket and spigot joint, protective type flanged coupling, piston of petrol engine, cross head, connecting rod, eccentric, flexible coupling, universal coupling, sleeve and cotter joint, Oldham's-coupling, lathe tool post, big end of a connecting rod, foot step bearing, Plummer block, lathe tail stock.**

4.0 Piping layouts

4.1. Classification of pipes and tubes.
4.2. Components of pipes lay-out.
4.3. Screw fitting bend, elbow, tee, lateral Cross-nipple, reducing socket and plug.
4.4. Unions: Screwed ground and flanged.
4.5. Valves: Gate valve: angle valve, check valve.
4.6. Various conventional symbol used for the above components.

Drawing Plate: 3

1. Single line diagram of pipe layout two exercises.
2. Double line diagram of pipe layout one exercise.
3. Cast iron flanged pipe joint, spigot and socket joint, hydraulic pipe joint, expansion joint, screwed joint, union joint - draw half sectional elevation and end view.

5.0 Welded fabrication drawings

5.1. Different types of weld and their basic symbols including sectional representation as per table of I.S. standards, fillet, square butt, single V-Butt, double V-Butt, single bevel butt, double bevel butt, stud, bead (edge or seal) spot, seam.
5.2. Elements of welding symbol and their standard location the symbol as per IS standards reference Kode arrow head, weld symbol supplementary symbol dimensions of welds, method of welding process, special reference.

5.3. Significance of arrow & position of arrow head significance of reference line as per I.S. standards with reference to fillet, V-Butt an stud welds.
5.4. Supplementary symbols and special instructions: surface of reference line; as per I.S. standards with reference to fillet, V-Butt an stud welds.
5.5. Dimensions of welds: length, location and spacing of welds as per I.S., B.I.S., standards with showing dimensions required on a welding.
5.6. Need of special reference

Drawing Plate: 4

1. Drawing tables and figs. Referred in the contents above taking form I.S. standards.
2. Dimensioning a given welding drawings as per I.S., SP-46-1988.
3. Preparing working drawing of welding fabrication from given data.

REFERENCE BOOKS

1. T.S.M & S.S.M in respect of Technical Drawing by TTTI, Madras
2. Machine Drawing by A.C. Parkinson.
3. Machine Drawing by Jones & Jones.
4. Machine Drawing by N.D. Bhat.
5. A text book for Technical Schools Engg. Drawing by N.C.E.R.T
6. Machine Drawing by R.B. Gupta.
7. Indian Standard Scheme of symbol for Welding by SP-46-1988.
8. Machine Drawing by Bhattacharyya (Oxford Publishers).
9. Machine Drawing by Ajeeth Singh (MGH Publishers)
10. Machine Drawing by N.Siddeswar, Kannaih, Sastri. (MGH Publishers)

FUELS LABORATORY PRACTICE

Subject Title : Fuels Lab Practice
Subject Code : ME – 308
Total No. of Periods : 03
Total Periods Per Semester : 45

TIME SCHEDULE

S. No.	Major Title	Periods
1.	Flash & Fire point tests	09
2.	Viscosity measurement	12
3.	Calorific value tests	12
4.	Carbon residue test	06
5.	Calibration of pressure gauge	06
	Total	**45**

OBJECTIVES
Up on Completion of the course the student shall be able to:

1.0 Understand the determination of flash and fire point of a given sample of fuel using given apparatus(Abels, Cleveland & Penesky martin)

2.0 Understand the determination of Viscosity of a given sample of oil using given apparatus

3.0 Understand the determination of Calorific value of a given sample of fuel using given apparatus

4.0 Understand the determination of amount of carbon residue of a given sample of petroleum product
.

5.0 Understand the need and importance of calibration of pressure gauges.

Competencies and KEY competencies to be achieved by the student

Title of the experiment (No.of periods)	Competencies	Key competency
1. Flash and Fire point tests		
a) Abel's Apparatus (3)	1. Handle the apparatus • Filling water • Fixing thermometer 2. Manipulate the apparatus • Checking heating element • Connecting regulator 3. Perform the precise operations • Observation of flame colour • Recording temperature 4. Explain the need and scope of the Experiment in industry	• Observe the flame for change in colour and type of flame • Record the temperature of fuel using thermometer
b) Cleveland Apparatus (3)	1. Handle the apparatus • Filling water • Fixing thermometer 2. Manipulate the apparatus • Checking heating element • Connecting regulator 3. Perform the precise operations • Observation of flame colour • Recording temperature	• Observe the flame for change in colour and type of flame • Record the temperature of fuel using thermometer
c) Penesky martin Apparatus (3)	1. Handle the apparatus • Filling water • Fixing thermometer 2. Manipulate the apparatus • Checking heating element • Connecting regulator 3. Perform the precise operations • Observation of flame colour • Recording temperature	• Observe the flame for change in colour and type of flame • Record the temperature of fuel using thermometer

Title of the experiment (No.of periods)	Competencies	Key competency
2. Viscosity measurement		
a) Redwood viscometer (6)	1. Handle the apparatus • Filling water • Fixing thermometer • Handle hydrometer 2. Manipulate the apparatus • Checking heating element • Connecting regulator • Checking hydrometer functioning 3. Perform the precise operations • Use Hydrometer to measure the density of given oil • Record the temperature of oil using thermometer • 3. Record the time to collect 50 ml of oil • Draw the graph between the temperature and viscosities	• Use Hydrometer to measure the density of given oil • Record the temperature of oil using thermometer • Record the time to collect 50 ml of oil
b) Saybolt viscometer(6)	1. Handle the apparatus • Filling water • Fixing thermometer • Handle hydrometer 2. Manipulate the apparatus • Checking heating element • Connecting regulator • Checking hydrometer functioning 3. Perform the precise operations • Use Hydrometer to measure the density of given oil • Record the temperature of oil using thermometer • 3. Record the time to collect 50 ml of oil 4. Draw the graph between the temperature and viscosities	• Handle the Hydrometer to measure the density of given oil • Record the temperature of oil using thermometer • Record the time to collect 50 ml of oil

Title of the experiment (No.of periods)	Competencies	Key competency
3. Calorific value tests		
a) Bomb calorimeter (6)	1. Handle the apparatus • Checking oxygen cylinder regulator & Water flow into equipment 2. Perform precise operations • Weigh the water collected & condensed steam • Record the inlet &outlet temperature of water • Record mass of fuel burnt • Determine the Calorific values of solid, liquid and gaseous fuels	• Weigh the water collected and condensed steam • Record the inlet &outlet temperature of water • Record mass of fuel burnt
b) Junkers gas calorimeter(6)	1. Handle the apparatus • Checking oxygen cylinder regulator & Water flow into equipment 2. Perform precise operations • Weigh the water collected & condensed steam • Record the inlet &outlet temperature of water • Record volume of gas burnt • Determine the Calorific values of solid, liquid and gaseous fuels	• Weigh the water collected and condensed steam • Record the inlet &outlet temperature of water • Record volume of gas burnt

Title of the experiment (No.of periods)	Competencies	Key competency
4. Carbon residue test (6)	1. Handle the apparatus • Checking heating element • Pouring of fuel oil sample • Placing of crucible in equipment 2. Perform precise operations • Weighing the porcelain crucible with and without oil • Measure the weight of carbon residue • Assess the percentage carbon residue	• Weigh the porcelain crucible with and without oil • Measure the weight of carbon residue
5. Calibration of pressure gauge (6)	1. Handle the apparatus • Checking oil leakage • Pouring sufficient oil 2. Perform precise operations • Operate screw pump to generate system pressure • Observe and record the pressure due to mass load • Record the gauge pressure	• Operate screw pump to generate system pressure • Observe and record the pressure due to mass load • Record the gauge pressure

COURSE CONTENT

1. Determination of flash and fire points of various fuels and lubricants using Abel's, Pensky Martin's, and Cleveland's apparatus.
2. Determination of Kinematics and Absolute viscosities of the fuel and lubricating Oils using Redwood & Saybolt viscometers.
3. Determination of Calorific values of Solid and liquid fuels using Bomb calorimeter. and Determination of Calorific value of gaseous fuel by using Junker's calorimeter.
4 Determination of Carbon residue using Conradson's apparatus.
5. Calibration of a pressure gauge using dead weight pressure gauge tester

ELECTRICAL ENGINEERING LABORATORY PRACTICE

Subject Title : Electrical Engineering Lab Practice
Subject Code : ME-309
Periods/Week : 03
Periods/Year : 45

TIME SCHEDULE

S. No.	Major Topics	No. of Periods(3 periods per Session)
1	Network Laws & Theorems	12
2	Calibration of meters	06
3	Measurement of Power	06
4	Speed control of DC Motor	06
5	Brake test on 3-phase squirrel cage induction motor	03
6	Identification of components	06
7	Earthing and Safety	06
	TOTAL	45

OBJECTIVES

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

I Verify Network Laws & Theorems

II Calibrate the different meters

III Measure Power in DC and AC circuit

IV PerformSpeed control of DC Shunt Motor by

V Conduct Brake test on 3-phase squirrel cage induction motor.

VI Identify the various components

VII Demonstrate Earthing and Safety

Safety Precautions
General Safety Precautions to be observed by the student for all Electrical laboratory Practices

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 and key competencies to be achieved by the student

Title of the experiment (No.of periods)	Competencies	Key competency
1. Network Laws & Theorems		
a)Verify Ohm's Law (3)	•	•
b)Verify the limitations of Ohm's law (3)	•	•
c)Verify Kirchoff's current Law (3)	•	•
d)Verify Kirchoff's Voltage law (3)	•	•

Title of the experiment (No.of periods)	Competencies	Key competency
2. Calibrate the different meters		
a) Calibrate Dynamometer type of wattmeter (3)	•	•
b) Calibrate single phase Energy meter (3)	•	•
3. Measure Power in DC and AC circuit		
a) Measure power across a Resistor using voltmeter and ammeter when connected across a DC supply (3)	•	•
b) Measure power and Power factor in 1 - Ø inductive circuit by using Wattmeter, Volt meter and Ammeter when connected across an AC supply (3)	•	•

Title of the experiment (No.of periods)	Competencies	Key competency
4. PerformSpeed control of DC Shunt Motor by		
a) Rheostatic control method (3)		
b) Field control method (3)		
5. Conduct Brake test on 3-phase squirrel cage induction motor.		
a) Conduct brake test on 3-phase squirrel cage induction motor (3)		

Title of the experiment (No.of periods)	Competencies	Key competency
6.Identification of components		
a) Identify resistors based on their colour code. b) Identify capacitors based on their colour code. c) Identify diodes with their rating d) Identify Zener diode. e) Identify the type of transistor (NPN or PNP) and their terminals (C,E,G). (6)		
7. Earthing and Safety (6)		
a) Demonstrate Pipe Earthing b)Demonstrate Plate Earthing c) Demonstrate Procedure of first aid on Electric shock.		

COURSE CONTENT

(I) Network Laws & Theorems
Ohm's Law - limitations of Ohm's law-. Verification of Ohms Law - Kirchoff's current Law- Kirchoff's Voltage law -Super position theorem-Thevenins theorem

(II) Calibration of meters
Dynamometer type of wattmeter-Single phase Energy meter

(III) Measurement of Power
Across a Resistor in DC circuit- Across an Inductive circuit in an AC circuit.

(IV) PerformSpeed control of DC Shunt Motor by
Rheostatic control method - Field control method

(V) Brake test on 3-phase squirrel cage induction motor.
Conduct Brake test on 3-phase squirrel cage induction motor.

(VI) Identify the various components
Identify the various components- Resistors,Capacitors,Diode, Zener Diode,Transistor.

(VII) Earthing and Safety.
Demonstrate Pipe Earthing-Plate Earthing-First aid.

MANUFACTURING AND FABRICATION ENGINEERING LAB PRACTICE-I

Subject Title : Manufacturing and Fabrication Engg.Lab Practice-I
Subject Code : ME – 310
Periods per Week : 03
Periods per Semester : 45

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

1.0 Practice the casting principles and operations in foundry
- 1.1 Write the sand moulding procedures in foundry.
- 1.2 Prepare a mould sand mix.
- 1.3 Identify various tools used in foundry shop.
- 1.4 Prepare mould in two boxes, three boxes.
- 1.5 Prepare a mould ready for casting with proper provision for runners, risers and gates
- 1.6 Place the cope over the drag without any mismatch
- 1.7 Prepare the molten metal and calculate the amount of metal to be poured in the mould

2.0 Practice the operation of Lathe
- 2.1 Perform a plain turning operation on a lathe machine.
- 2.2 Select proper tool to perform the job.
- 2.3 Centre the job by dial gauge
- 2.4 Select the suitable speed for different operations
- 2.5 Use various measuring instruments for taking dimensions.
- 2.6 Perform step turning operation on lathe.
- 2.7 Calculate the taper angle.
- 2.8 Practice different taper turning methods on lathe
- 2.9 Turn the required tapers by swivelling the compound rest.
- 2.10 Produce articles of industrial application such as ring gauges, plug gauges, handle etc.

3.0 Practice the joining of metals in Arc Welding
- 3.1 Prepare the edges for welding
- 3.2 Select the suitable electrode, voltage and current
- 3.3 Handle the Electrode Holder for laying welding beads.
- 3.4 Operate the welding transformer and generator.
- 3.5 Perform various weld joint operations.

KEY competencies to be achieved by the student.

Title of the experiment	Key competency
Moulding and Casting of solid bearing	– Select the suitable sand and mix it for the mould – Cut gates and runners – Pour sufficient quantity of molten metal
Moulding and Casting of flange coupling	– Prepare and place the core – Cutt the gates and runners – Pour the sufficient quantity of molten metal
Moulding and Casting of split bearing	– Prepare and place the core – Cutt the gates and runners – Pour the sufficient quantity of molten metal
Moulding and Casting of connecting rod	– Prepare and place the core – Cutt the gates and runners – Pour the sufficient quantity of molten metal
Moulding and Casting of V-pulley	– Cut gates and runners – Pour sufficient quantity of molten metal
Moulding and Casting of Gear pulley	– Cut gates and runners - Pour sufficient quantity of molten metal
Plain turning	- Check the centering of the work piece using dial gauge - Fix the cutting tool at proper inclination - Select the suitable speed, feed and depth of cut for rough and finishing operations - Check the dimensions
Step turning	• Check the centering of the work piece using dial gauge • Fix the cutting tool at proper inclination • Select the suitable speed, feed and depth of cut for rough and finishing operations • Check the dimensions
Taper turning	• Check the centering of the work piece using dial gauge • Fix the cutting tool at proper inclination • Select the suitable speed, feed and depth of cut for rough and finishing operations • Check the dimensions • Rotate the compound rest to the suitable angle

Title of the experiment	Key competency
Collar turning	• Check the centring of the work piece using dial gauge • Fix the cutting tool at proper inclination to turn the work piece • Select the suitable speed, feed and depth of cut for rough and finishing operations • Check the dimensions
Knurling	• Check the centring of the work piece using dial gauge • Fix the cutting tool at proper inclination to turn the work piece • Select the suitable speed, feed and depth of cut for rough and finishing operations • Check the dimensions • Fix the knurling tool and selecting the suitable speed and feed
Welding Layout of beads	• Perform Edge preparation • Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Check the bead
Lap joint	• Perform Edge preparation • Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Check the bead
Butt joint	• Perform Edge preparation • Hold the electrode at suitable angle and distance with respect to the work piece to maintain the arc • Check the bead

COURSE CONTENT

1 Foundry

Moulding and casting of

1.1 Solid bearing
1.2 Flange coupling
1.3 Split bearing
1.4 Connecting rod
1.5 V – Pulley
1.6 Gear pulley

2 Machine Shop (Turning)

2.1 Plain Turning
2.2 Step Turning
2.3 Taper Turning
2.4 Turning Collars
2.5 Knurling
2.6 Facing

3. Welding

3.1 Layout of Beads
3.2 Butt joints.
3.3 Lap joints.

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
IV Semester

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:								
ME - 401	Mathematics - III	4		60	3			100
ME - 402	Design of Machine Elements-I	4		60	3			100
ME - 403	Industrial Engineering	4		60	3			100
ME - 404	Heat Power Engineering-I	5		75	3			100
ME - 405	Fluid Mechanics & Hydraulic Machinery	5		75	3			100
ME - 406	Production Technology -I	4	-	60	3			100
PRACTICAL:								
ME - 407	Production Drawing Practice	-	7	105	3			100
ME - 408	Communication Skills Practice	-	3	45	3			100
ME - 409	Material Testing Lab Practice	-	3	45	3			100
ME - 410	Manufacturing & Fabrication Engg. Lab Practice -II	-	3	45	3			100
	TOTAL	26	16	630				1000

ENGINEERING MATHEMATICS – III
(Common to all Branches)

Subject Title : Engineering Mathematics-III
Subject Code : ME-401
Periods per week : 04
Periods per Semester : 60

Blue Print

S. No	Major Topic	No of Periods	Weightage of Marks	Short Type			Essay Type		
	Unit -I Differential Equations			**R**	**U**	**App**	**R**	**U**	**App**
1	Homogenous Linear Differential equations with constant coefficients	05	06	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
App: **Application type** 33 marks

OBJECTIVES

Upon completion of the course 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 n^{th} 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

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 $t^n f(t),\ \frac{f(t)}{t},\ f^{(n)}(t),\ \int_0^t f(u)\,du$ 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

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

5.0 Understand the basic concepts of Probability

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 (2^{nd} 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

DESIGN OF MACHINE ELEMENTS- I

Subject Title : Design of Machine Elements - I
Subject Code : ME – 402
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1.	Introduction, Principal stresses & Theories of failure	12	21	02	1 1/2
2.	Bolted Joints	12	21	02	1 1/2
3.	Riveted Joints and Welded Joints	11	23	01	02
4.	Shafts, Keys and Couplings	15	29	03	02
5.	Bearings	10	16	02	01
Total		**60**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall able to

1.0 Understand the concept of mechanical engineering design

1.1 Explain the basic requirements of design.
1.2 Explain the phases of design process
1.3 List the factors governing design.
1.4 Use relevant Indian Standard Codes
1.5 Derive the expressions for normal and shear stresses on any plane subjected to combined loading
1.6 Derive the expressions for principal stresses
1.7 Solve the simple numerical problems
1.8 Explain the importance of principal stresses in machine design
1.9 Explain the importance of theories of elastic failure in machine design
1.10 Write the statements and equations of theories of elastic failure (05) without derivation

2.0 Understand the design of Bolted Joints and power screws

2.1 Explain screw thread nomenclature and specifications of screw threads
2.2 List the different threaded fasteners with legible sketch
2.3 Explain power screw mechanism with legible sketch
2.4 Derive an expression for the torque required to raise and lower a load in a power screw
2.5 Derive an expression for the efficiency and self locking of power screw
2.6 Explain the strength of screwed fasteners
2.7 List the stresses in bolts
2.8 Design the size of bolt for a given load requirement.
2.9 Design the size of eye bolt for a given load requirement
2.10 Draw an eye bolt (not to scale) showing the proportions
2.11 Solve numerical problems related to the above cases

3.0 Understand the design of Riveted Joints and Welded Joints

3.1 List the basic types of riveted joints with legible sketch
3.2 Explain the terms used in riveted joints
3.3 List the types of failures in riveted joints
3.4 Evaluate the strength of a riveted joint
3.5 Design a riveted joint under the given conditions (E.g.Direct loading)
3.6 Explain the concept of Diamond or Lozenge joint
3.7 Design the diamond (structural) joint
3.8 List the types of welded joints
3.9 List the welded symbols with legible sketch
3.10 Explain the terms related to welded joints
3.11 List the merits and demerits of welded joints
3.12 Explain the lap and butt joints with legible sketch
3.13 Design the welded joints subjected to simple loading
3.14 Solve the numerical problems related to the above cases

4.0 Understand the design of Shafts, Keys and Couplings

4.1 Define the terms shaft and axle
4.2 State the functions of shaft
4.3 List the types of shafts
4.4 Distinguish between the shaft and axle
4.5 List the standard sizes of shafts as per I.S
4.6 Write the formula for power transmitted by the shaft
4.7 Design the shaft subjected to only torsion
4.8 Design the shaft subjected to only bending load(Design of axle)
4.9 Design the shaft subjected to bending and torsion based on Rankine and Guest theories
4.10 Design the shaft against the rigidity
4.11 Compare the strength and rigidity of solid and hollow shafts
4.12 Explain the function of keys and splines.
4.13 Name the recommended materials used for keys and splines.
4.14 Design the keys based on different modes of failure and also based on empirical relations
4.15 Write all the proportions of a spline for a given application referring tables.
4.16 Write the specifications of parallel, gib-head and taper sunk keys as per B.I.S.
4.17 Explain the function of a coupling
4.18 Classify the couplings
4.19 Design the muff coupling for a shaft of given size using empirical relations.
4.20 Design the cast iron flange-coupling (rigid type) for a given torque
4.21 Draw the above couplings according to the standard specifications

5. Understand the design of Bearings

5.1 State the function of bearing
5.2 Classify the bearings
5.3 List the types of lubrication
5.4 Explain the construction and working principle of journal bearing
5.5 Explain the nomenclature of roller bearing
5.6 List the types of roller bearings
5.7 List the types of thrust bearings
5.8 List the Advantages and disadvantages of sliding contact bearings
5.9 List all the differences between sliding contact and roller bearings
5.10 Explain about the bearing material
5.11 Define the terms- Rating life, Bearing load, Basic load rating and equivalent radial load
5.12 Select a bearing for given loads using tables

5.13 List all the advantages and disadvantages of anti-friction bearings
5.14 Derive the expressions for the load and torque carried by thrust and collar bearings under uniform pressure and wear conditions
5.15 Design a simple journal bearing using McKee's equation
5.16 Calculate heat generated and dissipated in journal bearing
5.17 Calculate heat generated and dissipated in collar bearing based on uniform pressure and uniform wear conditions
5.18 Specify a bearing
5.19 Solve the numerical problems

COURSE CONTENT

1. Introduction

Design philosophy, Derivation of normal and shear stresses an an inclined plane, Derivation of principal stresses and their importance. Theories of elastic failure- Definition and their mathematical statement.

Factors governing the design of machine element - nature of load, working stress, mechanical properties of the material of the product, process of manufacture, reliability, durability, Cost, life of product and safety.

Design procedure: General sequence of steps in designing a machine element.

Need of standard data for design purpose, use of machine design data, hand books and other data manuals.

2. Bolted Joints

Revision of nomenclature, form of threads – specifications.

Strength of screwed fasteners and failure of bolts due to different reasons

Types of screw fasteners, Self - locking and efficiency of screw

Stresses due to initial tightening and stresses due to external forces

Stress due to combination of forces – Stresses due to shear loads application

Design of Nut – Hexagonal and square shapes only.

Design of eye bolt for a given load and sketching - using empirical proportions, Applications of eye-bolt and Numerical problems

3. Riveted joints and Welded Joints

Types of Riveted joints; Caulking and Fullering;

Types of failures; Terms related to joints, Modes of failure of riveted joint

Strength equations; Efficiency of joints; Simple problems on lap joints and butt joints;

Concept of Diamond or Lozenge joint: Simple problems.

Types of Welded joints; Advantages and disadvantages over other joints;

Terms related to weld; strength equation;

Calculation of strength of welded joints (problems on eccentric loading are omitted)

Numerical problems.

4. Shafts, Keys and Couplings

shafts

Function of shafts and materials used for shafts

Standard sizes of shafts as per I.S, Types of shafts.

Design of diameters for solid and hollow shafts to transmit a given power at given rpm.,

a) based on strength
b) based on rigidity.

Comparison of solid and hallow shafts

Design of axle.

Numerical problems

keys

Function of keys and splines, Specification of splines.
Materials of keys and splines.
Discussion over nature of failure of key-effect of key way and the shaft strength.
Design of a rectangular sunk key considering its failure against shear and crushing – given the power transmitted by the shaft and rpm.
Design of rectangular sunk key using empirical proportions for given diameter of the shaft. Check for strength.
Proportions of a spline for a given application using tables.

Couplings : Function of coupling & types of couplings.
Calculation of proportions of a muff coupling (solid) for a given shaft size using empirical formulae, sketching the same from the computed dimensions.
Rigid flange coupling : Calculation of dimensions for a C.I. flange coupling and coupling bolts for a given torque using empirical proportions – Sketching the flange coupling with the computed dimensions.
Numerical problems and sketching.

5. Bearings

Functions, Types of bearings
Journal bearing – terminology, McKee's Equation, Bearing Modulus
Friction in journal bearing, Friction circle, power lost in friction at a bearing
Thrust bearing- Power lost in friction, flat pivot and flat collar under conditions of uniform intensity of pressure and wear
Rolling contact bearings – advantages and disadvantages
Components of rolling contact bearing, Rating life of roller bearing, Static load carrying capacity, Dynamic load carrying capacity, Equivalent radial load-Life relationship(No derivations), Foot step and collar bearings
Market or commercial specifications of ball and roller bearings as per BIS standards

REFERENCES

1. Design of Machine Elements - Abdulla Shariff.
2. Machine Design - R.S.Khurmi.
3. Design of Machine Elements - Pandya and Shah.
4. Theory of machines- Thomas Bevan.
5. Machine Design – R.K. Jain
6. Design of Machine Elements – V B Bhandari (MGH Publishers)

INDUSTRIAL ENGINEERING

Subject Title : Industrial Engineering.
Subject Code : ME-403
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1.	**Work Study**				
	A. Method Study	12	26	02	02
	B. Work Measurement	12	21	02	11/2
2.	Job Evaluation & Merit Rating	10	16	02	01
3.	Wage & Incentive Systems	10	21	02	11/2
4.	Inspection and S.Q.C.	16	26	02	02
Total		60	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 A. Understand the principle of work study

1.1 Apply method study to a given situation.
1.2 State the steps involved in method study.
1.3 Identify the elements of chart used in method study.
1.4 Assemble the elements with symbols to form the required chart.
1.5 State the question in their order to analyse the operational sequence.
1.6 Analyse the question to form the best sequence.
1.7 Conclude the best sequence
1.8 Draw modified chart.

B. Understand the work measurement techniques

1.9 State the purpose of work Measurement.
1.10 Describe the time – study Equipment.
1.11 Describe the sequence of making Time – study.
1.12 State the rules for elemental Break down
1.13 State the procedure of recording the Time.
1.14 Explain the need for rating factor.
1.15 Compute normal time.
1.16 Explain the importance of Allowances.
1.17 Compute the standard time for an operation using observed time.
1.18 State the advantages of PMTS (Predetermined Motion Time Standards).
1.19 Compute standard time using PMTS data.
1.20 State the purpose of work – sampling.
1.21 State the advantages of work – sampling.
1.22 Describe the method of conducting work – sampling.
1.23 Draw conclusion from work sampling.

2.0 Understand the job evaluation & merit rating

2.1 Define job evaluation
2.2 State the purpose and procedure of job evaluation
2.3 Explain the job analysis, job description and jobs specification
2.4 Explain the methods of job evolution
  a) Ranking Method
  b) Classification Method
  c) Factor comparison Method
  d) Point Rating method
2.5 State the advantages and disadvantages of above methods
2.6 Define the merit rating
2.7 State the purpose of merit rating
2.8 Explain the methods of merit rating
  a) Rating Scale method
  b) Check list method
  c) Employee comparison method
2.9 State the advantages and disadvantages of merit rating.

3.0 Understand the wage systems existing in industry.

3.1 State the types of wages.
3.2 Define the terms base wage, production bonus.
3.3 State the different incentives.
3.4 Outline the standard wage plans such as Halsey, Rowan, Emerson, Taylor's differential piece rate system
3.5 State the incentives for supervisor and executives.
3.6 Solve problems in calculating wages under different wage plans.

4.0 Understand inspection procedures & the quality control functions.

4.1 Distinguish between the terms quality of design and quality of manufacturing.
4.2 Discuss quality – cost relationship.
4.3 Discuss quality variation parameters.
4.4 Explain inspection procedures.
4.5 State the different inspection methods.
4.6 Identify the difference between different methods of inspection.
4.7 State the advantages and limitations of the methods.
4.8 Define statistical terms.
4.9 State the meaning of above terms.
4.10 State the characteristics of normal distribution.
4.11 Apply normal distribution and use of its characteristics to construct control charts.
4.12 Construct control charts for variables and attributes.
4.13 Interpret control chart for "process in control" or "process out of control".
4.14 Decide the use of proper chart in given situation.
4.15 Apply the principles of "Random Sampling''.
4.16 Identify the situation where Random Sampling is useful.
4.17 Compute the probability of acceptance for a given product.
4.18 Draw O.C. curve for single sampling plans.
4.19 Interpret required values for O.C. Curves.

COURSE CONTENT

Contribution of work study to productivity

1.0 Method Study.

Meaning and purpose.Process chart symbols- types.Operation process chart; method of Constructing. Flow process chart, its elements and Relational ship. Flow diagrams.

Other tools for method analysis.Analysing the charts and methods by questioning processes.Decisions for improving the Methods.Purpose, basic procedures.

Time study equipment – stop watch, study board, time study forms. Making time study, checking the methods, break down of the job – recording – selection of elements – measurement of time.

Time study – rating – average rating – normal performances, factors affecting performances, rating scales, rating factor.

Allowance to be considered in determining standard time – determination of standard time. Predetermined motion time standard, Standard data, uses of the standard data.

Work sampling; work sampling procedure – Purpose – collection of data – determination of the results.

2.0 Job Evaluation & Merit Rating

Job evaluation – definition, objectives and procedure, job analysis Job description and Job specification.

Methods of Job Evaluation – Ranking, classification, factors comparison and point rating methods.Merit rating – definition and objectives, Methods of merit rating – rating scale, check list and employee comparison methods, advantages and disadvantages of merit rating

3.0 Wage Systems.

Wages – definition, types – wage differentials – reasons, Methods of wage payments, Types of incentives, standard wage plans – Halsey, Weir, Emersons, Rowan's Gantt's task and Bonus systems, - Taylor's piece rate system, Merric's piece rate system – Numerical problems on the above plans, Incentives to the supervisor and executives.

4.0 Inspection and Statistical quality control - Inspection

Introduction – meaning of the term quality, quality of design, quality conformance & quality assurance- quality & cost relationship, reliability, Inspection – definition-objectives of inspection - methods of inspection – floor or patrolling inspection & centralised inspection – merits, demerits-kinds of inspection – trial run inspection-first piece inspection - pilot piece inspection - operation inspection - sample inspection, notional inspection -final inspection - working inspection. Review of statistical terms-Quality control-measurable & non-measurable, Variation in manufacture-assignable causes - chance causes-inspection, causes-variables-attributes-tally sheet frequency table histogram- frequency polygon-Normal curve-properties of normal curve.

Control chart for variables

Average and grand average – their significance determination of upper and lower control limits of X and R using statistical tables, construction of X and R charts for a group of samples. Analysis of control charts – process out of control, and in control' Thumb rules for analysis – shifts, runs, trends, erratic fluctuations.

Control chart for attributes – fraction defective - percent defective - P,NP, 100P charts – significance – characteristics of X and R charts – calculation of P from data –

control limits -process 'in control ' and 'out of control' – differences between P,NP and 100P charts.
Sampling procedure lot,Meaning of the term- lot - lot quality, lot size, sample size and acceptance number – lot sampling.
Probability of acceptance - producer's risk - consumers' risk LTPD, AOQ and AOQL.

Single sampling plan - Parameters that affect the lot size and sample size and acceptance number – effect of sample size and acceptance number on Probability of acceptance (Pa) - 'OC' curves of a single sampling plan – calculation of Pa - Double sampling plan - Variables involved in double sampling plan – Calculation of Pa.
A B C standard. Problems using tables.

REFERENCE BOOKS

1. Work study – by Ralph Banes.
2. Work study – by I.L.O.
4. Industrial Engineering & - Management Science - by T.R.Banga
5. S.Q.C – by Grant & Levenworth
6. S.Q.C -by Juran
7. S.Q.C -by Gupta

HEAT POWER ENGINEERING-I

Subject Title : Heat Power Engineering-I
Subject Code : ME-404
Periods/Week : 05
Periods per Semester : 75

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Air Standard Cycles	18	21	02	01½
2	Construction and working of IC Engines	08	16	02	01
3	Systems of IC Engines	16	26	02	02
4	Performance of IC Engines	06	10	-	01
5	Air Compressors	17	21	02	01 ½
6	Gas Turbines & Jet Propulsion	10	16	02	01
	Total	75	110	10	08

OBJECTIVES

Up on the completion of the course the student shall be able to

1.0 Appreciate the study of air standard cycles.

1.1 Define the term 'Air Standard cycle'
1.2 Define the term 'Reversible Cycle'.
1.3 Explain with a line diagram the Working of carnot cycle.
1.4 State the assumptions made in Carnot cycle.
1.5 Derive the formula for the air standard efficiency of a Carnot cycle.
1.6 Solve simple problems on Carnot Cycle.
1.7 Explain the working of Otto Cycle with help of a line diagram.
1.8 State the assumptions made in Otto Cycle.
1.9 Derive the formula for air standard Efficiency of Otto Cycle.
1.10 Solve simple problems on Otto Cycle.
1.11 Explain the working of a Diesel cycle with line diagrams.
1.12 State assumptions made in Diesel Cycle.
1.13 Derive the formula for Air Standard Efficiency of Diesel Cycle.
1.14 Solve the simple problems on Diesel Cycles.
1.15 State the reasons for Carnot cycle being highly efficient than any other cycle working between the same temperature limits.

2.0 Understand the construction and working of internal combustion engines.

2.1 Define "Heat Engine".
2.2 Classify heat engines.
2.3 Give examples for each type.
2.4 Summarise the advantages of internal combustion engines over external combustion engines.
2.5 Classify Internal Combustion Engines
2.6 Draw the legible sketch of an I.C. engines and name the various parts.
2.7 Explain with line diagram the working of a four-stroke diesel engine.
2.8 Explain with a line diagram the working of a two-stroke diesel engine.
2.9 Explain with a legible sketch the working of a four-stroke petrol engine.

2.10 Explain with a legible sketch the working of a two-stroke petrol engine.
2.11 Compare two stroke engines with four stroke engines.
2.12 Compare diesel engines with petrol engines.
2.13 Draw the valve time diagrams for two-stroke petrol and diesel engines also for four-stroke petrol and diesel engines.

3.0 Understand the systems of internal combustion engines.

3.1 Name the various elements of the fuel systems of diesel engine.
3.2 Explain with legible sketch the working of the elements of fuel system of diesel engine.
3.3 Name the various elements of the fuel system of a petrol engine.
3.4 Explain the functions of the elements of the fuel system in a petrol engine.
3.5 Explain with a line diagram the working of a simple carburettor.
3.6 Explain with a line diagram the working of a zenith carburettor.
3.7 State the methods of cooling in I.C. engine cylinders.
3.8 Explain with a legible sketch air – cooling in I.C. engine.
3.9 Explain with line sketch the working of water cooling system with thermo syphon method of circulation.
3.10 Explain with legible sketch the working of water – cooling system with a radiator and forced circulation.
3.11 Compare air cooling system with water – cooling system.
3.12 Name the ignition systems used in petrol engines.
3.13 Explain with line sketch the working of a battery – coil ignition system.
3.14 Explain with legible sketch the working of a magneto ignition system.
3.15 Compare the battery ignition system with magneto ignition system.
3.16 Name the different methods of lubricating systems in I.C. engines.
3.17 Explain with legible sketch the methods of lubricating systems in I.C. engines.
3.18 Name the different methods of governing I.C. engines.
3.19 Explain the hit and miss method governing of I.C. engines.
3.20 Explain the quality method of governing of I.C engines.
3.21 Explain with line sketch the quantity method of governing of petrol engines.
3.22 Explain the concept of super charging of I.C. engines.
3.23 List the objectives of super charging in I.C. engines.

4.0 Understand the performance of internal combustion engines.

4.1 Write the formula for brake power.
4.2 Write the formula for indicated powder.
4.3 Write the formula for Mechanical Efficiency.
4.4 Write the formula for Thermal Efficiency.
4.5 Write the formula for Relative Efficiency.
4.6 Explain the Heat balance sheet
4.7 Solve simple problems on the performance of I.C. engines using brake test data.

5.0 Comprehend the construction and working of air compressor.

5.1 State the functions of air compressors.
5.2 Enumerate the uses of compressed air.
5.3 Name the different types of compressors.
5.4 Explain with line diagram the working of a single reciprocating air compressor.
5.5 Write the formula for work done and power required by a single stage compressor.
5.6 Solve simple problems on single acting reciprocating air compressors.
5.7 State the advantages of multi- stage compressors over single stage compressor.
5.8 Explain the use of inter cooler.

5.9 State the conditions for minimum work done in two stage compression.
5.10 Write the formula for work done and power required in two stage compressor.
5.11 Solve simple problems in two stage air compressor.
5.12 Name the types of rotary compressors.
5.13 Explain with line diagram the working of a centrifugal compressor.
5.14 Explain with line diagram the working of an axial flow type compressor.
5.15 Explain with line sketch the working of a vane type compressor.

6.0 Understand the working and applications of gas turbines & Jet Propulsion.

6.1 Give broad classification of gas turbines.
6.2 Compare Gas turbines with Steam turbines.
6.3 Compare gas turbines with reciprocating I.C. engines.
6.4 Mention the applications with limitations of gas turbine.
6.5 Explain with line diagrams the working of an open cycle constant pressure type gas turbine.
6.6 Explain with line diagram the working of a closed cycle type gas turbine.
6.7 Represent cycle of operation for the above type on P-V and T-s diagrams.
6.8 Explain with line diagram the principles of operation of Ramjet engine and turbo- jet engines.
6.9 State the application of jet engine.
6.10 Explain with line sketches the working of rocket engine.
6.11 Identify the fuels used in jet propulsion.

COURSE CONTENT

1.0 Air standard cycles.

1.1 Meaning of air standard cycle-its use-Reversible and irreversible process – reversible and irreversible cycles conditions for reversibility of a cycle.
1.2 Brief description of Carnot cycle with P.V. and T-S diagrams, Assumption made – Efficiency - Problems on Carnot cycle.
1.3 Brief explanation of Otto cycle with P.V. and T-S diagrams, assumptions made – Efficiency - Simple problems on Otto cycle.
1.4 Brief description of Diesel cycle with P.V. and T-S diagrams, Assumption made – Efficiency - Simple problems on Diesel cycle.
1.5 Reasons for the highest efficiency of Carnot cycle over other cycles working between same temperature limits.

2.0 The construction and working principle of Internal Combustion Engines.

2.1 Heat engines – Internal combustion engines and external combustion engines advantages of I.C. engines over external combustion engines classification of I.C. engines, neat sketch of I.C. engine indicating component parts, state the function of each part and materials used for the component parts – Cylinder, crank case, crank pin, crank, crank shaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve.
2.2 Brief explanation on the principle of working of four-stroke diesel engine and two-stroke diesel engine.
2.3 Brief explanation on the principle of working of four stroke and two stroke petrol engines.
2.4 Comparison of two stroke engines and four stroke engines. Comparison of diesel engine and petrol engine.
2.5 Draw the valve time diagrams for two stroke and four stroke engines.

3.0 The systems of Internal Combustion Engines.

3.1 Descriptive treatment, with sketches of a diesel fuel system, fuel tanks, fuel filter, fuel pump and fuel injector.

3.2 Descriptive treatment of petrol engine fuel system functions of tank, fuel filter, fuel pump and carburettor, principles of working of a Zenith Carburettor (Line sketch) and its advantages over simple carburettor.

3.3 Cooling system I.C. engines, air cooling, water cooling system with thermo siphon method of circulation and water cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water cooling system.

3.4 Ignition systems – Battery coil ignition and magneto ignition (description and working). Comparison of two systems.

3.5 Types of lubricating systems used in I.C. engines descriptive treatment only with line diagram.

3.6 Types of governing of I.C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing their applications. Objective of super charging.

4.0 The Performance of Internal Combustion Engines.

4.1 Formulae for B.P.,F.P., I.P., mechanical efficiency, indicated thermal efficiency, air standard efficiency, relative efficiency, Morse test,Heat balance sheet, simple problems on performance of I.C. engines.

5.0 Air Compressors.

5.1 Functions of air compressor – uses of compressed air – types of air compressors.

5.2 Single stage reciprocating air compressor its construction and working (with line diagram) using P.V. diagram Formulae for work done and power required- simple problems on calculation of work done and power required.

5.3 Multi stage compressors – advantages over single stage compressors. Use of air cooler – conditions for minimum work in two stage compressor (without proof) Formulae for work done and power required in two stage compressors – simple problems.

5.4 Rotary compressors – types – descriptive treatment of Centrifugal compressor, axial – f low type compressor and vane-type compressors.

6.0 Gas Turbines & Jet Propulsion

6.1 Gas turbines – Classification – open cycle gas turbines and closed cycle gas turbines – comparison of gas turbine with reciprocating I.C. engines and steam turbines. Applications and limitations of gas turbines.

6.2 Open cycle constant pressure gas turbine – general lay-out. P.V. and T.S diagram and working of gas turbine.

6.3 Closed cycle gas turbine – cycle of P.V. and T.S diagrams – working of gas turbine.

6.4 Principle of operation of Ram – jet engine and turbojet engines – application of jet engines.

6.5 Rocket engine – its principle of working & application.

6.6 Fuels used in jet – propulsion.

REFERENCE BOOKS

1. Thermal Engineering by R.S.Khurmi.
2. Thermal Engineering by Mahesh M Rathore (MGH Publishers)
2. Thermal Engineering by Mathur & Mehtha
3. Fundamentals of I.C.Engines by Heywood
4. Thermal Engineering by P.L.ballaney

FLUID MECHANICS & HYDRAULIC MACHINERY

Subject Title : Fluid Mechanics & Hydraulic Machinery
Subject Code : ME-405
Periods/Week : 05
Periods per Semester : 75

TIME SCHEDULE

S.No	Major Topics	Number of Periods	Weightage of Marks	Short answer Questions	Essay Type Questions
1	Fluid Properties &Hydrostatics	10	16	02	01
2	Flow of Liquids	10	16	02	01
3	Flow through pipes	10	16	02	01
4	Impact of jets	15	18	01	1 ½
5	Hydraulic Turbines	15	21	02	1 ½
6	Hydraulic Pumps	15	23	01	02
	Total	75	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to

Understand the importance of Fluid mechanics, its application in the present day industry and will be in a position to understand the working of Hydraulic Machines.

PART – A – Fluid Mechanics

1.0 Understand the Fluid properties and Hydrostatics

1.1 Define the fluid
1.2 Classify the fluids
1.3 Distinguish between compressible (gases) and incompressible (liquids) fluids
1.4 Distinguish between ideal and real fluids
1.5 State the various units used in fluid mechanics
1.6 Define various properties of fluids and state their units
1.7 Define intensity of pressure
1.8 State units for pressure
1.9 State the Pascal's law
1.10 Differentiate between gauge, absolute and vacuum pressure
1.11 Derive the expression for hydrostatic pressure gradient
1.12 Explain the concept of buoyancy
1.13 Explain the working principle of various instruments used for determining the pressure of fluids
1.14 Solve the problems on pressure measurement by different manometers

2.0 Understand the behaviour of liquids in motion

2.1 Classify the fluid flows
2.2 Distinguish between laminar flow and turbulent flow
2.3 Explain the concept on Reynolds number.
2.4 Explain three laws of conservation
2.5 Explain the various types of energies and the total energy.
2.6 Explain the velocity of a flowing liquid
2.7 Write the discharge equation and equation of continuity of flow.

2.8 State Bernoulli's equation and its application in hydraulics
2.9 Explain the working principle of venturimeter, pitot tube, water and current meters
2.10 Define Co-efficient of Velocity (Cv), Co-efficient of Contraction (Cc), Co-efficient of discharge (Cd).
2.11 Solve problems (simple) on law of continuity, Bernoulli's equation, Venturimeter and Pitot tube.

3.0 Comprehend flow of liquids through pipes

3.1 List various losses when liquid flows through pipes
3.2 State laws of fluid friction
3.3 Write the equations for loss of head due to friction in pipes - Darcy's and chezy's formulae
3.4 List various minor losses in pipe flow
3.5 Explain the hydraulic gradient and total energy lines for different pipes
3.6 Explain the pipes in series(compound pipe) and equivalent pipe
3.7 Calculate the velocity of flow, discharge and diameter of pipes connecting two reservoirs
3.8 Explain the function of siphon and give reason for limiting the height of the pipes
3.9 Explain how the power can be transmitted through pipes carrying liquid under pressure
3.10 Write the condition for maximum power through pipes
3.11 Solve simple problems on power transmission through pipes

4.0 Analyse forces due to the impact of jets

4.1 Derive expression for force of jet on fixed vertical, flat plate, fixed inclined flat plate, and moving flat plate
4.2 Derive expression for the force of jet on a series of plates fixed on the rim of a wheel
4.3 Draw velocity triangles for fixed and moving curved blades
4.4 Derive the expressions for work done, power and efficiency in the above
4.5 Solve simple problems related to the above

B. Hydraulic machines

5.0 Understand the working of hydraulic (water) Turbines

5.1 State the importance of water turbines
5.2 Draw the layout of a hydroelectric power station
5.3 Classify the water turbines on different criteria
5.4 Explain the construction details and working of Pelton wheel
5.5 Explain the construction details and working of Francis turbine
5.6 Explain the construction details and working of Kaplan turbine
5.7 Explain the draft tube theory
5.8 Explain the governing of water turbines with a legible sketch
5.9 Write the formulae for work done and efficiency of pelton wheel turbine
5.10 Write the formulae for work done and efficiency of francis turbine
5.11 Solve simple problems on water turbines

6.0 Understand the working of hydraulic pumps

6.1 Explain the function of hydraulic pump
6.2 Classify the hydraulic pumps
6.3 Explain the principle of operation of reciprocating pumps
6.4 Describe the constructional details of single acting pump with the legible sketch
6.5 Describe the constructional details of double acting pump with the legible sketch

6.6 Explain the slip in the reciprocating pump
6.7 State the effect of velocity and acceleration of fluids in suction and delivery pipes
6.8 Explain the principle of air vessel with respect to reciprocating pump
6.9 Solve simple problems on power required to drive reciprocating pump
6.10 Explain the principle of operation of centrifugal pumps with a legible sketch
6.11 Explain the constructional details of centrifugal pump
6.12 Compare the centrifugal pump with a reciprocating pump
6.13 Explain the working of multi-stage pumps with a legible sketch
6.14 Appreciate the importance of priming in centrifugal pump
6.15 Identify the effects of leakages of air, its prevention
6.16 Explain the phenomenon of cavitation and state its effect
6.17 Write the expressions for static and manometric head of centrifugal pump
6.18 Write the formula for work done by the impeller of centrifugal pump
6.19 Explain the various losses and efficiencies of a centrifugal pump
6.20 Solve simple problems on centrifugal pumps
6.21 Draw the layout of a centrifugal pump installation
6.22 Explain the working of Jet pump with a legible sketch
6.23 Explain the working of submersible pump with a legible sketch

COURSE CONTENT

PART – A – Fluid Mechanics

1.0 Properties of fluids

1.1 Definition of fluid, Ideal and Real fluids, Newtonian and Non-Newtonian fluids, compressible and incompressible fluids
1.2 Units used in Fluid Mechanics.
1.3 Fluid properties-Density, specific weight, specific gravity, viscosity and surface tension, compressibility and capillarity.
1.4 Intensity of pressure, Pascal's law, Atmospheric,Vacuum,Gauge and absolute pressures.
1.5 Measurement of pressures by piezo-meter, , U-Tube - manometer, differential manometer bourdon pressure gauge
1.6 The concept of buoyancy
1.7 Simple problems on pressure measurement

2.0 Flow of Liquids

2.1 Types of fluid flow- Steady and unsteady flow, Uniform and Non-uniform flow, Two &Three dimensional flow, Rotational & irrotational flow, Laminar & Turbulent flow
2.2 The concept of Reynold's Number.
2.3 Pressure, potential and kinetic energy of liquids, total energy
2.4 Continuity equation for one-dimensional flow
2.5 Solving of simple problems
2.6 Laws of conservation- Mass, Energy and Momentum
2.7 Velocity of liquids and discharge
2.8 Bernoulli's equation and assumptions its practical applications
2.9 Applications of Bernoulli's equation - Venturimeters, pitot-tube, current meters
2.10 Problems on Bernoulli's Equation, Venturimeter and pitot tube.
2.11 Definition of Cv,Cc, and Cd

3.0 Flow through pipes

3.1 Various losses when liquid flows through pipes, Laws of fluid friction
3.2 The equations for loss of head in pipes due to friction- Darcy's & Chezy's formula (without proof)
3.3 Minor losses in pipe flow
3.4 Hydraulic gradient and total energy line for different pipes
3.5 Pipes in series(Compound pipe) and equivalent pipe
3.6 Calculation of discharge, velocity, diameter of pipe etc., for pipes connecting two reservoirs (considering frictional losses only)
3.7 The function of Siphon, study of pressure head variations at its different sections, minimum pressure at apex and its influence in causing separation (Numerical problems omitted)
3.8 Expressions for power transmitted through pipes carrying liquid under pressure
3.9 Expressions of transmission efficeny, condition for maximum efficiency (without proof.)
3.10 Simple problems on power transmission through pipes

4.0 Impact of jets

4.1 Derivation of formulae for the force of jet on
a) Fixed vertical flat plate
b) Fixed inclined flat plate
c) Moving flat plates – vertical and inclined
d) Series of flat plates fixed on the rim of a wheel

4.2 Force of jet striking at the centre and at the top of a fixed curved blade and moving curved blade, velocity triangles
4.3 Work done, power and efficiency in the above cases. Simple problems only

PART – B – Hydraulic Machines

5.0 Water turbines

5.1 Introduction to hydraulic machines- water turbines, pumps
5.2 Use of water turbines in Hydra-electric power stations; line sketch showing layout of hydro-electric power plant with head race, dam, sluice gate, pen stock, turbine, generator and tail race.
5.3 Classification of turbines-impulse and reaction turbines brief sub-classification as axial, radial and tangential flow type
5.4 Working principle of Pelton wheel, Francis turbine and Kaplan turbine with simple line sketches only.
5.5 Draft tube and Governing of Water turbines
5.6 Work done and Efficiencies of Pelton wheel and Francis turbine(Without derivation)
5.7 Simple Problems on power & efficiency of water turbines

6.0 Pumps

6.1 Function of a pump
6.2 Classification of pumps
6.3 Principle of operation of a reciprocating pump
6.4 Constructional details of single acting, double acting pumps.
6.5 Effect of velocity and acceleration of fluids, in suction and delivery pipes (without proof)
6.6 Expression for theoretical power required to drive the pump (without proof). Simple problems related to above

6.7 Coefficient of discharge, slip, % of slip and negative slip
6.8 Air vessel
6.9 Working principle & Constructional details of centrifugal pump
6.10 Installation of centrifugal pump, showing its mountings and other accessories
6.11 Comparison between Reciprocating and Centrifugal pumps
6.12 Priming of centrifugal pump and its necessary leakages of air its prevention
6.13 Work done by the impeller, Static head, Manometric head
6.14 Efficiencies- Manometric efficiency, Volumetric efficiency, Mechanical efficiency and Overall efficiency
6.15 Cavitation and its effect.
6.16 Simple problems on work, power and efficiency
6.17 Working principle of Jet & Submersible pumps with line diagrams.

REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines by Sukumar Pati, Tata McGraw Hill publication.
2. Hydraulic Machines By S.Anantha Swamy
3. Hydraulic Machines By R.C. Patel
4. Hydraulics By Malhotra & Malhotra
6. Hydraulics & Hydraulic Machinery By Yeaple
8. Hydraulics and Pneumatics By Reya and Rao.

PRODUCTION TECHNOLOGY - I

Subject Title : Production Technology-I
Subject Code : ME – 406
Periods Per Week : 04
Periods Per Semester : 60

TIME SCHEDULE

S.No	Major Topics	Number of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Milling	20	39	03	03
2	Gear Making	10	16	02	01
3	Grinding and finishing processes	16	34	03	02½
4	Metrology	14	21	02	01½
	Total	60	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to understand

1.0 Understand the concept of Milling

1.1 Explain the principle of working of a Milling machine.
1.2 Classify the milling machines.
1.3 Illustrate the constructional details of milling machine
1.4 Explain the functions of each part of the milling machine.
1.5 Explain the various milling operations.
1.6 List the different milling cutters.
1.7 Explain selection of tool and work holding devices.
1.8 Explain the different indexing methods.
1.9 Explain the specifications of milling machines.

2.0 Understand the concept of Gear Making

2.1 List the different methods of producing gears.
2.2 Illustrate gear shaping.
2.3 Draw the gear hob and label its components
2.5 Describe the working of the above m/c.
2.6 List the sequence of operations in generating gear by gear hobbing m/c.
2.7 Explain the different methods of finishing & checking gear teeth dimensions.
2.8 Specify the gear.
2.9 List the various gear materials.
2.10 State the different heat treatment processes applied to gears.

3.0 Understand the concept of Grinding and finishing Processes

3.1 Explain the principle of metal removal by grinding.
3.2 List the different abrasives.
3.3 Explain the bonds and binding processes in grinding wheel manufacturing
3.4 Identify the grinding wheel from the standard code (Marking system or designation of wheel).

3.5 State the factors for selecting the grinding wheels.
3.6 State the methods of grinding.
3.7 Classify the grinding machines.
3.8 Illustrate the cylindrical, surface, tool and cutter grinders.
3.9 List the different work holding devices.
3.10 State the methods of wheel maintenance.
3.11 State different finishing processes by grinding.(Honing, Lapping, Super finishing)
3.12 Explain the principle of electro–plating with a legible sketch.
3.13 Explain the principle of hot dipping processes namely galvanising, tin coating, Parkerizing and anodising.
3.14 List the various organic coatings.
3.15 Describe the processes of various organic coatings
3.16 State the principles of metal spraying.
3.17 State the features of wire process and powder process.
3.18 Select the appropriate process for surface roughness of a given application

4.0 Understand the concept of Metrology

4.1 Identify various linear and angular measuring instruments.
4.2 Explain the principle of working of (at least 4 types) comparators with a legible sketch.
4.3 Predict the amount of measuring accuracy using the comparator.
4.4 Identify the in-accuracies in surface finish.
4.5 Suggest the surface finish measuring instrument.
4.6 State the use of collimator and microscope.
4.7 State the principle of working of interferometer.

COURSE CONTENT

1.0 Milling

1.1 Introduction.
1.2 Types of milling machines: plain, Universal, vertical, constructional details – specifications.
1.3 Milling operations
1.4 Indexing: simple, compound and differential indexing.
1.5 Milling cutters – types – nomenclature of teeth – teeth materials
1.6 Tool signature of milling cutter.
1.7 Tool & work holding devices.

2.0 Gear Making

2.1 Manufacture of gears – by casting, moulding – stamping - coining extruding- rolling – Machining.
2.2 Gear generating methods: Gear Shaping with pinion cutter & rack cutter
2.3 Gear hobbing – Description of gear hob – Operation of gear hobbing machine.
2.4 Gear finishing processes.
2.5 Gear materials and specification.
2.6 Heat treatment processes applied to gears.

3.0 Grinding and finishing processes

3.1 Introduction – principles of Metal Removal by Grinding.
3.2 Abrasives – Natural & Artificial.
3.3 Bonds and binding processes: Vitrified, silicate, shellac, rubber, bakellite.
3.4 Factors effecting the selection of grind wheels – size and shape of wheel – kind of abrasive – grain size – grade and strength of bond – structure of grain – spacing – kinds of bind material.
3.5 Standard marking systems: Meaning of letters & numbers sequence of marking – Grades of letters.
3.6 Grinding machines – classification: Cylindrical, Surface, Tool & Cutter grinding machine- construction details – relative merits.
3.7 Principle of centreless grinding
3.8 Advantages & limitations of centreless grinding
3.9 Work- holding devices.
3.10 Wheel maintenance – Balancing of wheels – Dressing and trimming of grind wheels: Coolants used.
3.11 Finishing by grinding: Honing, Lapping, Super finishing
3.12 Electroplating – Basic principles – Plating metals – applications.
3.13 Hot dipping: Galvanizing, Tin coating, parkerising, Anodizing.
3.14 Metal spraying: wire process, powder process and applications.
3.15 Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubber base coating.
3.16 Finishing specifications.

4.0 Metrology.

4.1 Linear measurement: Slip gauges and dial indicators.
4.2 Angle measurements: Bevel protractor, Sine Bar, Angle Slip Gauges.
4.3 Comparators :a) Mechanical b) Electrical c) Optical d) pneumatic
4.4 Measurement of surface roughness: methods of measurements by comparison, tracer instruments and by interferometry.
4.5 Collimators.
4.6 Measuring Microscope. Interferometer.

REFERENCE BOOKS

1. Manufacturing Technology - P N Rao (MGH Publishers)
2. Production Technology - R.C.Patel
3. Production Technology - Jain & Gupta.
4. Gear Technology - Charrathi
5. A Text Book of Production Engg. - Dora
6. Tool Design - Donaldson

PRODUCTION DRAWING PRACTICE

Subject Title : Production Drawing Practice
Subject Code : ME-407
Period/Week : 07
Period per Semester : 105

TIME SCHEDULE

S.No	Major Topics	Number of Periods	Weightage of Marks	Short Answer Questions	Esaay Type Questions
1	Drawing of a Component	12	05	01	-
2	Limits, Fits & Tolerances	14	05	01	-
3	Surface finish	14	-	-	-
4	Specification of materials	14	05	01	-
5	Process sheet & Exercises in Production Drawing	45	80	-	02*
6	Reprographic process	06	05	01	-
	Total	105	100	04	02

***NOTE :**
1. Candidate has to answer all questions in part- A and one question from Part- B out of two.
2. Part B question carries 40 marks and distributed for views, process Sheet, selection of materials, surface finish, limits, fits and tolerances

OBJECTIVES

Up on the completion of the course the student shall be able to

1.0 Understand the need of production drawing.
- 1.1 Distinguish the machine drawing from a production drawing.
- 1.2 State the factors that govern the preparation of a production drawing.
- 1.3 Identify the components of a production drawing.
- 1.4 List the function of the component.
- 1.5 Prepare the relevant views of the part and dimension the part.
- 1.6 Indicate the details of specific processes like, heat treatment, welding, counter boring etc.

2.0 Interpret dimension to obtain a fit as per BIS standards.
- 2.1 State definition of fit, allowance and tolerance.
- 2.2 Select dimension from standards to give different type of fit for a given mating parts.
- 2.3 Compute the fit from tables.
- 2.4 Indicate fits on the drawings**.**

3.0 Identify the standard symbol and indication added to it, to represent surface finish.
- 3.1 Indicate the roughness grade number and corresponding symbol as per BIS.
- 3.2 Indicate surface roughness on drawings.

4.0 Interpret and estimate the material requirement.

4.1 Identify the material of various components.
4.2 Specify the raw material as per commercial/BIS Standards.
4.3 Identify the standard part that can be procured directly from the market and specify the part as per commercial/BIS Standards for procurement.

5.0 Write the process sheet of production and prepare the number of production drawings.

5.1 Indicate the sequence of process of production.
5.2 Specify the relevant tools to obtain the accuracy and finish.
5.3 Indicate the suitable equipment.
5.4 Specify the type of measuring instruments to be used to check the prescribed accuracy.
5.5 Prepare exercises on production drawing as mentioned in the contents.

6.0 Practice the method of preparing blue print and ammonia prints.

6.1 Understand the preparation of blue and ammonia prints from tracing.
6.2 List the advantages and disadvantages of the above prints.
6.3 Identify the other methods of reproducing drawing.

Key Competencies to be achieved by the student

Topic	Key competency
Drawing of a Component	• Understand the difference between machine drawing and production drawing. • Identify the components in Assembly Drawing • Appraise the importance of symbols.
Limits, Fits & Tolerances	• Use of fits, allowances and tolerances. • Identify tolerance grades and zones. • Distinguish types of fits, limits • Select suitable fit for mating parts
Surface finish	• Identify the surface texture , symbols and grading as per BIS • Indicate surface roughness symbols on drawings
Specification of materials	• Identify of different material of the each component drawing.
Process sheet & Exercises in Production Drawing	• Interpret the production processes and the sequences. • Specify the relevant tools to obtain required accuracy and finish • Indicate equipment and measuring instruments to produce and check the accuracy of the component.
Reprographic process	• Operate the Xerox machine, Ammonia printing machine and microfilming machine

COURSE CONTENT

1.0 Introduction and Drawing of component.

Need of preparing a production drawing, requirements for manufacturing a product like equipment, tools, measuring instruments depending upon processes, accuracy

and finish data available in machine drawing – components of a production drawing, fits and tolerances, surface finish, specific processes, material of the component.
Read a given assembly drawing – study of the functions of the various parts of the assembly drawing.
Preparation of detailed drawing of a specified part of the assembly.

2.0 Limits, fits and tolerances.

Definitions of limits, fits and tolerances.
Select dimensions from BIS standards to obtain clearance, transition and interference fits for a given set to mating parts – computation of fit and tolerance from BIS table.
Preparation of drawing of mating parts and representation of fits and tolerances.
Exercises in computing tolerance and representation on the drawings for different types of fits.

3.0 Surface finish.

Standard symbol of surface finish and indications added to it.
Representation of quality of surface finish on the drawing as BIS roughness grade numbers.

4.0 Specifications of materials.

Materials of the parts of the assembly – size of part, estimation of raw material required for a component and specification.
Standard components (parts) like bolts, nuts, bearings etc. – specification of standard parts.

5.0 Process sheets and Production drawing exercises.

Sequence of processes of production for a particular product.
Specifications of relevant equipment and tools to obtain the desired accuracy and surface finish. Selection of measuring instruments to check the accuracy.
Prepare the relevant views of the part(s) of a given assembly drawing needed for the purpose of production.
Dimension the views obtained in 7.1, and indicate on it with relevant notes the specific processes. Compute the fit from ISI tables as per the function of the component and indicate the limits at appropriate place on the drawing prepared.
Mark the surface finish symbols with indications added.
Prepare the process sheet indicating sequence of processes and equipment, tools, measuring instruments required.

6.0 Reprographic processes.

Brief description, sequence of operations to prepare Ammonia prints, Advantages and limitations.
Other reproduction processes of drawings like Xerox, Microfilming etc.

NOTE: In order to develop the abilities required in the preparation of production drawing in the student, the use of actual production drawing from the local industries as exercises to the students is of vital importance.

Exercises

Flange Coupling, Universal Coupling, Eccentric, Clapper Block, Connecting rod
Drill jig, Lathe tail stock, Revolving Centre, Knuckle Joint, Plummer Block
Lathe Tool post, Non Return valve, Foot Step bearing, and Stuffing box

REFERENCE BOOKS

1. IS 696 – 1972-Code of Practice for General Engg. Drawing & B.I.S Code – SP . 46.
   IS 696 – 1988- IS Code on fits and tolerances.
2. Blur print reading for Mechanical Trades by B.R.Sachdeva.
3. Machine drawing by R.B. Gupta.
4. Machine Drawing by Siddeswar.
5. Production Drawing by K.Venkat Reddy
6. Machine Drawing by Nagpal

COMMUNICATION SKILLS LAB PRACTICE
(Common to all branches)

Subject title : Communication skills practice
Subject code : ME - 408
Periods per week : 03
Periods per semester : 45

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

Rationale and Scope

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.

PBJECTIVES

Upon completion of the course the students shall be able to

- Strengthen their listening skills
- Strengthen their speaking skills

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.

MATERIAL TESTING LABORATORY PRACTICE

Subject Title : Material Testing Lab Practice
Subject Code : ME-409
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE

S.NO	EXPERIMENT TITLE	NO.OF PERIODS
1	Tensile test	06
2	Compression test	06
3	Impact test	06
4	Hardness test	09
5	Torsion test on springs	09
6	Study of micro structure of Metals and alloys	09
	TOTAL	45

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

1.0 Understand the various material testing methods.

1.1 Define the various properties of materials such as: yield stress, Ultimate stress, percentage elongation, Young's Modulus.
1.2 Conduct experiments on concrete cube, cast iron, timber to test for its compressive strength.
1.3 Practice the method of determining the Young's modulus of materials by the principle of deflection.
1.4 Determine the modulus of rigidity by the method of deflection of helical springs.
1.5 Appreciate the importance of various mechanical properties such as hardness, impact strength.
1.6 Perform tests to determine the above.
1.7 Practice the method of preparing a specimen for the metallography.
1.8 Interpret the microstructure of specified ferrous and non ferrous materials.
1.9 Handle the metallurgical microscope to study the microstructures.

Key competencies to be achieved by the student

Exercise	Key competencies expected	Max. Marks	Marks awarded
1. Tensile test	A. Fix specimen in the jaws of the machine B. Fit strain gauge to the specimen C. Apply load gradually on the specimen D. Record load, elongation, diameter without error E. Plot graph stress vs strain F. Locate points of elastic limit, yield stress, ultimate stress on the graph	A. 1 B. 2 C. 1 D. 2 E. 2 F. 2 Total: 10	

Exercise	Key competencies expected	Max. Marks	Marks awarded
2. Compression test	A. Place the specimen in the machine properly B. Apply load on the specimen C. Record load	A. 2 B. 1 C. 2 Total : 5	
3. Impact test	A. Prepare specimen by making V notch at the required height B. Fix specimen on the machine C. Release load to hit the specimen precautious D. Record load	A. 2 B. 1 C. 1 D. 1 Total 5	
4. Hardness test	A. Place the specimen on the machine at correct location B. Identify suitable indenter for the specimen C. Make indent on the specimen properly D. Measure diameter of indentation E. Calculate hardness number	A. 1 B. 1 C. 2 D. 3 E. 3 Total 10	
5. Torsion test of springs	A. Measure spring diameter and spring wire diameter with vernier callipers B. Measure deflection applying load C. Calculate modulus of rigidity of spring material	A. 4 B. 2 C. 4 Total 10	
6. Study of micro structure of Metals and alloys	A. Prepare specimen B. Handling microscope to observe micro structure C. Plot microstructure	A. 5 B. 2 C. 3 Total 10	

COURSE CONTENT

1. Determination of yield stress, ultimate stress, percentage reduction in area, percentage elongation, Young's modulus by conducting tension test on Universal testing machine.
2. Determination of crushing strength of concrete cube, cast iron, glass, tiles, timber etc., using UTM/CTM
3. Determination of Young's Modulus by the method of deflection.
4. Determination of Modulus of rigidity of spring steel by the deflection of springs.
5. Determination of impact strength of the material using Izod and Charpy's tests.
6. Determination of hardness of meterial using Brinnel and Rockwell Testing methods.
7. Specimen preparation for the metallography.
8. Study of microstructures of Mild steel, pure iron, Grey cast iron, S.G. Iron, Eutectoid steel, Stainless steel, Aluminum, Brass, Bronze.

MANUFACTURING&FABRICATION ENGINEERING LAB-II PRACTICE

Subject Title : Manufacturing/Fabrication Engg. Lab Practice II
Subject Code : ME-410
Periods/Week : 03
Periods per Semester : 45

TIME SCHEDULE

S.NO	EXPERIMENT TITLE	NO.OF PERIODS
1	Hands on practice on Lathe	18
2	Hands on practice in welding	12
3	Hands on practice in foundry processes	15
	TOTAL	45

OBJECTIVES

Up on the completion of the course the student shall able to

1.0 Practice the operations on the Lathe.

1.1 Calculate the gear ratio for thread cutting.
1.2 Cut threads on a lathe machine.
1.3 Produce articles of industrial application such as snap gauges, plug gauges, handle etc.
1.4 Perform the combination of operations to produce jobs.
1.5 Perform special turning operations to produce machine handle, eccentric turning, male and female fit assembly

2.0 Practice the joining operations in Welding.

. 2.1 Weld the material to produce. T, H, and angular joints.

3.0 Practice the Foundry processes

3.1 Prepare a mould for connecting rod, pulleys.
3.2 Prepare Core for hollow jobs.

COURSE CONTENT

A. Machine Shop (Turning)

1. Thread cutting 2. Handle 3. Combination of all the operations.
4. Eccentric turning. 5. Male and female fit assembly

B. Welding

1. T. Joint, 2. H – Joints, 3.Angular joints.
4. 2-joints (H Joints and T Joints)

3. Foundry

1.Connecting rod, 2.core making 3.pulleys.

Key competencies Expected from the student

S.No	Exercise	Key competency
Machine shop (Turning Shop)		
1	Thread cutting	a. Center the job with dial gauge b. Fix the cutting tool in suitable angle c. Turn the component with suitable speed and feed d. Cut the threads with back gear arrangements
2	Production of handle	a. Align job with the axis of lathe b. Cut the threads with back gear arrangements
3	Combination of all operations	a. Perform Centering of job b. Feeding the tool c. Fix the cutting tool in appropriate position d. Cut the metal with suitable speed and feed
4	Eccentric turning	a. Fix the job in a chuck with correct eccentricity b. Fix the cutting tool in correct position c. Cut the metal with suitable speed and feed
5	Male and female fit assembly	a. Center the job with dial gauge b. Fix the cutting tool in suitable angle c. Turn the component with suitable speed and feed d. Locate the center of hole e. Select suitable drill bit f. Drill the hole with suitable speed and feed g. Enlarge the hole to suitable diameter by using boring tool
Welding		
6	T-Joints, H- Joints, Angular Joints	a. Perform edge preparation b. Hold the electrode at suitable angle c. Identify the suitable Method of welding technique. d. Maintain proper distance between work piece and electrode tip produce arc e. Check the weld bead
Foundry		
7	Connecting rod	a. Select the suitable sand and its mix for the mould b. Place the pattern in correct position c. Ram the sand properly d. Provide vent holes e. Remove the pattern slowly f. Cut gates and runners g. Pour sufficient quantity of molten metal into the mould cavity
8	Core making	a. Prepare suitable core sand mix b. Select wooden mould box c. Pour the core sand into the mould box and proper ramming of the sand d. Prepare baking of the core

S.No	Exercise	Key competency
9	Pulleys	a. Select the suitable sand and its mix for the mould b. Place the pattern in correct position c. Prepare the core d. Place the core in correct position e. Ram the sand properly f. Provide vent holes g. Remove the pattern slowly h. Cut gates and runners i. Pour sufficient quantity of molten metal into the mould cavity

REFERENCE BOOKS

7. Exercises on Work shop practice- Course material prepared By TTTI, ECH

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
V Semester

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:								
ME-501	Industrial Management	4	-	60	3			100
ME-502	Design of Machine Elements -II	4	-	60	3			100
ME-503	Estimating & Costing	4	-	60	3			100
ME-504	Heat Power Engineering-II	4	-	60	3			100
ME-505	Fluid Power System	4	-	60	3			100
ME-506	Machine Tool Engineering	4	-	60	3			100
PRACTICAL:								
ME-507	CAD Lab Practice	-	6	90	3			100
ME-508	Life skills	-	3	45	3			100
ME-509	Hydraulics & Pneumatics Lab Practice	-	3	45	3			100
ME-510	Field practices	-	6	90	3			100
	TOTAL	24	18	630				1000

INDUSTRIAL MANAGEMENT

Subject Title : Industrial Management
Subject Code : ME –501
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Type Questions
1.	Principles and functions of Management	10	21	02	1½
2.	Organisation structure & organisational behaviour	20	34	03	2 ½
3	Production Management	14	26	02	02
4.	Materials Management	16	29	03	02
	Total	60	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the principles of management as applied to industry

1.1 Define industry, commerce (Trade) and business.
1.2 Explain the scope and need for management.
1.3 Understand the evolution of management
1.4 Explain the principles of scientific management.
1.5 Understand functions of Management.
1.6 Differentiate between management and administration.

2.0 Understand types of ownerships, the organisation structure of an industry and the behaviour of an individual in an organisation

2.1 Explain types of ownerships
2.2 Differentiate types of ownerships.
2.3 Explain salient features of joint stock companies.
2.4 Need of organisation structure of an industry.
2.5 Explain the line, staff and Functional organisations along with legible sketches.
2.6 List the advantages and limitations of line, staff and functional organisations.
2.7 List different departments in a large scale industry.
2.8 Explain the factors of effective organisation.
2.9 Explain organisational behaviour.
2.10 Explain job analysis.
2.11 Assess the incurring applicants.
2.12 Outline the selection process.
2.13 List the sources of manpower.

2.14 State motivation theories.
2.15 State Maslow's Hierarchy of needs.
2.16 Explain the phenomena of satisfaction.
2.17 Explain the performance levels.
2.18 Explain reward system
2.19 List different leadership models.
2.20 Explain the trait theory of leadership.
2.21 Explain behavioural theory of Leadership.
2.22 Explain the process of decision Making.
2.23 Explain the communication process.
2.24 Analyse the behaviour of groups in an organisation.
2.25 Explain group dynamics.
2.26 Detail the process of managing conflict.
2.27 Explain conflict resolution strategies.

3.0 Understand the different aspects of production management

3.1 Differentiate and integrate production, planning and control.
3.2 Relate the production department with other departments.
3.3 State the need for planning and it's advantages.
3.4 Explain the stages of Production, planning and control.
3.5 Explain routing methods.
3.6 Explain scheduling methods.
3.7 Explain dispatching.
3.8 Draw PERT/CPM networks.
3.9 Identify the critical path.

4.0 Understand the role of materials management industries

4.1 Explain the role of the materials in Industry.
4.2 Derive expression for inventory control.
4.3 Explain ABC analysis.
4.4 Define safety stock.
4.5 Define reorder level.
4.6 Write the expression for economic ordering quantity and mention the terms involved in the expression.
4.7 Explain stock layout.
4.8 List stores records.
4.9 Explain the Bin card.
4.10 Describe Cardex method.
4.11 Explain purchasing procedures.
4.12 List purchase records.
4.13 List the stores equipment
4.14 Explain the need of material handling methods.
4.15 Explain material handling methods. List out hoists, cranes, conveyers, trucks, and forklift trucks.
4.16 Explain break-even analysis.

COURSE CONTENT

1. Principles and functions of management

Definitions of Industry, Commerce and Business. Evolution of management theories. Principles of Scientific Management, functions of management. Difference of administration and management.

2. Organisation Structure & organisational behaviour

Role of industry, Types of ownership – Sole proprietorship, Partnership, Private limited, Public limited company, Industrial Cooperatives, Philosophy, types of Organisations, Line and Staff and functional organisations. Advantages and limitations, departments in a large scale industry. Effective organisation. Job analysis, Assessing applicants, selection, motivation, different theories, satisfaction, performance reward systems , Leadership in organisation, decision making, communication, group dynamics, Managing conflict.

3. Production Management.

Production, planning and control, relation with other departments, need for planning and its advantages, Routing, scheduling, despatching, PERT and CPM, simple problems.

4. Materials Management.

Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, Economic ordering quantity, Break even analysis, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, Hoist, Cranes, conveyors, trucks, fork trucks.

REFERENCE BOOKS

1. Industrial Engineering and Management -by O.P Khanna
2. Production Management- by Buffa.
3. Engineering Economics and Management Science - by Banga & Sharma.
4. Personnel Management by Flippo.

DESIGN OF MACHINE ELEMENTS-II

Subject Title : Design of Machine Elements-II
Subject Code : ME–502
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

S. No	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1.	Belts and chain drives	12	21	02	1 ½
2.	Gear drives	12	21	02	1 ½
3.	Fly wheels and Governors	10	21	02	1 ½
4.	Brakes and Clutches	14	26	02	02
5.	Cams	12	21	02	1 ½
Total		**60**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall be able to

1. Understand the Design of Belts and chain drives

1.1 List the different power drives
1.2 Compare the flexible drives with the rigid drives
1.3 Classify the belt drives
1.4 List the belt materials
1.5 Define the slip and creep in belts.
1.6 Explain the effect of slip and creep on power transmission
1.7 Derive the expression for the length of open and cross belts
1.8 Derive the expression for ratio of limiting belt tensions
1.9 Derive the expression for centrifugal tension in the belt
1.10 Explain the effect of centrifugal tension on power transmission
1.11 Design the belt cross-sectional dimensions (V-belts are excluded)
1.12 Design the cone pulley for open and cross belts
1.13 Solve the numerical problems related to the above cases
1.14 List the different elements of chain drive
1.15 Classify the chain drives
1.16 Differentiate between belt and chain drives
(Problems and derivations are excluded for chain drives)

2. Understand the Design of Gear drives

2.1 Explain the nomenclature of spur gear tooth.
2.2 State the law of gearing (Derivation is excluded)
2.3 Identify various tooth profiles of gear.
2.4 Explain the terminology related to gear drive
2.5 List the gear material
2.6 List different types of gear trains
2.7 List all the advantages and disadvantages of gear drives
2.8 Classify the gear drives based on different criteria

2.9 Write the Lewis bending equation
2.10 Design the gear based on Lewis equation
2.11 Design different types of gear trains for given velocity ratios
2.12 Explain the applications of gear trains
2.13 Solve the problems related to simple, compound and reverted gear trains

3. Understand the Design of Fly wheels and Governors

3.1 State the function of flywheel
3.2 List the applications of flywheel
3.3 Explain the terms related to flywheel
3.4 Derive the expression for maximum fluctuation the formula for energy stored by flywheel
3.5 Design the rim type flywheel for the max fluctuation of energy
3.6 Solve simple problems on fly wheel
3.7 Explain the function of governor using legible sketch
3.8 Classify the governors
3.9 Distinguish between Governor and Flywheel
3.8 Describe the working principle of Watt governor and Porter governor using legible sketch
3.9 Write the expressions for the height of watt and Porter governor
3.10 List the applications of governor
3.11 Explain the terms – sensitiveness, stability, isochronism, hunting, effort and power of governor
3.12 Solve simple problems on governors

4. Understand the Design of Brakes and Clutches

4.1 State the function of brake
4.2 Classify the brakes
4.3 List all the brake material
4.4 Explain the working of block brake with the help of legible sketch
4.5 Explain the working of shoe brake with the help of legible sketch
4.6 Explain the working of band brake with the help of legible sketch
4.7 Derive an expression for the braking torque
4.8 Solve simple problems related to brakes
4.9 Explain the Function of clutch
4.10 Classify the clutches
4.11 List all the clutch materials
4.12 Explain the working of single and multiple plate c
4.13 Design single plate and multi-plate clutches based on uniform pressure and uniform wear
4.14 Solve simple problems related to clutches

5. Understand the Design of Cams

5.1 Explain the function of cam
5.2 Explain the features of cam profile.
5.3 Classify the cams.
5.3 Define terms related to cam profile.
5.4 Draw angular - displacement diagram for lift motion for:
a) Uniform velocity.
b) S.H.M.
c) Uniform acceleration & retardation.

5.5 Draw simple cam profiles in above three cases for knife edged, flat and roller followers. (offset followers are omitted)

COURSE CONTENT

1. Belts and chain drives

Factors to be considered while selecting the type of drive -Belt drive, types of belt drives; belt materials, belt joints- length of open and crossed belts (without proof). Design procedure (Phases of design) - Design of stepped pulley belt drive only.- Expression for the ratio of belt tensions (without proof).- Concept of centrifugal tension – Relation between centrifugal tension and the tension on tight side for transmitting maximum power (derivation omitted) - Permissible stress in the belt per unit width : per unit cross section-Calculation of belt thickness and width for given permissible stress for open and crossed belts, considering centrifugal tension and without considering centrifugal tension. – Simple problems-Chain drives – Advantages - Types of chains – Roller and silent chains - (problems on chain drives omitted)

2. Gear drives

Gear tooth terminology – involute and cycloidal profiles - Simple, compound, reverted & Epi cyclic gear trains. Gear material - Law of gearing-Design of number of teeth for simple, compound and reverted gear trains for a given speed ratio and sketching the arrangement-Applications of gear trains – thread cutting on a lathe – back gear assembly of a lathe-Selection of gear wheels to cut threads for a given pitch on a lathe-Design of spur gear based on Lewis equation-Problems on screw cutting on lathe – Back gear assembly - 3- Speed gear box of an automobile, Calculation of velocity ratio-Description and application of epi-cyclic gear trains (Problems on epi-cyclic gear trains not included)

3. Fly wheels and Governors

Purpose and applications of fly wheels – Definitions of Coefficient of fluctuation of speed and Coefficient of fluctuation of energy - Turning moment diagram of flywheels-Design of rim type flywheel knowing the fluctuation of energy - Formula for energy stored by fly wheel (without proof) – simple problems - Governor – function – Classification - Explanation of Simple Watt governor and Porter governor - Difference between Flywheel and Governor - Sensitiveness, Stability, Isochronism, Hunting, Effort and Power of governor - Simple problems on watt governor and porter governor.

4. Brakes and clutches

Function of brakes – Classification of brakes-Brake materials - Working of simple shoe brake and band brakes only - Simple problems on shoe brake and band brakes only - Function of clutch – Classification of clutches- Clutch material - Working of single plate and multi-plate clutches, Difference between Brake and clutch - Simple problems on single plate and multi-plate clutches based on uniform pressure and uniform wear

5. Cams

Function of cam - Classification of cams and followers – uses. Working principle of plate and cylindrical cams - Nomenclature of radial cam - Explanations of terms cam profile, base-circle, cam angles, trace point - Motion of follower – Uniform velocity, uniform acceleration and retardation and simple harmonic motion – Time Vs. displacement diagram only - Construction of cam profile of a plate cam with knife edged, flat & roller follower for all three types of motions stated above - Problems on drawing of cam profiles as stated above for the follower axis passes through the axis of the cam shaft (offset followers not included)

REFERENCES

1. Machine Design - R.S.Khurmi.
2. Design of Machine Elements - Pandya and Shah.
3. Theory of machines- Thomas Bevan.
4. Design of Machine Elements – V B Bhandari [Tata Mc Graw Hill]

ESTIMATING AND COSTING

Subject Title : Estimating and Costing
Subject Code : ME-503
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1.	Elements of costing	12	21	02	1 ½
2.	Fundamentals of estimation	06	08	01	½
3	Estimation of weights of materials and Machining times	16	39	03	03
4.	Estimation of fabrication cost	08	13	01	01
5.	Estimation of forging cost	10	16	02	01
6.	Estimation of foundry cost	08	13	01	01
Total		**60**	**110**	**10**	**08**

OBJECTIVES

Op on completion of the course the student shall be able to

1.0 Understand the elements of costing.

1.1 Define Costing
1.2 List the objectives of costing
1.3 Explain the elements of costing
1.4 Define Depreciation
1.5 Explain the causes of depreciation
1.6 Compute depreciation by different methods.
1.7 Explain the components of cost - prime cost, factory cost, office cost, total cost
1.8 Calculate the cost of a product taking into consideration all the items.
1.9 Calculate the selling price of a Product.

2.0 Understand the fundamentals of estimation.

2.1 Define Estimation.
2.2 List the qualities of Estimator.
2.3 List the objectives and functions of estimation.
2.4 Explain the various constituents of estimation.
2.5 Explain the estimating procedure.

3.0 Estimate the weight of material required for a product and machining times

3.1 Divide the component drawing into simple and smaller geometrical configurations.
3.2 Calculate the volumes and the weight of the material required.
3.3 Estimate the cost of material.
3.4 Solve simple problems on the above.
3.5 Estimate time required for machining like turning, drilling, shaping, boring, screw cutting and grinding.
3.6 Use standard tables for feeds, cutting speeds.
3.7 Solve problems on the above.

4.0 Estimate the fabrication cost.

4.1 Define the Meaning of Fabrication
4.2 List the types of fabrication.
4.3 Estimate the cost of Fabrication by Gas welding – using table
4.4 Estimate the cost of Fabrication by Arc welding .
4.4 Estimate the cost of Gas cutting – using table

Note: Use Gas welding & Gas cutting table for obtaining consumption of gas, filler rods, rate of welding, speed of cutting.

5.0 Estimate forging cost.

5.1 Define Forging.
5.2 List the types of forging
5.3 Explain various forging losses.
5.4 Estimate the length, net and gross weight and cost of forging for a given component.

6.0 Estimate foundry cost.

6.1 List steps for making castings in foundry.
6.2 Explain the allowances provided in foundry.
6.3 State the various costs involved in estimating foundry cost
6.4 Estimate foundry cost.

COURSE CONTENT

1.0 Elements of costing.

Explanation of term costing – objectives of cost accounting – elements of cost viz., material, labour and expenses –Depreciation-causes- : Calculation of depreciation charges by a few important methods.
Determine the items that go into prime cost. On cost, calculate the cost of a product taking into consideration all items. Calculate the selling price of a product.

2.0 Fundamentals of estimating

Explanation of the term, objectives and function of estimating – principal constituents of the estimating of the cost of component – design time, drafting, planning and production time, design and procurement or manufacture of special tools and equipment, estimate work, labour, materials, overheads, miscellaneous expenses – estimating procedure.

3.0 Estimation of weights of materials and machining time.

Principles of dividing the component drawing into simple and smaller geometrical configurations. Calculation of volumes and the weight of the material. Estimating the cost Exercises in the calculation of weight of material and cost.

Basic formula for the calculation of machining times for operations like, turning, drilling, shaping, boring, screw cutting and grinding,. Use of standard table of feeds, cutting speed etc. Exercises for the calculation of machining time for the above mentioned operations.

4.0 Estimation of fabrication cost.

Explain the term fabrication – types, estimate the cost of fabrication by gas welding and arc welding – estimate the cost of gas cutting – exercises for the calculation of fabrication cost.

5.0 Estimation of forging cost.

Components of forging cost, estimation of stock weight, net weight, gross weight, losses in forging, estimation of stock size.

Exercise in the estimation of length, net and gross weight and cost of forging for given components.

6.0 Estimation of foundry cost.

Process for finding the foundry cost, cost of metal, cost of metal melting, moulding cost, core cost, cleaning cost, grinding and tooling cost. Methods of estimating the above. Exercises in estimating the foundry cost.

REFERENCE BOOKS

1. Mechanical Estimating & Costing -by B.P.Sinha
2. Industrial Engineering & Management Science. - by T.R.Banga
3. Estimating & Costing - by Agarwal.
4. Estimating & costing -by Narang & charya.
5. Estimating & Costing -by T.R. Banga – Sharma.

HEAT POWER ENGINEERING - II

Subject Title : Heat Power Engineering - II
Subject Code : ME-504
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Properties of Steam	10	20	02	01
2	Steam Boilers	15	32	02	02
3	Steam Nozzles	10	18	02	1 ½
4	Steam Turbines	15	20	02	02
5	Steam Condensers	10	20	02	1 ½
	Total	**60**	**110**	**10**	**08**

OBJECTIVES
Up on completion of the course the student shall be able to

1.0 Understand the Properties of Steam
- 1.1 Define the various properties of steam
- 1.2 Compute the enthalpy, internal energy and entropy at given pressure.
- 1.3 Use of the steam tables
- 1.4 Interpret the data in steam tables to calculate enthalpy and entropy.
- 1.5 Compute the above values using Mollier chart.
- 1.6 Solve simple problems on the above.
- 1.7 Identify the various thermodynamic processes (Expansion & Compression of vapours)
- 1.8 Compute the work done, internal energy, enthalpy and entropy in each of the above processes.
- 1.9 Represent the above process on T-S and H-S diagrams
- 1.10 Calculate dryness fraction by using Steam calorimeters

2.0 Understand the Working of Steam Boilers.
- 2.1 State the function of boiler
- 2.2 List all the uses of boilers.
- 2.2 Explain the working of Cochran Boiler with a legible sketch
- 2.3 Explain the working of Babcock Wilcox Boiler with a legible sketch
- 2.4 Distinguish between water tube and fire-tube boilers
- 2.5 Recognise the need of high-pressure modern boilers
- 2.6 Explain the working principle of Lamont and Benson Boilers with a legible sketch
- 2.7 List all the boiler mountings
- 2.8 Explain the function all the mountings with a legible sketch such as pressure gauge, water level indicator, safety valve and fusible plug.

2.9 List all the boiler accessories.
2.10 Illustrate the function of all the accessories with a legible sketch such as economiser, Super Heater, Steam traps & Separators.
2.11 Explain the terms actual/equivalent evaporation and factor of evaporation.
2.12 Define the boiler Power
2.13 Define the boiler efficiency
2.14 Write the formula for the above.
2.15 Compute the equivalent and actual evaporation from given data.
2.16 Solve problems on Boiler Power & efficiency
2.17 Draw heat balance for boiler performance
2.18 Explain draught systems (Natural, forced & induced) in detail with a legible sketch

3.0 Understand the Working of Steam Nozzles

3.1 Explain the Flow of steam through nozzle
3.2 Derive the expression for Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
3.3 Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
3.3 Write the expression for Discharge of steam through nozzles
3.4 Write the formula for Critical pressure ratio
3.5 Calculate cross-sectional areas at throat and exit for maximum discharge
3.6 Explain the Effect of friction in nozzles and Super saturated flow in nozzles.
3.7 Explain the Working of steam jet injector with a legible sketch.
3.8 Solve simple problems of nozzles.

4.0 Understand the Working of Steam Turbines

4.1 Explain the principle of working of a turbine
4.2 Classify the Turbines with examples.
4.3 Differentiate the impulse turbines from reaction turbine
4.4 Explain the Principle of working of simple De-Laval turbine with a line diagram.
4.5 Draw velocity triangles
4.6 List the various blade angles
4.7 Derive formula for work done, axial thrust, energy lost, power and efficiencies.
4.8 State the necessity of compounding a turbine.
4.9 Describe the methods of reducing rotor speeds with the help of legible sketch (3 compounding methods)
4.10 Explain the working principle of Parson's Reaction Turbine with a line diagram.
4.11 Velocity triangle for Parson's reaction turbine.
4.12 Simple problems on Single stage Impulse turbines (without blade friction) and reaction turbines (including data on blade height)
4.13 Define the terms bleeding & reheating.
4.14 State the necessity of governing a turbine
4.15 Explain the methods of turbine governing

5.0 Understand the Working of Steam Condensers

5.1 Define the Steam condenser

5.2 State the functions of steam condenser
5.3 Classify the condensers
5.4 Explain the working principle of Low level counter – Flow and Parallel – Flow jet condensers with legible sketch
5.5 Explain the working principle of High level Jet condenser with legible Sketch
5.6 List the Advantages and Disadvantages of High- Level Jet condenser
5.7 Explain the working principle of Ejector condenser with legible Sketch
5.8 Explain the working principle of Shell and Tube Surface condenser with Legible sketch
5.9 Distinguish between down flow and central flow surface condenser
5.10 Explain the working principle of Evaporative condenser with legible Sketch
5.11 List the Advantages and Disadvantages of Surface condenser
5.12 Distinguish between Jet Condenser and Surface Condenser
5.13 Write the Formulae for cooling water required, Condenser efficiency, Corrected vacuum, absolute pressure and Vacuum efficiency
5.14 Solve Simple problems on Steam condensers to Estimate the Cooling water required, Condenser efficiency and Vacuum efficiency
5.15 Define Air Extraction
5.16 List the types of Air Extraction systems
5.17 Distinguish between Dry-air Extraction and Wet-air Extraction systems
5.18 Explain the working principle of Air pump and Steam –Jet Air Ejector with legible sketch

COURSE CONTENT

1.0 Properties of steam.

1.1 Formation of steam under constant pressure, dryness, fraction and degree of superheat, specific volume.
1.2 Determination of enthalpy, internal energy, internal latent heat, entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart.
1.3 Simple direct problems on the above using tables and charts.
1.4 Vapour processes – simple problems using tables and charts.
1.5 Steam calorimeters – Separating, throttling, Combined Separating and throttling calorimeters – problems.

2.0 Steam Boilers.

2.1 Function and use of steam boilers.
2.2 Classification of steam boiler with examples.
2.3 Brief explanation with line sketches of Cochran and Babcock Wilcox Boilers.
2.4 Comparison of water tube and fire tube boilers.
2.5 Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers.
2.6 Brief explanation with line sketches of boiler mountings namely, pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve (dead weight type, spring loaded type, high pressure and low water safety alarm).

2.7 Brief explanation with line sketches of boiler accessories such as feed pump, economiser, super heater and air pre-heater only.
2.8 Study of steam traps & separators.
2.9 Explanation of the terms : Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency.
2.10 Formula for the above terms without proof.
2.11 Simple direct problems on the above.
2.12 Draught systems (Natural, forced & induced).

3.0 Steam Nozzles

3.1 Flow of steam through nozzle.
3.2 Velocity of steam at the exit of nozzle in terms of heat drop by analytical and mollier diagram.
3.3 Discharge of steam through nozzles.
3.4 Critical pressure ratio.
3.5 Methods of calculation of cross – sectional areas at throat and exit for maximum discharge.
3.6 Effect of friction in nozzles and Super saturated flow in nozzles.
3.7 Working steam jet injector.
3.8 Simple problems of nozzles.

4.0 Steam Turbines

4.1 Classification of steam turbines with examples.
4.1 Difference between impulse & reaction turbines.
4.3 Principle of working of a simple De-lavel turbine with line diagrams.
4.4 Velocity diagrams.
4.5 Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency.
4.6 Methods of reducing rotor speed compounding for velocity, for pressure or both pressure and velocity.
4.7 Working principle with line diagram of a Parson's Reaction turbine – velocity diagram.
4.8 Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height.
4.9 Bleeding, re-heating and re-heating factors (Problems omitted).
4.10 Governing of steam turbines : Throttle, By-pass & Nozzle control governing.

5.0 Steam Condensers

5.1 Steam condenser ,its functions, Classifications
5.2 Low level counter – Flow and Parallel –
Flow jet condensers, High level Jet condenser and Ejector condenser, Advantages and Disadvantages of High- Level Jet condenser
5.3 Shell and Tube Surface condenser, Down flow, Central flow Surface Condenser and Evaporative condenser, Advantages and Disadvantages of Surface condenser
5.4 The Formulae for cooling water required, Condenser efficiency, Corrected vacuum, Absolute pressure and Vacuum efficiency
5.5 Simple problems on Steam condensers to Estimate the Cooling water Required, Condenser efficiency and Vacuum efficiency

5.6 Air Extraction, Types of Air Extraction systems, Dry-air Extraction and Wet-air Extraction systems, Air pump and Steam –Jet Air Ejector

REDERENCE BOOKS

1. Thermodynamics	by	Ballaney
2. Elements of Heat Engines – Volume II	by	R.C. Patel & Karamchandani
3. Thermal Engineering	by	Arora & S. Domkundwar
4. Thermal Engineering	by	Roy & Sarao
5. Thermal Engineering	by	Vasandani & Kumar

FLUID POWER SYSTEMS

Subject Title : Fluid Power Systems
Subject Code : ME-505
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Fluid power	06	13	01	01
2	Circuit devices	12	26	02	02
3	Pneumatics	20	42	04	03
4	Hydro - Pneumatic systems	12	16	02	01
5	Hydro – Pneumatic measurements	10	13	01	01
	Total	60	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the concept of Fluid power

1.1 Explain the meaning of fluid power
1.2 List the various applications of fluid power
1.3 List the basic components of the fluid power system
1.4 Appreciate the use of Hydraulic control system
1.5 State merits and demerits of hydraulic control system.
1.6 State the essential components of hydraulic circuits and their functions.
1.7 List types of Hydraulic pumps
1.8 List the types of Hydraulic Motors.
1.9 Explain the function of hydraulic pump and motor

2.0 Understand the Working of Circuit devices
Hydraulic Intensifier

2.1 State the purpose of intensifier
2.2 Explain the principal of working of intensifier with a legible sketch
2.3 List the types of accumulators.
2.4 List the types of hydraulic cylinders
2.5 Explain the construction and working principle of double acting hydraulic cylinder
2.6 Write the expressions for force, velocity and power for hydraulic cylinder
2.7 Select intensifiers and accumulators for specific application.
2.8 Explain the principle of Hydraulic Jack with a legible sketch
2.9 Explain the principle of Hydraulic crane with a legible sketch

Hydraulic control valves - Directional

2.10 State the function of control valve
2.11 Classify the control valves
2.12 State the functions of Directional control valves
2.13 Classify the directional control valves
2.14 Explain the construction and working principle of directional control valve
2.15 Draw the graphic symbols of directional control valves
2.16 Explain the different applications of directional control valves
2.17 Explain the working principle of solenoid-actuated valve with a legible Sketch
2.18 Define the valve overlap

Pressure control valves

2.19 State the functions of Pressure control valves
2.20 Classify the Pressure control valves
2.21 Explain the construction and working principle of pressure control valve
2.22 Draw the graphic symbols of pressure control valve
2.23 Explain the different applications of pressure control valves

Flow control valves

2.24 State the functions of Flow control valves
2.25 Classify the Flow control valves
2.26 Explain the construction and working principle of flow control valve
2.27 Draw the graphic symbols of flow control valve
2.28 Explain the different applications of Flow control valves
2.29 Explain the working of bleed-off circuits

Oil Reservoirs

2.30 State the functions of oil reservoir
2.31 Identify the elements of a Fluid Reservoir
2.32 Explain the purpose and types of filters
2.33 Explain the purpose of seals and packings.
2.34 Identify the different types of seals and packings.

3.0 Understand the concept of Pneumatics

Pneumatic Power Unit

3.1 Explain the meaning of pneumatic circuits
3.2 State the elements of pneumatic circuits
3.3 State the areas of application of pneumatic power unit
3.4 Compare with hydraulic power unit
3.5 Identify different symbols used for pneumatic circuit
3.6 Draw the pneumatic circuit diagram.
3.7 Classify the compressors.
3.8 Explain the working of Regulator, Filter and Lubricator (R-F-L)

Pneumatic circuit valves

3.9 Explain the function of circuit valves.
3.10 Explain the different methods of actuation of valves.
3.11 Describe the direction control valves – Spool type.

Air Cylinders

3.12 List the types of air cylinders
3.13 Explain the factors pertaining to installation and maintenance of Air cylinders
3.14 List the applications of Air cylinders

Pneumatic Circuits

3.16 Explain the principle of working of power operator holding devices.
3.17 Explain the pneumatic safety circuits.
3.18 Explain the meaning of Remote control
3.19 Describe the components of Remote control system.
3.20 Explain different Remote control valves and switches.

4.0 Understand the concept of Hydro Pneumatic Systems

4.1 Explain the advantages and applications of combined air and oil systems.
4.2 Explain the principle of combination system.
4.3 Explain the methods of combining the hydraulic cylinder to Air cylinder.
4.4 Explain the principle of Air controlled hydraulic valve with a legible sketch
4.5 Describe the use of air as cushion for hydraulics system with a legible sketch

5.0 Understand the concept of Hydro Pneumatic measurements

5.1 Illustrate the working of flow meter (Mechanical Type) with a legible sketch
5.2 Illustrate the working of flow meter (Electro Magnetic Type) with a legible sketch
5.3 Illustrate the working of flow meter (Ultrasonic) with a legible sketch
5.4 Illustrate the working of Air gauge with a legible sketch

COURSE CONTENT

1.0 Fluid Power

1.1 The meaning of fluid power
1.2 The various applications of fluid power
1.3 The basic components of the fluid power system
1.4 The use of Hydraulic control system
1.5 The merits and demerits of hydraulic control system.
1.6 The essential components of hydraulic circuits and their functions.
1.7 The types of Hydraulic pumps
1.8 The types of Hydraulic Motors.
1.9 The function of hydraulic pump and motor

2.0 Circuit devices

Hydraulic Intensifier

2.1 The purpose of intensifier
2.2 The principal of working of intensifier with a legible sketch
2.3 The types of accumulators.
2.4 The types of hydraulic cylinders
2.5 The construction and working principle of double acting hydraulic cylinder
2.6 The expressions for force, velocity and power for hydraulic cylinder
2.7 The Selection of intensifiers and accumulators for specific application.
2.8 The principle of Hydraulic Jack with a legible sketch
2.9 The principle of Hydraulic crane with a legible sketch

Hydraulic control valves - Directional

2.10 The function of control valve
2.11 The control valves
2.12 The functions of Directional control valves
2.13 Classification of directional control valves
2.14 The construction and working principle of directional control valve
2.15 The graphic symbols of directional control valves
2.16 The different applications of directional control valves
2.17 The working principle of solenoid-actuated valve with a legible Sketch
2.18 Definition of the valve overlap

Pressure control valves

2.19 The functions of Pressure control valves
2.20 Classification of Pressure control valves
2.21 The construction and working principle of pressure control valve
2.22 The graphic symbols of pressure control valve
2.23 The different applications of pressure control valves

Flow control valves

2.24 The functions of Flow control valves
2.25 Classification the Flow control valves
2.26 The construction and working principle of flow control valve
2.27 The graphic symbols of flow control valve
2.28 The different applications of Flow control valves
2.29 The working of bleed-off circuits

Oil Reservoirs

2.30 The functions of oil reservoir
2.31 Identification of elements of a Fluid Reservoir
2.32 The purpose and types of filters
2.33 The purpose of seals and packings.
2.34 Identification of different types of seals and packings.

3.0 Pneumatics

Pneumatic Power Unit

3.1 The meaning of pneumatic circuits
3.2 The elements of pneumatic circuits
3.3 The areas of application of pneumatic power unit
3.4 Comparison with hydraulic power unit
3.5 Identification of different symbols used for pneumatic circuit
3.6 The pneumatic circuit diagram.
3.7 Classification of compressors.
3.8 Explanation of working of Regulator, Filter and Lubricator (R-F-L)

Pneumatic circuit valves

3.9 Explanation of function of circuit valves.
3.10 Explanation of different methods of actuation of valves.
3.11 The direction control valves – Spool type.

Air Cylinders

3.12 The types of air cylinders

3.13 Function of Air cylinder – Tube, Cover, Packing gland, Cushion assembly, Piston and Piston seal.
3.14 Explanation of factors pertaining to installation and maintenance of Air cylinders
3.15 The applications of Air cylinders

Pneumatic Circuits

3.17 Explanation of principle of working of power operator holding devices- Lever clamp, Toggle clamp, Power vice, Mandrels, Collets and chucks.
3.18 Explanation of pneumatic safety circuits for a) Protection against pressure drop, b) Protection against overload
3.19 Explain the meaning of Remote control
3.20 The components of Remote control pneumatic system – Pilot operated valves, Solenoid valves, and Cam operated valves
3.21 Explain different Remote control valves and switches.

4.0 Hydro Pneumatic Systems

4.1 The principle of combination system.
4.2 The advantages and applications of combined air and oil systems
4.3 The methods of combining the hydraulic cylinder to Air cylinder
4.4 The principle of Air controlled hydraulic valve with a legible sketch
4.5 The use of air as cushion for hydraulics system with a legible sketch

5.0 Hydro Pneumatic Measurements

5.1 Illustratation of working of flow meter (Mechanical Type) with a legible sketch
5.2 Illustratation of working of flow meter (Electro Magnetic Type) with a legible sketch
5.3 Illustratation of working of flow meter (Ultrasonic) with a legible sketch
5.4 Illustratation of working of Air gauge with a legible sketch

REFERENCE BOOKS:

1. Pneumatics by SRIHARI RAO
2. Pneumatic controls by FESTO
3. Fluid Power Pneumatics by ALAN H. JOHN
4. Pneumatics by FLIPPO
5. Pneumatics By TTI
6. Hydraulics & Pneumatics by RAY & RAO
7. Fluid Power & Pneumatics by AUDEL Series

MACHINE TOOL ENGINEERING

Subject Title : Machine Tool Engineering
Subject Code : ME–506
Periods Per Week : 04
Periods Per Semester : 60

TIME SCHEDULE

S.No	Major Topics	Number of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Modern Machining Process	16	29	03	02
2	Plastic processing	16	26	02	02
3	Press Tools, Jigs and Fixtures	20	42	04	03
4	Jig Boring	08	13	01	01
	Total	60	110	10	08

OBJECTIVES
Up on completion of the course the student shall be able to

1.0 Understand the Modern Machining Processes
- 1.1 Distinguish between non-conventional machining processes and traditional methods.
- 1.2 State their relative advantages.
- 1.3 Explain the principle of working of ultrasonic machining.
- 1.4 List the equipment used in U.S.M. processes.
- 1.5 Explain the principle of electric discharge machining with a legible sketch.
- 1.6 Explain the working of Abrasive jet machining with a legible sketch
- 1.7 Explain the working of Laser beam machining with a legible sketch
- 1.8 State the principle of chemical machining.

2.0 Understand the concept of Plastic Processing
- 2.1 State the principle of manufacturing plastic products.
- 2.2 Explain the methods of injection moulding, compression moulding, transfer moulding with legible sketches
- 2.3 Explain the principle of extruding, casting and calendaring with legible sketches
- 2.4 State the principle of machining and welding plastics
- 2.5 Explain the different fabrication methods – Sheet forming, Blow moulding, Laminating and Reinforcing
- 2.6 List Engineering applications of plastics

3.0 Understand the use of Press Tools, Jigs and Fixtures

3.1 Explain the Importance of Press Tools
3.2 Classify presses based on power and design of frame.
3.3 Explain the constructional details of a power press with the help of a legible sketch
3.4 State the meaning of Press size.
3.5 Explain Press Tools – Punch and die.
3.6 Explain Die-clearance and Die Accessories
3.7 Explain shear action in die cutting operation – Punch and die clearances, Angular clearance, centre of pressure, cutting forces.
3.8 Explain various press working operations.
3.9 Explain different types of dies.
3.10 List various die operations
3.11 List types of jigs and explain their constructional details with the help of legible sketches
3.12 State general considerations in design of drill jigs
3.13 State the function of drill bush.
3.14 List different types of fixtures and explain their constructional details with the help of legible sketches.
3.15 Differentiate between jigs and fixtures.
3.16 List the advantages of Jigs and Fixtures
3.17 Explain basic principle of location.
3.18 Identify different locating methods and devices.
3.19 Explain the basic principle of clamping.
3.20 Identify different types of clamps and their constructional details with the help of legible sketches

4.0 Understand the process of Jig Boring

4.1 List the situations where jig-boring machines are needed.
4.2 State the principle of working of a jig boring machine.
4.3 Explain the process of button boring on lathes.
4.4 Classify the jig boring machines.
4.5 Explain the constructional details of open front machine and cross rail type machine with the help of legible sketches.
4.6 Explain the function of above machines.
4.7 Describe the systems of location of holes.

COURSE CONTENT

1.0 Modern Machining Processes.

Introduction – comparison with traditional machining.
Ultrasonic machining- Principle – Description of equipment - applications.
Electric Discharge Machining - Principle – Description of equipment – Type of EDM Processes - applications.
Abrasive jet machining - principle - description of equipment – application.
Laser beam machining - principle - description of equipment- application.
Chemical machining – Principle – description of equipment - Applications.

2.0 Plastics Processing.

Processing of plastics - Injection moulding - Compression moulding - Transfer moulding – Extruding - Casting - Calendaring
Fabrication methods -Sheet forming methods, Blow moulding -

Laminating plastics (sheets, rods & tubes) - Tool angles for machining Plastics - Coolants used in machining of plastics - Applications of Plastics

3.0 Press Tools, Jigs and Fixtures:

Introduction - Types of Presses – hand, power, gap, inclinable, adjustable, horn, straight side, pillar presses.

Constructional details of a power press - Press size.

Press Tools – Punch and die

Die Accessories – Stops, Pilots, strippers, Knock outs, pressure pads.

Shear action in die cutting operation – punch and die clearance and angular clearance, centre of pressure, cutting forces.

Press working operations: blanking, piercing and forming, lancing, cutting off and parting, notching, shaving, trimming, embossing, beading and curling, bulging, twisting, coining, swaging, hole flanging or extruding – line sketches and meaning of terms.

Sheet metal bending: bending methods, spring back, bend allowance, bending pressure – sketches and empirical formulae.

Types of dies meaning of inverted, progressive, compound and combination dies.

Material selection for punch and die.

Definition of jig - Types of jigs - leaf jig, box and handle jig, template jig, plate jig, Indexing jig, Universal jig, vice jigs.

Explain the constructional details of the above jigs.

General consideration in the design of drill jigs

Explain drill bush

Types of fixtures : vice fixtures, milling fixtures, boring fixtures, grinding fixtures - Explain the constructional details of the above fixtures.

Basic principles of location - Explain the locating methods and devices

Explain the basic principles of the clamping - Types of clamps - strap clamps, cam clamps, screw clamps, toggle clamps, hydraulic and pneumatic clamps.

4.0 Jig Boring.

Introduction - Button boring on lathes- Jig boring on vertical milling machine.

Types jig boring machines - Open front machine - Cross rail type machine constructional details & their working - System of location of holes.

REFERENCE BOOKS

1.Manufacturing Technology - Hajra Chowdhary Volume I & II

2.Manufacturing Technology - P.N.Rao Volume II

3.Production Technology - R.C.Patel

4.Production Technology - Jain & Gupta.

5.Tool Design - Donaldson

CAD PRACTICE

Subject Title : CAD Practice
Subject Code : ME–507
Periods per week : 06
Period per semester : 90

TIME SCHEDULE

Sl No.	Major Topics	No. of periods
1.	Introduction to CAD	03
2.	Selecting commands & Working with drawing	06
3.	Viewing drawing	03
4.	Working with coordinates	03
5.	Creating simple and complex entities	06
6.	Getting Drawing information	06
7.	Modifying entities	06
8.	Working with text	03
9.	Dimensioning drawing	03
10.	2D Drawing	21
11.	Layers	03
12.	Isometric views	06
13.	Working with blocks	03
14.	Printing drawing	03
15.	3D Drawings	15
TOTAL		90

OBJECTIVES
Up on completion of the course the student shall be able to

1.0 Understand about the Computer Aided Drafting and its software
- 1.1 Define Computer Aided Drafting
- 1.2 List the Advantages of CAD
- 1.3 Explain the importance of CAD software
- 1.4 Explain the features of Graphic Work station
- 1.5 Use CAD Environment: Screen, Various tool bars and menus.

2.0 Use appropriate selection commands

2.1 Practice commands using toolbars, menus, command bar
2.2 Practice repeating a command, Nesting a command and modifying a command
2.3 Use prompt history window and scripts
2.4 Practice mouse shortcuts
2.5 Practice the Creating the drawing, Opening existing and damaged Files, saving the drawing
2.6 Practice the setting up a drawing
2.7 Practice the setting and changing the grid and snapping alignment
2.8 Practice the Entity snaps

3.0 Use Viewing tools of CAD

3.1 Practice the use of Scroll bar, pan command, and rotating view to move around within drawing
3.2 Practice the changing of magnification of drawing
3.3 Practice the displaying of multiple views
3.4 Practice the use of controlling visual elements like Fill, Text, Blips and Line weight

4.0 Use coordinate systems of the drawing

4.1 Practice how the coordinate system work
4.2 Practice how the coordinate system displayed
4.3 Practice the Find tool to determine the coordinates of a point
4.4 Practice the Two dimensional coordinates such as Absolute Cartesian, Relative Cartesian and Polar coordinates
4.5 Practice the use of right-hand rule
4.6 Practice the how to enter into x, y, z - coordinates
4.7 Practice the Three dimensional coordinates such as Spherical and Cylindrical coordinates
4.8 Practice the use of filters in two and three dimensions
4.9 Practice the defining user coordinate system
4.10 Practice the use of present user coordinate system

5.0 Create the simple and complex entities

5.1 Draw the lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines
5.2 Practice the Creation of point entities
5.3 Practice the Editing of point entities
5.4 Draw the complex shapes like rectangles, polygons, polylines, Splines, donuts, planes
5.5 Practice the adding of hatch pattern

6.0 Use the drawing information retrieving tools Measure, Divide, Calculate, Display, and Track

6.1 Measure the intervals on entities
6.2 Divide the entities in to segments
6.3 Calculate the areas defined by points, of closed entities, and Combined entities
6.4 Calculate the distance between the entities
6.5 Calculate the angle between the entities
6.6 Display the information about the entities and drawing status

6.7 Track time spent working on a drawing

7.0 Use the Modifying tools to modify the properties of entities

7.1 Practice the entity selection and deselection methods
7.2 Practice the Deletion of entities
7.3 Practice the Copying of entities within a drawing, between drawings
7.4 Practice the making of parallel copies, Mirroring entities and Arraying entities
7.5 Practice the Rearranging of entities by Moving, Rotating and Reordering
7.6 Practice the Resizing of entities by Stretching, Scaling, Extending, Trimming, and Editing the length
7.7 Practice the Braking and joining of entities
7.8 Practice the creating, modifying the groups and ungrouping of Entities
7.9 Practice the Editing of polylines: Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices
7.10 Practice the Exploding of entities
7.11 Practice the Chamfering and Filleting of entities

8.0 Use the Text tool to create and formatting the various types of text fonts and its styles

8.1 Practice the creating, naming and modifying the text fonts
8.2 Practice the Creation of line text, paragraph text
8.3 Practice the Setting of line text style and its alignment
8.4 Practice the Setting of Paragraph text style and its alignment
8.5 Practice the Changing of line text and Paragraph text
8.6 Practice the use of alternate text editor

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimension styles & variables and Adding geometric tolerances

9.1 Practice the creating of linear, Angular, Diametral, Radial, Ordinate dimensions
9.2 Practice the creating leaders and annotations
9.3 Practice the making dimensions oblique
9.4 Edit the dimension text
9.5 Practice the Controlling of dimension arrows and format
9.6 Practice the Controlling of line settings and dimension text
9.7 Practice the Controlling of dimension units, and dimension tolerance

10.0 Create 2D Drawings

10.1 Create 2D drawings of standard mechanical components

11.0 Organize the information on layers

11.1 Practice the setting a current layer, layers color, line type, line weight, print style
11.2 Practice the locking and unlocking of layers
11.3 Practice the layer visibility and layer printing
11.4 Practice the setting of current line type
11.5 Practice the loading of additional line types
11.6 Practice the creating and naming of line type

11.7 Practice the editing of line type

12.0 Create Isometric Views

12.1 Create Isometric views of simple objects

13.0 Use the Blocks, Attributes and External references to manage the Drawing

13.1 Define a block
13.2 Explain the purpose of a block
13.3 Practice the creating a block
13.4 Practice the inserting a block
13.5 Practice the redefining a block
13.6 Practice the exploding a block
13.7 Define an Attribute
13.8 Practice the editing attribute definitions
13.9 Practice the attaching attribute to blocks
13.10 Edit attributes attached to blocks
13.11 Extract attributes information
13.12 Define external reference
13.13 Practice the Attaching, Removing, and Reloading of external references
13.14 Practice the Binding, Clipping and changing the path of external References

14.0 Use Layouts, Layout view ports, and customizing printing in CAD

14.1 Define layout for printing
14.2 Understand the layouts
14.3 Practice the viewing of drawings in paper and model space
14.4 Display the model and layout tabs
14.5 Create the new layout
14.6 Reuse the layouts from other files
14.7 Manage the layouts in a drawing
14.8 Define layout view ports
14.9 Create layout view ports
14.10 Practice the viewing and scaling of layout view ports
14.11 Modify the layout viewports
14.12 Select the appearance of print dialog
14.13 Set the paper size and orientation
14.14 Select a printer or a plotter
14.15 Set the scale and view
14.16 Choose how line weight print

15.0 3D Drawings

15.1 Explain the concept of 3D
15.2 Create 3D solids using solid tool bar options
15.3 Create 3D Drawings of Standard Mechanical Components
15.4 Practice Rendering

KEY competencies to be achieved by the student

S.No	Experiment Title	Key Competency
1.	Introduction to CAD	• Open/close Autocad program • Understands Autocad Graphic User Interface(GUI) and various toolbars
2.	Selecting commands & Working with drawing	• Use prompt history window and scripts • Practice the setting up a drawing • Practice the Entity snaps
3.	Viewing drawing	• Use Scroll bar, pan command, and rotating view to move around within drawing • Control visual elements like Fill, Text, Blips and Line weight
4.	Working with coordinates	• Use Two dimensional coordinates and Three dimensional coordinates • Use right-hand rule • Use filters in two and three dimensions • Define user coordinate system
5.	Creating simple and complex entities	• Draw the simple shapes like lines, circles, arcs and complex shapes like polygons, planes etc., • Practice the adding of hatch pattern
6.	Getting Drawing information	• Measure the intervals and distance between entities • Divide the entities in to segments • Calculate the areas defined by points, of closed entities, and Combined entities
9.	Dimensioning drawing	• Create linear, Angular, Diametral, Radial, Ordinate dimensions • Practice the making dimensions oblique • Edit the dimension text • Practice the Controlling of dimension units, and dimension tolerance
10.	2D Drawings	• Use proper 2D commands to create 2D drawings
12.	Isometric Views	• Use Iso snap command to create Isometric views

S.No	Experiment Title	Key Competency
13.	Working with blocks	• Create , insert and explode a block Attach attribute to blocks • Edit and extract attributes attached to blocks
14.	Printing drawing	• Display the model and layout tabs • Create the new layout and Manage the layouts from other files • Practice the viewing, scaling and Modifying of layout view ports • Set the paper size, orientation, scale, view and line weight to print
15.	3D Drawings	• Region 2D Drawings • Use proper 3D commands to create 3D drawings

COURSE CONTENT

1.0 The Computer Aided Drafting and its software

Definition of Computer Aided Drafting, the Advantages and importance of CAD software ,The features of Graphic Work station, CAD Environment: Screen, Various tool bars and menus.

2.0 Selection of commands

Commands using toolbars, menus, command bar
Repeating a command, Nesting a command and modifying a command
Use of prompt history window and scripts, mouse shortcuts
Creating the drawing, Opening existing and damaged files, saving of drawing, setting up a drawing
Setting and changing the grid and snapping alignment, the Entity snaps

3.0 Use of viewing tools of CAD

Use of Scroll bar, pan command, and rotating view to move around within drawing, changing of magnification of drawing
Displaying of multiple views, the use of controlling visual elements like Fill, Text, Blips and Line weight

4.0 Use of coordinate systems of the drawing

Two dimensional coordinates such as Absolute, Cartesian, Relative Cartesian and Polar coordinates, the use of right-hand rule,
Three dimensional coordinates such as Spherical and Cylindrical Coordinates, the use of filters in two and three dimensions, Defining user Coordinate system

5.0 Creating simple and complex entities

Drawing of lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines, Creating and editing of point entities

Drawing of complex shapes like rectangles, polygons, polylines, Splines, donuts, planes, and adding of hatch pattern

6.0 Use the drawing information retrieving tools Measure, Divide, Calculate, Display, and Track

Measuring the intervals on entities, dividing the entities in to segments

Calculation of areas of defined by points, closed entities, and combined Entities, calculate the distance and angle between the entities

Displaying the information about the entities and drawing status

Tracking time spent working on a drawing.

7.0 Use the Modifying tools to modify the properties of entities

Entity selection and de selection methods, the Deletion of entities

Copying of entities within a drawing, between drawings, parallel copies, Mirroring entities and Arraying entities

The Rearranging of entities by Moving, Rotating and Reordering

The Resizing of entities by Stretching, Scaling, Extending, Trimming, and Editing the length

The Braking and joining of entities,The creating, modifying the groups and ungrouping of Entities

Editing of polylines: Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices,

The Exploding of entities, the Chamfering and Filleting of entities

8.0 Use the Text tool to create and formatting the various types of text Fonts and its styles

The creating, naming and modifying the text fonts, the Creation of line text, paragraph text, setting of line text style and its alignment

The Setting of Paragraph text style and its alignment, the Changing of line text and Paragraph text, the use of alternate text editor

9.0 Use Dimensioning concepts to create dimensions, Edit dimensions, Control dimension styles & variables and Adding geometric tolerances

The creating of linear, Angular, Diametral, Radial, Ordinate dimensions

The creating leaders and annotations, making dimensions oblique,

Editing the dimension text, controlling of dimension arrows and format

The Controlling of line settings and dimension text, the Controlling of dimension units, and dimension tolerance

10.0 2D Drawings

Using appropriate commands creation of 2D drawings of standard mechanical components

11.0 Organize the information on layers

Setting a current layer, layers color, line type, line Weight, print style

Locking and unlocking of layers, the layer visibility and layer printing

Setting of current line type, the loading of additional line types, creating and naming of line type, editing of line type

12.0 Isometric Views

Create Isometric views of simple objects

13.0 Use the Blocks, Attributes and External references to manage the Drawing Blocks

The purpose of a block, creating a block, inserting a block, redefining a block, exploding a block

Attribute

Editing attribute definitions, attaching attribute to blocks
Editing attributes attached to blocks, Extracting attributes information

External reference

Attaching, Removing, and Reloading of external references
The Binding, Clipping and changing the path of external references

14.0 Use the Layouts, Layout view ports, and customizing printing in CAD layout for printing

Layouts, Viewing of drawings in paper and model space, Displaying of model and layout tabs, creating the new layout, Reuse the layouts from other files, Manage the layouts in a drawing

Define layout view ports

Create layout view ports
Practice the viewing and scaling of layout view ports, Modify the layout viewports,

Select the appearance of print dialog

Setting the paper size and orientation, selecting a printer or a plotter
Setting the scale and view, choosing line weight

15.0 3D Drawings

3D drawings of standard components
Rendering of 3D images

REFERENCE BOOKS

4MCAD User Guide- IntelliCAD Technology Consortium (WWW.intellicad.org)

4MCAD Software:
1. 4MCAD Viewer,
2. 4MCAD Classic,
3. 4MCAD Standard,
4. 4MCAD Professional.

LIFE SKILLS
(Common to all branches)

Subject Title : Life skills
Subject Code : ME – 508
Periods per week : 03
Period per semester : 45

TIME SCHEDULE

Sl 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	1 1/2	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.
9.7 List the Factors affecting the creativity in Individuals.
9.8 Give the concept of Vertical thinking and lateral thinking.
9.9 Explain the importance of Lateral thinking.
9.10 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.

HYDRAULICS & PNEUMATIC LABORATORY PRACTICE

Subject Title : Hydraulics & Pneumatics Laboratory
Subject Code : ME-509
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE - Hydraulics Lab (ME – 509 A)

S. No.	Major Components	No. of Periods
1.	Venturimeter	03
2.	Pipe Friction	03
3.	Pelton Wheel	03
4.	Kaplan turbine	03
5.	Francis turbine	03
6.	Reciprocating pump	03
7.	Centrifugal Pump	03
	Total	**21**

OBJECTIVES
Up on Completion of the Lab the student shall be able to:

1.0 Practice the determination of C_d of Venturimeter
1.1 State the practical applications of venturimeter.
1.2 Record the manometric head readings from U-tube manometer
1.3 Record the time taken for collecting discharge by varying the discharge
1.4 Calculate the areas of the pipe and throat of the given venturimeter
1.5 Calculate coefficient of discharge of venturimeter.

2.0 Practice the determination of loss of head in a given pipe
2.1 Measure the length of the given pipe
2.2 Record the manometric head readings from U-tube manometer
2.3 Record the time taken for collecting discharge by varying the discharge
2.4 Calculate the loss of head through the pipe
2.5 Calculate the friction factor

3.0 Practice the determination of Power and Efficiency of Pelton Wheel
3.1 Identify the components of Pelton wheel
3.2 Start turbine by switching on jet of water slowly
3.3 Apply load steadily
3.4 Record load, speed
3.5 Calculate power and efficiency of turbine

4.0 Practice the determination of Power and Efficiency of Kaplan Turbine
4.1 Identify the components of Kaplan Turbine

4.2 Start turbine by giving input water supply
4.3 Apply load steadily
4.4 Record load, speed
4.5 Calculate power and efficiency of turbine

5.0 Practice the determination of Power and Efficiency of Francis Turbine

5.1 Identify the components of Francis Turbine
5.2 Start turbine by switching on jet of water slowly
5.3 Apply load steadily
5.4 Record load, speed
5.5 Calculate power and efficiency of turbine

6.0 Practice the determination of output Power and Efficiency of Reciprocating Pump

6.1 Identify the components of reciprocating pump
6.2 Record the suction and delivery pressures from pressure gauges
6.3 Record the time taken for collecting the discharge
6.4 Record the energy meter readings and calculate input power
6.5 Calculate the output power
6.6 Calculate the efficiency

7.0 Practice the determination of output Power and Efficiency of Centrifugal Pump

7.1 Identify the components of centrifugal pump
7.2 Record the suction and delivery pressures from pressure gauges
7.3 Record the time taken for collecting the discharge
7.4 Record the energy meter readings and calculate input power
7.5 Calculate the output power
7.6 Calculate the efficiency

Key competencies to be achieved by the student

Exercise	Key competency expected	Max. Marks	Marks awarded
Calculation of coefficient of discharge of Venturimeter	A. Maintain constant head B. Record readings of U-tube manometer without parallax error C. Record time taken for collection of specific quantity of water D. Calculate discharge and coefficient of discharge of venturimeter E. Repeat experiment for different heads (discharge)	A. 2 B. 2 C. 2 D. 4	
Determination of pipe friction	A. Ensure flow through pipe is full to remove air bubbles B. Record time taken for collection of specific quantity of water in tank C. Calculate pipe friction using formula	A. 1 B. 2 C. 2	
Pelton wheel	A. Start turbine by switching on jet of water slowly B. Apply load steadily C. Record load, speed D. Calculate power and efficiency of turbine E. Plot performance curves	A. 1 B. 1 C. 2 D. 3 E. 3	
Kaplan Turbine	A. Start turbine by switching on water supply B. Apply load steadily C. Record load, speed D. Calculate power and efficiency of turbine E. Repeat experiment by Varying load/speed; Plot performance curves	A. 1 B. 1 C. 2 D. 3 E. 3	

Exercise	Key competency expected	Max. Marks	Marks awarded
Francis Turbine	A. Start turbine by switching on water supply B. Apply load steadily C. Record load, speed D. Calculate power and efficiency of turbine E. Repeat experiment by Varying load/speed; F. Plot performance curves	A. 1 B. 1 C. 2 D. 2 E. 2 F. 2 Total 10	
Reciprocating Pump	A. Maintain steady flow in suction and delivery pipes B. Record suction and delivery pressure gauge readings C. Record time for collection of specific quantity of water, electrical meter reading (input power) D. Calculate indicated power and efficiency E. Vary the head (flow) and repeat experiment	A. 1 B. 2 C. 3 D. 2 E. 2 Total 10	
Centrifugal Pump	A. Maintain steady flow in suction and delivery pipes B. Record suction and delivery pressure gauge readings C. Record time for collection of specific quantity of water, electrical meter reading D. Calculate indicated power and efficiency E. Vary the head (flow) and repeat experiment	A. 1 B. 2 C. 3 D. 2 E. 2 Total 10	

COURSE CONTENT

1. Determination of Coefficient of discharge of Venturimeter.
2. Determination of major losses in pipes due to friction.
3. Determination of B.P. and efficiency of Pelton wheel.
4. Determination of B.P. and efficiency of Kaplan turbine.
5. Determination of B.P. and efficiency of Francis turbine.
6. Determination of I.P. and overall efficiency of a reciprocating pump
7. Determination of I.P. and efficiency of the Centrifugal pump

TIME SCHEDULE - PNEUMATICS LAB (ME – 509 B)

Sl No.	Major Topics	No. of periods
1.	Introduction to Pneumatic components	03
2.	Direct control of a single-acting cylinder	03
3.	Direct control of a double-acting cylinder	03
4.	Speed control of a double-acting cylinder	03
5.	Control of a double-acting cylinder with OR logic	06
6.	Control of a double-acting cylinder with AND logic	06
TOTAL		24

OBJECTIVES

Up on completion of the Lab the student shall be able to

1.0 Understand about the working of Pneumatic components.

1.1 Explain Pneumatics
1.2 Identify & List Symbols used in Pneumatic circuits.
1.3 Explain the phenomena of compressed air for transmitting power.
1.4 State Pascal's law.
1.5 List all the pneumatic applications.
1.6 Define Pneumatic actuator.
1.7 Classify the actuators.
1.8 Explain Linear actuators and Rotary actuators.
1.9 Define valve.
1.10 List different types of valves.
1.11 Explain the function of a valve.
1.12 Identify the components of a valve.
1.13 Identify about ports and positions.
1.14 List the Applications of valves.

2.0 Understand about the working of Direct control of a Single-acting cylinder

2.1 Draw the circuit diagram for actuating a single-acting cylinder.
2.2 Select the suitable valve.eg:3/2 valve.
2.3 Connect 3/2 valve to the actuator.
2.4 Actuate the single-acting cylinder by operating 3/2 valve.

3.0 Understand about the working of Direct control of a Double-acting cylinder

3.1 Draw the circuit diagram for actuating a Double-acting cylinder.
3.2 Select the suitable valve.eg:4/2 valve.
3.3 Connect 4/2 valve to the actuator.
3.4 Actuate the double-acting cylinder by operating 4/2 valve.

4.0 Understand about the working of Speed control of a Double-acting cylinder

4.1 Draw the pneumatic circuit for controlling the speed of double-acting cylinder

4.2 Select 4/2 or 5/2 valve and a throttle valve.

4.3 Connect 4/2 valve and throttle valve as per the circuit.

4.4 Operate the 4/2 valve and adjust the throttle valve to control the speed of double-acting cylinder

5.0 Understand about the working of Control of a Double-acting cylinder with OR LOGIC

5.1 Draw the pneumatic circuit for controlling the speed of double- acting cylinder using OR logic.

5.2 Select two 3/2 valves and a shuttle valve(OR Valve).

5.3 Connect 3/2 valves and OR valves to the double- acting cylinder as per the circuit.

5.4 Operate either one of the 3/2 valves to control the speed of double-acting cylinder.

6.0 Understand about the working of Control of a Double-acting cylinder with AND LOGIC

6.1 Draw the pneumatic circuit for controlling the speed of double-acting cylinder using AND logic.

6.2 Select two 3/2 valves and AND valve.

6.3 Connect 3/2 valves and AND valves to the double-acting cylinder as per the circuit.

6.4 Operate two valves simultaneously to control the speed of double- acting cylinder.

KEY competencies to be achieved by the student

S.No	Experiment Title	Key Competency
1.	Introduction to Pneumatics	• Identify the components of a pneumatic circuits.
2.	Direct control of a single-acting cylinder	• Select the suitable valve.eg:3/2 valve. • Connect 3/2 valve to the actuator.
3.	Direct control of a double-acting cylinder	• Select the suitable valve.eg:4/2 valve. • Connect 4/2 valve to the actuator.
4.	Speed control of a double-acting cylinder	• Select two 3/2 valves and a shuttle valve(OR Valve). • Connect 3/2 valves and OR valves to the double- acting cylinder as per the circuit.
5.	Control of a double-acting cylinder with OR logic	• Select two 3/2 valves and a shuttle valve(OR Valve). • Connect 3/2 valves and OR valves to the double- acting cylinder as per the circuit.
6.	Control of a double-acting cylinder with AND logic	• Select two 3/2 valves and AND valve. • Connect 3/2 valves and AND valves to the double- acting cylinder as per the circuit.

COURSE CONTENT

1.0 Identify the Pneumatic components and its applications.
2.0 An experiment on Direct control of a single-acting cylinder and to know the functioning of the equipment.
3.0 An experiment on Direct control of a double-acting cylinder and to know the functioning of the equipment.
4.0 An experiment on Speed control of a double-acting cylinder and to know the functioning of the equipment.
5.0 An experiment on controlling the speed of a double-acting cylinder with OR logic and to know the functioning of the equipment.
6.0 An experiment Control speed of a double-acting cylinder with AND logic and to know the functioning of the equipment.

REFERENCE BOOKS

1. Course Material on Basic Pneumatic Controls- ATI, Vidyanager, Hyderabad
2. Course Material on Applications of Pneumatics- TTTI, Extension centre, Hyderabad(NITTTR-ECH)

FIELD PRACTICES

Subject Title : Field Practices
Subject Code : ME – 510
Periods Per Week : 06
Periods Per Semester : 90

TIME SCHEDULE

1. Production

Project	Skill Exercise	Number of Periods
Measuring sizes with a vernier caliper	• Measure the outside diameter, Inside diameter of a bore • Measure the width of a tongue • Measure the length of a step • Measure the depth of a stepped bore	04
Filing practice	• File the of Drill base of 151x101x6 on all sides to remove material 1 mm	04
Drilling practice	• Drill through holes of 4XØ6 (@ 6,6) from all the corners of the Drill base of 150x100x5 (Repeat the same procedure for Drill Guide)	04
The above practices can be exercised by considering similar components fulfilling the above requirements		
Gear hobbing	• Perform gear hobbing on a given MS job with OD Ø74, ID Ø17 and thickness 10mm, Take 1 module as teeth thickness (or) Performing spur gear cutting on a given MS job with OD Ø74, ID Ø17 and thickness 10mm, Take 1 module	06
Manufacture of solid shaft	• Turn and face the given cylindrical rod according to the dimensions • Cut the key way on the above shaft for the flat key • Make the seat to mount the bearing on the above shaft	04
Cutting splines on the shaft	• Turn and face the given cylindrical rod according to the dimensions • Index the job using dividing head • Cut the splines on the above shaft on milling machine	04
Cutting straight teeth on the gear blank	• Index the job using dividing head • Cut the teeth on the gear blank on milling machine	04

1. Production (contd,.....

Project	Skill Exercise	Number of Periods
Manufacturing of square threaded screw	• Turn and face the given cylindrical rod according to the dimensions • Cut the square threads on the rod for given pitch using back gear of the lathe	04
Preparing template for involute gear tooth	• Understand the law of gearing • Understand the properties and importance of involute profile	04
Casting of flange coupling	• Prepare the pattern • Prepare the mould and core for the flange coupling • Drill the holes on the casted flange • Cut the key way in the hub of flange	04

2. Fabrication

Project	Skill Exercise	Number of Periods
Fabrication of Almirahs and trunk boxes	• Measure the gauge of the sheet with gauge plate • Produce marking on sheet • Cut the sheet as per marking • Bend , weld the sheets • Apply primer and paint	04
Critical cases	• List out the sequencing of job planning when you have received a oversized component	04
Practically with the support of the process sheet proforma adopted. Eg:1.Supporting of heavy weight job by using Jigs & Fixtures 2.If the dia.of the rod is more while testing on a UTM the suitable jaws will be replaced for holding		

3. Servicing

Project	Skill Exercise	Number of Periods
Repair and Maintenance of	• Engines Eg:Differential,Gear box & M/c parts & its components,etc	04
	• Refrigeration and Air conditioning test rigs Eg:Evacuating & charging of the Refrigerant,etc	04
	• Pumps Eg:Inlet & outlet valves,foot valve,gland of a pump,etc.	04
The viist may arranged to the following: • Tyre servicing centers • Servicing and maintenance of Automobiles • Refrigeration system in dairies • Thermal power plants • Workshops (RTC)		

4. Human Resource management

Project	Skill Exercise	Number of Periods
Manpower requirement	• Planning and Assessing man power Student will be guided to prepare the man power requirement in the laboratories by assessing the demand. Eg:Boring of a component with an authorised process sheet,etc Skilled technician-1,Store keeper-1,Transport Asst.-1,Helper-1	06

5. Inventory management

Project	Skill Exercise	Number of Periods
Material requirement	• Handle the Store House and its transactions • Select the Appropriate Storehouse Equipment • Use Appropriate methods to Preserve the Store house material • Practice Replenishment of material • Practice Identification of store materials • Maintain Appropriate Records in Store Accounting • Use Material Budgeting Techniques • Use Techniques of Inventory control • Practice Purchasing and Disposal procedures • Use Quality control and Value Analysis • Practice Negotiation procedures • Use Transportation and Disposal procedures	08
Note: The student has to identify the material requirement in his field of working and should have knowledge on purchasing, store maintenance and disposal of unserviceable & outdated components & equipment.		

6. Case studies

Project	Skill Exercise	Number of Periods
Conduct energy audit for workshop/Home/SSI unit	• Collect information about energy utilization in a local industry. Identify energy saving measures (to be) taken up in the industry	04
Note: The viist may arranged to appropriate industry to collect the information		

6. Safety

Project	Skill Exercise	Number of Periods
Mock drill	• Rescue the persons from crash • Rescue the persons from Fire accident	06
Eg:Fire Accident • Knowledge & practice on fire extinguishers • Using of sand buckets • Informing to the fire fighting agency.		
First Aid	• Practice the First aid procedures	04
Eg:Hitting of a shaper ram • Cleaning the injured area with spirit • Applying betadin over injury • Temporary bandage over the injury • Moving person to nearest hospital • Artificial Respiration incase of electrical shock,etc		

SKILLS
Up on completion of the skill session the student shall be able to

1.0 Measure the outside and inside diameters of a bore

- Check the condition of the caliper
  - Confirm the looseness of the locking screw
  - Clean every part of the caliper with rags
  - Close the jaws, and examine the opening through light
  - Check whether the zero points coincide

Measure Outside diameter:

- Open out the movable jaw slightly more than the measurable size
- Place the jaws at right angles to the axis of the work piece
- Close the jaw over the work piece such that the nib of the jaws just slip from the point of contact
- Lock the nib and record the reading

Measure Inside diameter:

- Open out the ribs of the vernier caliper slightly less than the measurable size.
- Place the nibs inside the bore surface such that the nibs are parallel to the axis of the work piece and centre of the bore
- Open out the nibs so as to make contact on the bore surfaces, and swing the nibs to measure the maximum value of the bore size
- Lock the nib and record the reading

2.0 File the of Drill base of 151x101x6 on all sides to remove material 0.5 mm

- Wear the apron
- Check the raw material (Drill base) size as per the work sheet (151x101x6)
- Select the suitable height of the vice
- Clamp the work piece centrally across the base firmly in position
- File surfaces flat and parallel to an accuracy of ±0.05 mm
- File angle to **90^0** to a try-square accuracy
- Check for flatness and squareness using tri-square
- Measure the specifications of job is to be 150x100x5

3.0 Drill through holes of 4XØ6 (@ 6,6) from all the corners of the Drill base of 150x100x5

- Wear the apron
- Follow safety and procedural precautions
- Check the Drill base for its size
- Mark and locate the centres for the holes to be drilled
- Mount the job in a machine vice, using parallels and clamp it securely
- Set the work table in such a manner that the drill can be fixed and removed without disturbing the vice or table
- Fix a centre drill on the chuck in a drilling machine spindle and align with the centre mark on the job
- Spot the hole location with the centre drill
- Remove the centre drill and fix the required drill of Ø6 without disturbing the vice or table
- Perform an operation of drilling a hole of a diameter of Ø6 up to a depth of 1mm for first go
- Operate a coolant pump
- Drill through hole as per requirement

4.0 Perform gear hobbing on a given MS job with OD-Ø74, ID-Ø17 and Thickness 10mm, Take 1 module as teeth thickness

- Wear the apron
- Check the raw material specifications OD-Ø74, ID-Ø17 and thickness 10mm size as per the work sheet
- Fix the job on appropriate mandrel using watchers and ensure that the one side of mandrel to be fitted in the cullet of the Miller and another side should be tightened using nut
- Fix the 1 module cutter(Gear hobber) specified as $0^0.8^1$ $M20^0$ LA , 0^0 57^1 80^0 PA
- Set the index table to suit the cutter specifications
- Set the feed as 0.15 mm / rev as per the Gear train chart
- Set the speed as 624 m/min for the material MS EN8 as per the speed chart
- Switch on the machine to perform the operation i.e Gear hobbing
- Ensure that the operation is completed in 08 min
- Take care of safety and procedural precautions
- Remove the chips from the job

- Clean the machine
- Remove the job with mandrel from machine cullet

5. Understand the Material Requirement plan (Note**:** The faculty in charge needs to plan appropriate situation to accomplish the given exercises)

- **Handle the Store House and its transactions**
  1. Draw a typical layout of storeroom considering
     a) Optimum utilization of space
     b) Easier accessibility to all materials
     c) Maximum security of all materials
     d) Minimization of spoilage and damage
  2. Select appropriate Store depot based on their function and utility
     a) For minimum possible stocks of spares, Equipments, Tools
     b) If regular supplies are received, Un-necessary hold- ups and delays in work are avoided
        - CSD – Central Store Depot
        - BSD – Branch Store Depot
        - TSD – Tool Store Depot
- **Select the Appropriate Storehouse Equipment**
  1. Identify storeroom equipment for a given materials
  2. Group the articles according to their nature of storage
  3. Arrange appropriate racks to store various materials like Bar, Tubes, Angles, Plate, Sheet, Tyre and Drum
  4. Use Various measuring equipment to receive the different types of material
  5. Which type of material handling equipment do you select, If you are given the following materials
     a) Bricks
     b) Reels of wire
     c) Drums
     d) Bales of paper
  6. Which type of material handling equipment do you select to lift the machines of 2 to 6 tonnes up to the height of 40 feet

- **Use Appropriate methods to Preserve the Store house material**
  1. Preserve the following material according to the manufacturing criteria, degree of temperature and duration
     1. Metals
     2. Timber
     3. Textiles
     4. Rubber goods
     5. Chemicals
     6. Leather goods
  2. Maintain Replenishment of stock by fixing
     a) Maximum level
     b) Minimum level
     c) Order level
     d) Danger level

- **Practice Replenishment of material**
  Represent graphically the Working stock and Safety stock in Replenishment of material

- **Practice Identification of stores**
  1. Classify and Use Identification system for a given Raw material, Consumables, Machines and Equipment, Inflammable stores, Chemicals, Furniture, General stores, Scrap materials, Packaging materials, Fuel stock

- **Maintain Appropriate Documents in Store Accounting**
  1. Prepare the Documents for recording of **Receipt of material**
     a) Material Receipt book
     b) Material Receipt Note
     c) Daily Receipt Voucher
     d) Damage/Shortage/Excess Report
     e) Package slip
     f) Bin Card
     g) Stock Ledger
     h) Stock Identification Card
  2. Prepare the Documents for recording of **Inspection of material**
     a) Purchase order
     b) Daily Receipt Voucher
     c) Inspection Note
     d) Rejection Note
     e) Bin Card
     f) Stock Ledger
     g) Stock Identification Card
  3. Prepare the Documents for recording of **Issue of material**
     a) Material Requisition Slip
     b) Bin Card
     c) Gate pass
     d) Stock Ledger
     e) Stores Advice Note
  4. Prepare the Documents for recording of **Verification of Stores**
     a) Stock- Taking Sheet
     b) Stock Valuation Sheet
     c) Bin Card
     d) Material Transfer Note
     e) Material Return Note
     f) Stock Ledger
  5. Prepare the Documents for recording of **Material Control**
     a) Stock Day sheet
     b) Stock Ledger Card
     c) Kardex Card

- **Use Material Budgeting Techniques**
  1. Practice the Estimation of Consumption and Purchase of materials of a given Organization

2. Use the Techniques for Drawing up a Material Budget of a given Organization.

- **Use Tools and Techniques of Inventory control**
  1. Practicing of Estimation of Consumption and Purchase of materials of a given Organization
  2. Use the Techniques for Drawing up a Material Budget of a given
- **Use Tools and Techniques of Inventory control**

1. Practice the Estimation of Inventory carrying cost, Stock-out Cost and Control levels of a given Organization.
2. Use the Tools and Techniques of Inventory control
3. Prepare the Stock Control Card

- **Practice Purchasing and Disposal procedures**

1. Practicing the purchasing principles of six 'R's.
   a) Right Quality
   b) Right Quantity
   c) Right Time
   d) Right Price
   e) Right place, and
   f) Right Source
2. Use the Various Order Quantities in purchasing and Disposal
3. Practicing the use of purchasing systems considering legal aspects of purchasing
4. Practicing the use of the following documents in purchase procedure
   a) Purchase Requisition
   b) Purchase Enquiry
   c) Suppliers Quotation
   d) Comparative statement
   e) Purchase Order
   Bill / Invoice

- **Use Quality control and Value Analysis**

1. Practicing the use of the following Methods of describing quality of the product
   a) Samples
   b) Brand name
   c) Specifications
   d) Grades
2. Use the Five stages of Quality control for an effective accomplishment of Onerous task
3. Practicing the use of Techniques of Value Analysis in reducing the product cost
   a) EKCHANGE, and
   b) MISS

- **Practice Negotiation procedures**
    1. Practice the Phases of Negotiation

  [Note: Arrange a practicing session between two parties]

- **Use Transportation and Disposal procedures**

  1. Practicing the following tasks to be carried out for effective transportation of goods of an enterprise

  Estimation of

  a) Cost of transportation
  b) Commodity value
  c) Size of Shipment
  d) Distance control
  e) Type of Transport
  f) Speed

  2. Practicing the appropriate Disposal procedures

  a) Surplus Items
  b) Obsolete Items
  c) Scrap Items

DIPLOMA IN MECHANICAL ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATIONS
VI Semester/(THIRD 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:								
ME-601	Entrepreneurship and Project Management	4	-	60	3			100
ME-602	Refrigeration & Air Conditioning	5	-	75	3			100
ME-603	Energy Sources & Power Plant Engineering	4	-	60	3			100
ME-604	CAM	3	-	45	3			100
ME-605	Measurement & Control Systems	5	-	75	3			100
ME-606	Automobile Engineering	4	-	60	3			100
PRACTICAL:								
ME-607	CAM Lab	-	4	60	3			100
ME-608	T.E and R & AC Lab Practice	-	3	45	3			100
ME-609	Manufacturing &Servicing and Maintenance Lab Practice	-	3	45	3			100
ME-610	Project work	-	7	105	3			100
	TOTAL	25	17	630				1000

ENTREPRENEURSHIP AND PROJECT MANAGEMENT

Subject Title : Entrepreneurship and Project Management
Subject Code : M–601
Periods/Week : 04
Periods per Semester : 60

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Type Questions
1.	Role of Entrepreneur and Entrepreneurial Development	12	26	02	02
2.	Marketing ,Sales & Feasibility study	12	26	02	02
3.	Industrial legislation & safety	18	29	03	02
.4	Introduction to ISO 9000 & T.Q.M.	18	29	03	02
Total		60	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to

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

1.1 Explain the concepts of Entrepreneurship.
1.2 Define the word entrepreneur.
1.3 Explain the role of Entrepreneurship.
1.4 List the qualities of an entrepreneur.
1.5 Explain the requirements of an entrepreneur.
1.6 Outline the expectations of Entrepreneurship.
1.7 Explain the role of entrepreneurs in promoting Small Scale Industries.
1.8 Explain the details of self-employment schemes.
1.9 Explain the method of product selection.
1.10 Explain the method of site selection.
1.11 Outline the method of plant layout.
1.12 State the needs for a planned and co-ordinated effort.
1.13 State the importance of follow up.
1.14 Describe the small business scheme.
1.15 List the financial assistance programmes.
1.16 List the organisations that help an entrepreneur.

2.0 Understand marketing, sales and feasibility study.

2.1 Explain marketing functions.
2.2 Explain Sales function.
2.3 List out market conditions
2.4 Differentiate Sellers and Buyers' market.
2.5 Differentiate monopoly, oligarchy, and perfect competition.
2.6 Explain the conduct of demand surveys
2.7 Explain the conduct of a market survey
2.8 Differentiate product and production analysis.
2.9 List the input materials, i.e. Bill of materials

2.10 Define the main policy requirements
2.11 Explain the selection of site
2.12 Evaluate Economic and Technical factors
2.13 Prepare feasibility study
2.14 List different products currently in demand with market or industry
2.15 Explain Role of advertising, media of advertising and selection of media

3.0 Comprehend the provisions of industrial legislation in India. & Safety procedures

3.1 Describe employer and employee relations.
3.2 Describe the mechanics of Trade Unions.
3.3 Describe mechanics of settlement of in outs.
3.4 Explain the significance of collective bargain.
3.5 List Welfare activities.
3.6 List subsidy schemes.
3.7 Explain the total welfare concept.
3.8 List the rights and responsibilities of employees and employers.
3.9 List the salient features of Indian Factories Act.
3.10 List the salient features of Minimum Wages Act.
3.11 List the salient features of Industrial Disputes Act.
3.12 List the salient features of Workmen's Compensation Act
3.13 List the salient features of E. S .I. Act.
3.14 List the salient features of consumer protection rights Act
3.15 Explain the importance of safety at Work place.
3.16 Explain the significance and mechanics of safety education.
3.17 Explain hazard and accident
3.18 List different hazards in the Industry
3.19 Explain the causes of accidents
3.20 Explain the direct and indirect cost of accidents.
3.21 List types of fire extinguishers
3.22 Describe the method of artificial Respiration.
3.23 List provisions of Indian Electricity Rules laid in the electricity act1923.

4.0 Understand ISO 9000 & TQM.

4.1 Explain the concept of quality.
4.2 List the quality systems and elements of quality systems.
4.3 State the principles of quality Assurance.
4.4 State the Indian Standards on quality systems.
4.5 List the evolution of ISO standards.
4.6 Explain ISO standards and ISO 9000 series of quality systems.
4.7 State the constituents of ISO 9000 series of standards for quality systems.
4.8 State the outstanding features and drawbacks of ISO 9000 series of standards.
4.9 List the beneficiaries of ISO 9000.
4.10 Explain 5-S principles and ZERO DEFECT.

COURSE CONTENT

1. **Role of Entrepreneur & Entrepreneurial Development.**
   Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, Economic ordering quantity, Cost Elements of Cost, Contribution, Break even analysis, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, Hoist, Cranes, conveyors, trucks, fork trucks.

2. **Marketing, Sales & Feasibility Study**
   Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligarchy, perfect competition, Budgets, Pricing Policies. Market Survey, Product and production Analysis, Materials input, Manpower, Location, Economic and Technical Evaluation, preparation of Feasibility study reports, - different products – Mechanical, Electrical, Electronics, consumer items, Consumer desires etc.

3. **Industrial Legislation and safety**
   Employer – Employee relations, Trade, Union Settlement of disputes, collective bargaining, Welfare activities, subsidies, Total Welfare concept, rights and responsibilities and Employers and employees. Salient features of (i) Indian Factories Act, (ii) Minimum Wages Act, (iii) Industrial Disputes Act, (iv) Workmen's compensation Act, (v) E.S.I Act. (Vi) Consumer protection act Important of Safety at work places, Safety Education, Hazards, causes of accidents, Cost of accidents, Fire Extinguishers, Artificial respiration, Indian Electricity rules.

4. **Introduction to ISO 9000 and TQM**
   Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Juran, Kooru Ishikawa, Genichi Taguchi, Shigco Shingo.Quality systems –
   Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, quality control and quality assurance
   Elements quality systems : Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser – supplied product, product identification and traceability, process control, Inspection and testing. Principles of quality assurance – Definition of quality assurance.
   Indian standards on quality systems – Main features of IS 13999 : 1990, IS 14000 : 1990, IS 14004 : 1990, IS 14001: 1990, IS 14002 : 1990, IS 14003: 1990. The necessity of International standards – Evolution of ISO. **5-S** principles – importance – meaning – approach – benefits
   Various standards under ISO – Outstanding features of ISO 9000 series of standards – ISO 9000 Phenomenon ISO 9000 series of quality systems – Constituents of ISO 9000 series of standards for quality systems.
   Drawbacks of ISO 9000 series of standards, list the beneficiaries of ISO 9000

REFERENCE BOOKS

1. Industrial Engineering and Management -by O.P Khanna
2. Production Management- by Buffa.
3. Engineering Economics and Management Science - by Banga & Sharma.
4. S.S.I Hand Book by S.B.P. Publishers.
5. Personnel Management by Flippo.
6. Entrepreneurship – by NITTT&R, Chennai.
7. Industrial safety management- by Deshmukh (MGH Publishers)

REFRIGERATION AND AIR CONDITIONING

Subject Title : Refrigeration & Air conditioning
Subject Code : M-602
Periods/Week : 05
Periods per Semester : 75

TIME SCHEDULE

Sl. No.	Major Topics	No. of Periods	Weightage	Short	Essay
1.	Fundamentals of Refrigeration & Air Refrigeration	10	13	01	01
2.	Vapour compression & Vapour absorption Refrigeration Systems	18	26	02	02
3.	Refrigerants, Refrigeration equipment & Applications	16	26	02	02
4.	Fundamentals of A/c & A/c Equipment	08	13	01	01
5.	Psychrometry, Cooling & Heating loads	14	19	03	01
6.	Applications of A/c, Servicing and maintenance of Refrigeration and A/c equipment	09	13	01	01
Total		**75**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the various methods of Refrigeration.

1.1 Define refrigeration.
1.2 Explain the history of refrigeration.
1.3 Explain different methods of refrigeration such as ice, dry, ice, steam jet water refrigeration, liquid nitrogen refrigeration.
1.4 Express unit of refrigeration in Terms of ton of refrigeration.
1.5 Define coefficient of Performance.
1.6 Evaluate power required per ton of refrigeration.
1.7 Explain the principle of open air refrigeration.
1.8 Analyse Carnot refrigeration Cycle.
1.9 Analyse Bell-Coleman air-cycle.
1.10 Calculate COP in above cases.
1.11 Explain principle of closed air Refrigeration.
1.12 Distinguish between open air system with closed air system.

2.0 Understand Vapour Compression, and Vapour absorption Refrigeration Systems.

2.1 Explain the importance of vapour compression system.
2.2 Explain vapour compression refrigeration with the help of T-S and P-H diagrams.
2.3 Distinguish between wet and dry compression.
2.4 Explain the effects of under cooling and super heating and effect of pressure changes on COP.

2.5 State the use of flash chamber and accumulator.
2.6 Calculate COP of plant working on vapour compression system.
2.7 Explain principle of simple vapour absorption systems.
2.8 List refrigerant – Absorber pairs in the above system.
2.9 State the desirable properties of refrigerants absorbers.
2.10 Describe the working principle of vapour absorption refrigeration system with the help of a legible sketch.
2.11 Calculate "COP" of the ideal vapour absorption system.
2.12 Differentiate two fluid system and three fluid absorption system.
2.13 Explain working of solar powered refrigeration system with the help of a legible sketch.
2.14 Explain the working of Electrolux refrigeration with the help of a legible sketch.
2.15 Explain the working of Lithium Bromide absorption refrigeration system with the help of a legible sketch.

3.0 Understand the Refrigerants, Refrigeration Equipment and applications of Refrigeration

3.1 Distinguish between primary and secondary refrigerants.
3.2 State the requirements of Refrigerants.
3.3 List the properties of refrigerants.
3.4 List the commonly used refrigerants.
3.5 Explain different types of compressors such as reciprocating and rotary
3.6 State the function of condenser and classify the condensers
3.7 Explain different types of condensers such as shell & tube, shell and coil, fin and tube, flooded tube type with the help of a legible sketch..
3.8 State the function of evaporator and classify the evaporators
3.9 Explain various types of evaporators such as shell & tube, shell and coil, fin and tube, flooded tube type with the help of a legible sketch.
3.10 Explain the functions of various types of expansion devices such as capillary tube, thermostatic expansion valves and solenoid valves with the help of a legible sketch.
3.11 Explain the refill type and throw away type dryers.
3.12 Explain the working of domestic refrigerator with the help of a legible sketch.
3.12 Explain the working of ice Plant with the help of a legible sketch.
3.13 Explain the working of water cooler with the help of a legible sketch.
3.14 Explain the working of cold storage with the help of a legible sketch.
3.15 Explain the production of dry ice with the help of a legible sketch.

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4.0 Understand fundamentals of Air conditioning and Air conditioning equipment

4.1 Define air conditioning
4.2 List modern applications of A/c.
4.3 Explain Air conditioning as applied to human comfort.
4.4 Explain the functions of fans, ducts, filters (wet, dry, electric & viscous types) C.F dust collector with the help of a legible sketches.

4.5 Explain the use of heating and cooling coils.
4.6 Explain the air distribution system.

5.0 Understand Psychrometry, Cooling and Heating loads.

5.1 Define the terms humidity, Relative humidity, dew point, DBT & WBT, Absolute humidity, humidity ratio.
5.2 Explain the features of psychrometric chart.
5.3 Plot psychometric processes on the above chart.
5.4 Explain the psychrometric patterns for heating and cooling processes.
5.5 Define Fundamentals of Heat transfer – Conduction, convection and Radiation.
5.6 Compute cooling load – components involved in cooling load.
5.7 Compute heating load – components involved in heating load.
(Problems on load calculations are Omitted)

6.0 Appreciate the applications of A/C.

6.1 Explain the working of air coolers.
6.2 Explain the working of window air – conditioner.
6.3 Explain the working of cooling tower installations.
6.4 Explain the working of A/c systems viz., centralised and unitary systems.
6.5 Explain the working of summer/winter/year round air conditioners.
6.6 Explain the symptoms of gas shortage.
6.7 Explain the methods of leakage detection.
6.8 List the causes of common Breakdown.
6.9 List the remedial measures for breakdown.

COURSE CONTENT

REFRIGERATION

1.0 Fundamentals of Refrigeration and Air Refrigeration

Introduction – Definition and meaning of refrigeration, methods of refrigeration – unit of refrigeration – COP.

Thermodynamic analysis of Refrigeration cycles, Carnot refrigeration cycle – Air refrigeration cycle (Bell – Coloman) open air and closed air systems of refrigeration.

2.0 Vapour Compression and absorption Refrigeration Systems.

Principle & analysis of vapour compression refrigeration system with the help of T-S & P-H diagrams – wet, dry and superheated compression – Refrigerating effect – Effect of pressure changes on C.O.P., effect of sub – cooling of condense on COP and capacity – effect of super heating of vapour before compression – flash chamber and accumulator.

Principle of vapour absorption refrigeration, C.O.P of vapour absorption system - Refrigerants and absorbents – their properties – two fluid & three fluid systems – solar powered refrigeration system - Electrolux refrigeration – comparison of vapour absorption and vapour compression systems.

3.0 Refrigerants, Refrigeration Equipment and applications

Primary and secondary refrigerants with examples – requirements of a refrigerant – properties of refrigerants – Commonly used refrigerants

Compressors – types of compressors.Condensers – types of condensers.
Evaporators – types of evaporators.Expansion devices – types of expansion devices – Refill type and throw away type driers.
Domestic refrigerator – ice plant, Water cooler – cold storage – production of dry ice.

AIR CONDITIONING

4.0 Fundamentals of A/c and A/c equipment

Comfort air conditioning: Human comfort – effective temperature – Factors governing effective temperature conditions that effect body heat – comfort chart.
A/C Cycle equipment such as fans, supply ducts, outlets, return outlets and ducts, filters & dust collectors heating/cooling coil-Air distribution.

5.0 Psychrometry, Cooling and Heating

Psychrometry – Psychrometric terms – Psychrometric chart – Solving problems with psychrometric chart – Practical applications of psychrometric terms – Psychrometric processes. Psychrometric patterns for heating & cooling processes.
Conduction, convection and Radiation definitions - Heating and cooling load .

6.0 Applications of A/C, Servicing and maintenance of Refrigeration and A/c equipment

Applications of A/C: Air coolers – window air conditioner – (split & package type) – cooling towers – A/C systems: summer/winter/year round A/C, central A/C system – unitary system.
Food preservation – freeze drying.
Servicing & Maintenance of Refrigeration and A/c Equipment – trouble shooting.

REFERENCE BOOKS

1. Refrigeration and Air Conditioning – by Domakundavar
2. Refrigeration and Air Conditioning – by Arora (MGH Publishers)
3. Basic Refrigeration and Air conditioning - by P N Ananthanarayana (MGH Publishers)
4. Refrigeration and Air Conditioning – by Sarao & Gabi
5. Refrigeration and Air Conditioning – by Dosatt
6. Refrigeration and Air Conditioning – by Stoecker
7. Trouble shooting of Refrigeration & -by Ananthanarayana Air conditioning

ENERGY SOURCES AND POWER PLANT ENGINEERING

Subject Title : Energy Sources and Power Plant Engineering
Subject Code : M-603
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

S. No.	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Introduction of Renewal Sources of Energy	04	03	01	-
2	Solar and Wind Energy	12	26	02	02
3	Fuel Cells and MHD Generator	10	13	01	01
4	Bio and Tidal Energy	12	26	02	02
5	Thermal and Nuclear Power Plants	16	29	03	02
6	Environmental Pollution	06	13	01	01
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Up on the completion of the course the student shall be able to

1.0 Understand the need of Energy Sources

1.1 State various energy sources, give examples
1.2 Classify energy sources as renewable and non renewable energy
1.3 State Advantages and disadvantages of renewable and non renewable energy sources
1.4 Appreciate the need of renewable energy sources
1.5 State the different types of renewable energy sources

2.0 Understand the concept of Solar and Wind Energy

2.1 State the amount of solar radiation reaching the earth's surface
2.2 Determine the solar constant
2.3 State the principle of measuring solar radiation by pyranometer and pryheliometer
2.4 State the principle of conversion of solar radiation into heat.
2.5 Explain the function of liquid flat collector
2.6 Explain the working principle of solar air heater with a legible sketch
2.7 State the applications of solar air heater
2.8 Identify different types of concentrating collectors
2.9 Explain the working principle of concentrating collector (focusing type, parabolic trough collector and flat plate collectors with plain reflectors).

2.10 State the different methods of storing solar energy
2.11 Explain the methods of sensible heat, latent heat and thermo chemical storage.
2.12 Explain the working principle of solar pond with a sketch
2.13 State the applications of solar pond
2.14 Explain with the help of sketch the construction details and working principle of different types of solar water heater
2.15 Explain with the help of sketch the construction details and working principle of solar space heater
2.16 Explain with the help of sketch the construction details and working principle of absorption refrigerator type solar space cooler
2.17 Explain with the help of sketch the construction details and working principle of solar still
2.18 Explain with the help of sketch the construction details and working principle of cabinet and connective type of solar drier
2.19 Explain with the help of sketch the construction details and working principle of Box type solar cooker
2.20 State the principle of photo –voltaic conversion.
2.21 State the working principle of solar cell
2.22 Explain the conversion energy and current voltage characteristics of solar cell.
2.23 State the use of photo voltaic cell for power generation
2.24 Explain the solar photovoltaic arrays
2.25 Explain the solar water pumping system with a sketch
2.26 State the advantages and limitations of solar energy conversion.
2.27 Explain the power available in the wind and force caused by it on the blades.
2.28 State the collection of wind data and estimate the energy
2.29 State the different considerations for sight selection for installing wind mill.
2.30 Identify the basic components of a wind mill
2.31 Explain the construction details on the working principle of the wind mill
2.32 State the differences between horizontal axis and vertical axis type wind mills
2.33 Define the terms co-efficient of performance and tip speed ratio
2.34 Plot curves to indicate the variation of co - efficient of performance with tip speed ratio.
2.35 Explain the method of generation of electricity by wind mill

3.0 Comprehend Fuel Cells and MHD Generator

3.1 State the working principle of fuel cell
3.2 Explain the construction details and working principle of Bacan's High pressure fuel cell with a legible sketch
3.3 State the different types of fuels used in fuel cells
3.4 Explain the working principle of aluminium air fuel cell with a legible sketch
3.5 Explain the working principle of MHD Generator a legible sketch

4.0 Understand Bio and Tidal Energy

4.1 Define the meaning of bio-mass and bio-gas
4.2 State the principle of bio-gas generation
4.3 State the chemical composition and properties of bio-gas
4.4 List the applications of bio-gas

4.5 List the different types of bio-gas plants
4.6 Explain the construction details and working principle of fixed dome type and floating dome type bio-gas plants with sketches
4.7 State the different materials used for bio-gas generation
4.8 Express bio-gas plant capacity
4.9 State the methods of generator control and load control
4.10 Identify the energy available in tides and its usefulness in conversion
4.11 State the working principle of tidal power plant
4.12 State the different operation methods of utilisation of tidal energy
4.13 Explain single basin and double basin arrangements
4.14 State the site requirements for installation of tidal power plant
4.15 State the advantages and limitations of tidal power generation

5.0 Analyse the elements of Thermal and Nuclear Power Plants.

5.1 Draw the layout of a thermal power plant.
5.2 Explain the layout of thermal power plant
5.3 Locate the Boiler, superheater, turbine , Electric Generator, Condenser and hot well pump in the layout.
5.4 Explain function of circulating water pump, Economiser, Air pre heater, Soot – Blower.
5.5 Explain the dust extraction in Electrostatic precipitator.
5.6 Explain about the ash removal, water cooling.
5.7 Explain about the feed water treatment.
5.8 Explain about the coal handling
5.9 Explain about the coal storage.
5.10 Identify the fuel handling equipment.
5.11 Trace the ash disposal system.
5.12 State the necessity of condensing the steam
5.13 State the principle of condensation in condenser
5.14 List different types of condensers
5.15 Explain the chain reaction
5.16 Explain the process of nuclear fission and nuclear fusion.
5.17 List nuclear fuels
5.18 State the characteristics of atomic power plants
5.19 Explain the principle of working of a nuclear reactor
5.20 Classify the nuclear reactors
5.21 Explain with the help of legible sketch the constructional details and the working principle of : (i) PWR (ii) BWR power plant.
5.22 Explain with the help of legible sketch the constructional details and the working principle of: (i) GCR (ii) Liquid metal - C.R. Power plant.
5.23 Explain about the nuclear power in India.

6.0 Understand the concept of environmental pollution

6.1 Explain the various pollutants and their effect on the environment viz.,
i) Particulate pollutants.
ii) Solid waste pollutants.
iii) Gaseous pollutants.
6.2 Explain the effect of thermal pollution
6.3 Explain green house gases and green house effect
6.4 Explain the phenomena of global warming

6.5 Explain the effects of nuclear radiation
6.6 Explain the disposal of nuclear waste
(i) Ground (ii) Air (iii) Ocean

COURSE CONTENT

1.0 Introduction: Various energy sources, Examples for energy sources, advantages and disadvantages, Need for alternate sources of energy – types of non conventional (renewable) energy sources – solar energy, wind energy, energy from bio- mass and bio-gas, tidal and wave energy, hydrogen energy, fuel cells

2.0 Solar and Wind Energy

Solar Radiation: Solar constant – solar radiation at earth's surface – instruments for measuring solar radiation – pyranometer, pryheliometer.

Solar Energy Collection

Principle of conversion of solar radiation into heat
liquid flat collectors - solar air heater – Application of solar air heater – concentrating collectors – (focusing type) – parabolic collector –plate collectors with plane reflectors.

Solar Energy Storage

Methods of storing solar energy – sensible heat storage , latent heat storage and thermo chemical storage – solar pond – working principle and description of solar pond with a schematic diagram – applications of solar pond.

Solar Energy Applications

i) Solar water heater – natural circulation type and forced circulation type.
ii) Solar space heater – passive type and active type
iii) Solar space cooling – absorptive refrigeration system
iv) Solar still, Solar drier – cabinet type and convective type and Solar cooker

Photo voltaic conversion

solar cell – working principle – conversion efficiency and current voltagecharacteristics of a solar cell – photo voltaic cell for power generation solar photo voltaic arrays – solar water pumping system – Advantages and disadvantages of solar energy.

Wind Energy

Introduction – power in the wind forces on the blades – wind data – energy estimation – site selection considerations – basic components of a wind mill – construction details and working principles – types of wind mill – horizontal axis type and vertical axis type – variation of co efficient of performance with tip speed ratio – electric generation by wind mill – generator control – load control.

3.0 Fuel Cells and MHD Generator

working principle – Bacan's High pressure fuel cell – construction details and working principle – types of fuels used – Aluminium – air fuel cell working principle. working principle of MHD Generator

4.0 Bio and Tidal Energy

Bio Energy – Introduction to bio – mass bio-mass conversion into energy bio-gas generation – composition and properties of bio-gas – applications of bio-gas. Classification of bio-gas plants – continuous and batch type, the dome and drum type, floating gas holder and fixed dome type – construction details and working principle of fixed dome type and floating gas holder type bio – gas plants – materials used for bio-gas generation – capacity of bio-gas plant – starting of bio-gas plant.

Tidal Energy : Introduction to tidal power – components of tidal power plants – operation methods and utilisation of tidal energy – single basin and double basin arrangements- site requirements – advantages and limitations of tidal power generation.

5.0 Steam and Nuclear Power Plant

Steam Power Plant

Layout of a Thermal Power Plant, Choice of site, explanation of important elements in layouts:- Such as Boiler, Condenser , Feed water system, Circulating water pumps ,Economiser, Air heater, Soot–Blower , Forced draught Fan, Dust collectors, Electro static precipitator

Supporting activities:- Such as Water cooling, Feed water treatment, Coal handling, Coal storage , Chimney.

Description of fuel handling equipment, unloading equipment, preparing equipment, modern ash handling equipment, dust collection and disposal , roots blower, condensers, principles classification – comparison – condensers and vacuum efficiencies and simple problems.

Nuclear – Power Plants

Nuclear energy chain reaction , nuclear materials, reactor, nuclear fission , nuclear fusion, characteristics of automatic power plants, nuclear fuels , working principle of nuclear reactor, classification of reactors, working principle of PWR and BWR , Gas – Cooled reactor, liquid metal – cooled reactor, nuclear power in India

6.0 Environment Pollution.

Introduction - Pollutants particulate/solid/gaseous - Thermal pollution

Collection, green house gases, green house effect, global warming. Nuclear waste disposal.

REFERENCE BOOKS

1. Non conventional Energy source by G.D Rai.
2. Energy Technology by S. Rao & Dr. D.B. Palekr (Non conventional , Renewable and conventional)
3. Solar energy utilisation by G.D.Rai
4. Introduction to alternate sources of energy by TTTI, Madras
5. Solar energy by S.P. Sukhatme
6. Advances in bio-gas technology by O.P.Chawla.
8. Thermal Engineering by Arora & S. Domkundwar

CAM

Subject Title : Computer Aided Manufacturing
Subject Code : M – 604
Periods per week : 03
Period per semester : 45

TIME SCHEDULE

Sl No.	Major Topics	No. of periods	Weightage	Short	Essay
1.	Introduction to CAM	07	26	02	02
2.	CNC Machines and their components	10	29	03	02
3.	CNC Part Programming	12	26	02	02
4.	CIMS & Flexible Manufacturing Systems	10	16	02	01
5.	Robotics	06	13	01	01
TOTAL		45	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to

1. Understand Computer Aided Manufacturing

1.1. Define CAM
1.2. List the functions of CAM
1.3. Appreciate the advantages of CAM
1.4. Explain the computer integrated production system
1.5. Explain the terms related to material requirement planning (MRP I) and Manufacturing resources planning (MRP II)

2. Understand CNC Machines and their Components

2.1. Define numerical control
2.2. Identify the components of NC & CNC systems
2.3. Differentiate between NC, CNC & DNC systems
2.4. Explain Manufacturing Methodology on NC system
2.5. Illustrate the working principle of CNC system
2.6. Define Machining Centre
2.7. Identify the maintenance aspects of CNC machines
2.8. Appreciate the role of CNC in computer integrated manufacturing environment
2.9. Identify the various spindle drives
2.10 Illustrate slide ways
2.11 Explain the linear motion bearings, recirculatory ball screws
2.12 Appreciate the importance of automatic tool change

2.13 Illustrate tool magazine
2.14 Identify the various feed back devices

3. Understand the CNC Part Programming

3.1. Explain the structure of NC part program
3.2. Differentiate between manual and computer aided programming methods
3.3. Explain G & M codes
3.4. Explain the method of programming tool information, feed, speed data
3.5. Identify the various programming cycles like thread cutting cycle etc.
3.6. Write a part program in G & M codes for a simple turning job
3.7. Appreciate the importance of macros, sub routines, canned cycles, mirror image
3.8. Appreciate the necessity of tool nose radius compensation in programming
3.9. Explain APT programming

4. Understand the concept of CIMS & FMS

4.1. Define CIMS
4.2. Appreciate the necessity of CIMS
4.3. Appreciate the advantages of CIMS
4.4. Identify FMS as a sub set of CIMS
4.5. Identify the components of FMS
4.6. Illustrate the working of FMS
4.7. Identify the benefits of FMS
4.8. Appreciate the importance of coordinate measuring machine.
4.9. Illustrate the main features of CNC, CMM
4.10.List the Advantages of CNC, CMM

5. Understand Robotics

5.1. Define a robot
5.2. Classify robots
5.3. Identify the various elements of a robot
5.4. Illustrate the working of a manipulator
5.5. Illustrate the types of end effectors
5.6. Identify the applications of robots
5.7. Appreciate the role of robots in CIMS

COURSE CONTENT

1. Computer Aided Design and Manufacturing

1.1. CAM definition
1.2. Functions of CAM
1.3. Benefits of CAM
1.4. Integrated CAD / CAM Organization - concept
1.5. Computer integrated production system – features and advantages
1.6. Introductory treatment to MRP I & II

2. CNC Machines and their components

2.1. Introduction to numerical control
2.2. Features of NC system – advantages and limitations in comparison to conventional systems
2.3. Components of NC system – layout showing control unit, data input, feed back devices and machining unit

2.4. Manufacturing methodology on NC system – preparation of manuscript – programming – input to control unit – manufacturing
2.5. Development of CNC and DNC systems – comparative treatment of features for NC, CNC, DNC
2.6. Block diagram of CNC system and functions of each component
2.7. Working principle of CNC system – advantages over NC system
2.8. Types of turning centers – machining centers – horizontal, vertical
2.9. Specifications of CNC machines.
2.10. Care and maintenance of CNC machines
2.11. Spindle drives – DC drive – AC drive and linear induction motors
2.12. Slide ways – types with illustrations
2.13. Bearings – linear motion bearings – recirculatory ball screws
2.14. Automatic tool change – working of tool magazine
2.15. Feedback devices – encoders – linear transducers'

3. CNC Part programming

3.1. CNC program procedure – coordinate system – reference points – zero points
3.2. Preparatory and miscellaneous functions (G & M codes)
3.3. Methods of part programming – manual and APT programming
3.4. Tool information – speed – feed data
3.5. Interpolation – linear and circular
3.6. Macros – subroutines – canned cycles – mirror image – thread cutting cycles
3.7. Programming Practice problems on turning jobs

4. CIMS & FMS

4.1. Computer integrated manufacturing system – definition – features – necessity
4.2. Flexible manufacturing system – definition – features – necessity
4.3. Components of FMS – functions of each component – illustration
4.4. Advantages and limitations of FMS
4.5. Coordinate measuring machine – Introduction, CMM and CNC CMM – main features of CNC CMM – Scanning – Digitization – Advantages.

5. Robotics

5.1. Definition of robot – classification – features – necessity
5.2. Components of robot – illustration – functions of each component
5.3. Manipulator – illustration – degrees of freedom
5.4. End effectors - types with illustration – necessity and application
5.5. Industrial application of robots – advantages and limitations
5.6. Artificial intelligence – introductory treatment only

REFERENCE BOOKS:

1. Computer Integrated Design And Manufacturing,McGraw Hill–Bedworth David. D
2. Computer Integrated Manufacturing, PHI – Paul G. Ranky
3. Industrial Robotics, PHI – Gordon. N. Mair
4. Numerical Control And Computer Aided Manufacturing – T.K.Kundra,P.N.Rao(TMH)
5. Computer Aided Manufacturing,–T. K. Kundra, P.N. Rao (MGH Publishers)
6. CNC Machines, New Age–B.S. Pabla and M. Adithan

MEASUREMENT & CONTROL SYSTEMS

Subject Title : Measurement & Control Systems
Subject Code : M – 605
Periods per week : 05
Period per semester : 75

TIME SCHEDULE

Sl No.	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Type Questions
1.	Measuring Instruments & their Characteristics	12	16	02	01
2.	Measurement errors	06	13	01	01
3.	Transducers	20	26	02	02
4.	Measurement of Angular Speed, Temperature, Pressure and Flow	25	39	03	03
5.	Control Systems	12	16	02	01
	TOTAL	75	110	10	08

OBJECTIVES

Up on completion of the course the student shall be able to:

1. Understand the Measurement systems & their characteristics

1.1 Define Measurement
1.2 Explain the Significance of measurement
1.3 **Methods of Measurements**-
Explain
a.Direct and Indirect
b.Primary ,Secondary and Tertiary
c.Contact and Non-contact
1.4 Classify Instruments
1.5 List the Instruments and Measuring Systems-Its Functions
1.6 List the Applications of measurement systems
1.7 List the Instrument characteristics (Static & Dynamic)
Explain Static Characteristics:
1.7.1 Scale range and scale span
1.7.2 Scale readability
1.7.3 Repeatability and reproducibility
1.7.4 Drift
1.7.5 Noise- signal to noise ratio- sources of noise
1.7.6 Accuracy and precision
1.7.7 Static sensitivity

1.7.8 Linearity
1.7.9 Hysteresis
1.7.10 Threshold
1.7.11 Dead time and dead zone
1.7.12 Resolution or discrimination

Explain Dynamic Characteristics:

1.7.13 Speed of response and measuring lag
1.7.14 Fidelity and dynamic error
1.7.15 Overshoot

2. Understand the Measurement Errors

2.1 Explain the scope of Errors
2.2 Classify errors and explain
- 2.2.1 Instrument errors
- 2.2.2 Environmental errors
- 2.2.3 Translation and signal transmission errors
- 2.2.4 Observation errors
- 2.2.5 Operational errors
- 2.2.6 System interaction errors

2.3 Factors to be considered for selecting an instrument

3. Understand the Transducers

3.1 Define Transducer
3.2 Explain Mechanical detector-transducer elements
- 3.2.1 Elastic elements
- 3.2.2 Mass sensing elements
- 3.2.3 Thermal detectors
- 3.2.4 Hydro-pneumatic elements

3.3 Classify Transducers
Explain
- 3.3.1 on the basis of transduction form used,
- 3.3.2 Primary and secondary transducers
- 3.3.3 Passive and active transducers
- 3.3.4 Analog and digital transducers

3.4 Explain Resistive transducer, piezo electric transducer, capacitive transducer
3.5 Define Strain gauges
- 3.5.1 List the requirements of strain gauge
- 3.5.2 Explain the types of strain gauges
- 3.5.3 Explain unbounded metal strain gauges
- 3.5.4 Explain Bonded metal wire strain gauges
- 3.5.5 Explain Bonded metal foil strain gauges
- 3.5.6 Explain Bonded semiconductor strain gauges

3.6 Explain Rosettes

4. Understand the Measurement of Angular Speed, Temperature, Pressure and Flow

Measurement of angular speed

4.1 List the types of Tachometers

4.2 Explain the working principle of following Tachometers with a legible sketch

4.2.1 Mechanical Tachometers-Revolution counter and timer, slipping Clutch Tachometer

4.2.2 Electrical Tachometers-Drag cup tachometer, and Tachogenerator

4.2.3 Contactless Electrical Tachometer-Inductive pickup, and Capacitive, pickup tachometer

Measurement of Temperature

4.3 List the types of Thermometers

4.3.1 Explain Liquid in glass thermometer

4.3.2 Explain Bimetallic thermometer

4.3.3 Explain Thermocouples

4.3.4 Explain Thermistor

4.3.5 Explain Pyrometers-Radiation and Optical

Measurement of Pressure

4.4 List the Types of pressure measurement devices

4.4.1 Explain Bourdon tube pressure gauge

Measurement of Flow

4.5 List the Types of Flow meters

4.5.1 Explain Rota meters

4.5.2 Explain hot wire anemometer (constant temp and constant Current)

4.5.3 Explain Ultrasonic flow meter

5. Understand the Control Systems

5.1 Explain the Concept of a control system

5.2 List the Elements of Control Systems

5.3 Classify control systems-

5.4 Explain the following with legible sketch

5.4.1 Open loop and Closed loop systems

5.4.2 Servo mechanisms

5.4.3 Rotational system

5.4.4 Electrical systems

5.4.5 Analog systems

5.4.6 Pneumatic controller

5.4.7 Pneumatic relay, Pneumatic Actuator

5.4.8 Hydraulic control systems

5.5 List the Applications of Pneumatic control systems

COURSE CONTENT

1. **Measurement systems & their characteristics**

Definition of Measurement, Significance, Methods of Measurements, Classification of Instruments, Instruments and Measuring Systems-Its functions,

Applications of measurement systems, Instrument characteristics (Static & Dynamic)

2. Measurement of Errors

Classification of errors- Instrument errors, Environmental errors, Translation and signal transmission errors, Observation errors, Operational errors, System interaction errors, Factors to be considered for selecting an instrument

3. Transducers

Mechanical detector-transducer elements, Transducer-Classification of Transducers, Resistive transducer, piezo electric transducer, capacitive transducer, Strain gauges -requirements of strain gauge-types, Rosettes

4. Measurement of Angular Speed, Temperature ,pressure and Flow

Measurement of angular speed-Tachometers, Mechanical Tachometers-Electrical Tachometers-Contactless Electrical Tachometer

Measurement of Temperature-Thermometer, Liquid in glass thermometer, Bimetallic thermometer, Thermocouples, Thermistor, Pyrometers-Radiation and Optical

Measurement of Pressure-Types , Bourdon tube pressure gauge

Measurement of Flow- Rotameters, Hot wire anemometer(constant temp and constant current) and Ultrasonic flow meter

5. Control Systems

What is a control system- Classification, Open loop and Closed loop systems-Servo mechanisms-Rotational systems- Electrical systems-Analog systems-Pneumatic controller-Pneumatic relay- Pneumatic Actuator-Hydraulic control systems

Elements of Control Systems

Applications of Pneumatic control systems

REFERENCE BOOKS :

1. Mechanical Measurements and Instrumentation & Control – A.K.Sawhney Puneet Sawhney (Dhanpat Rai & Co)
2. Mechanical Measurements & Control-Dr.D.S.Kumar (Metropolitan book co.Pvt.Ltd)
3. Mechanical Measurements & Control-- R.V.Jalgaonkar
4. Instrumentation Devices & Systems -- C.S.Narang
5. Mechanical & Industrial Measurements -- R.K.Jain
6. Instrumentation,Measurement and Analysis -- B.C.Nakra and Chaudhry

AUTOMOBILE ENGINEERING

Subject Title : Automobile Engineering
Subject code : M-606
No. of periods/week : 04
Periods/Semester : 60

TIME SCHEDULE

S.No	Major Topics	Number of Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Introduction & Chassis Construction	10	16	2	1
2	Transmission & Clutches	16	32	4	2
3	Propeller shaft and rear axle	10	18	1	1 ½
4	Suspension system	06	13	1	1
5	Front axle and steering	12	18	1	1 ½
6	Brakes	06	13	1	1
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Understand the concept of automobile

1.1 List the various components of an automobile.
1.2 Explain the function of basic structure, power plant, transmission system, auxiliaries, controls of the automobiles.
1.3 List the various types of Chassis construction.
1.4 Explain conventional Chassis construction with a legible sketch
1.5 Explain Frame construction.
1.6 List the materials for frame
1.7 List the Defects in Frames.
1.8 Explain the frameless construction.

2.0 Understand the Transmission &Working principle of Clutches

2.1 Define the term Transmission.
2.2 State the Functions of transmission system.
2.3 Explain the Concept of total resistance to the vehicle motion – tractive effort- Necessity of transmission.
2.4 List the Types of gear boxes.
2.5 Explain the Selector Mechanism with legible sketch

2.6 Explain the Lubrication of gear box.
2.7 State the requirements for the effective functioning of Clutch.
2.8 List the Components of clutch.
2.9 Explain Mechanical operation of clutch.
2.10 List the main types of clutches.
2.11 State the Principle of friction clutches.
2.12 List the Different types of dry friction clutches.
2.13 Explain the Hydraulically operated (Fluid type) clutch with legible sketch

3.0 Understand the function of Propeller Shaft and rear axle.

3.1 State the functions of propeller shaft.
3.2 Explain construction of propeller shaft.
3.3 Know about various universal joints in automobile
3.4 Functions and operation of a differential in an automobile.
3.5 Sketch general arrangement of a live rear axle
3.6 Identify loads on rear axle.
3.7 Identify different methods of supporting rear axle.
3.8 Distinguish between semi-Floating and fully floating rear axle.

4.0 Understand the working of Suspension System

4.1 List the Objectives of vehicle suspension.
4.2 List the various factors considered for suspension
4.3 List the different types of suspension springs
4.4 Explain the Construction details of leaf spring and its mounting on front and rear axles with legible sketch.
4.5 List the Different types of rubber springs.
4.6 Explain air suspension system with legible sketch.
4.7 Explain the principle of shock absorber.
4.8 Explain the construction details and working of a telescopic type of shock absorber with legible sketch.

5.0 Understand the function of Front Axle and Steering.

5.1 Define the terms Front Axle and Steering.
5.2 Define Stub Axle type.
5.3 Explain the Front wheel assembly
5.4 List the Factors of wheel alignment.
5.5 Explain the Balance of wheels-Inflation of tyres- Brake Adjustment.
5.6 Explain the Steering geometry
5.7 List Steering linkages.

5.8 Write correct steering angle.
5.9 Explain the Steering mechanism with legible sketch
5.10 Explain cornering force – Self righting torque.
5.10 Explain under steering – over steering.
5.11 Write the Principle of power steering.

6.0 Understand the function of Brakes

6.1 List the requirements of automobile brake.
6.2 Explain the transfer of weight during braking operation.
6.3 Explain the wheel skidding and techniques to prevent wheel Skidding.
6.4 Various factors influencing braking effect.
6.5 Classify the brakes.
6.6 Describe the mechanical shoe brake with legible sketch.
6.7 Draw a simple diagram to show the layout of a hydraulically operated four wheel brake system and explain its working in detail.
6.8 Draw a schematic diagram showing the layout of complete air pressure system of brakes and explain the working of its main units in detail.

COURSE CONTENT

1.0 Introduction & Chassis construction

1.1 Identify the various components of an automobile.
1.2 The basic structure, the power plant, transmission System, the auxiliaries the controls and the superstructure of an automobile.
1.3 Different types of Chassis construction.
1.4 The functions of the Frame.
1.5 The loads on the frame,
1.6 Frame construction with a neat sketch.
1.7 Identification of various materials for frame.
1.8 Sub frames and defects in frames.
1.9 Frameless construction with a sketch.

2.0 Transmission and Clutches

2.1 Introduction and Functions of transmission system
2.2 Concept of total resistance to the vehicle motion – Tractive effort – necessity of transmission.
2.3 Working of Sliding mesh – Constant mesh – Synchromesh gear boxes.
2.4 Working of selector mechanism with gear lever on top of transmission case.

2.5 Lubrication of gear box.
2.6 Functions of clutches.
2.7 Requirements of Clutch.
2.8 Brief description of Components of clutch, clutch plate- clutch facing – pressure plate – Springs – Bearings.
2.9 Mechanical operation of clutch.
2.10 Main types of clutches (friction clutch and fluid clutch only)
2.11 Principle of friction clutches – coefficient of friction (μ), Axial Pressure (w) and mean radius of contact surfaces(R)
2.12 Description and working of dry friction clutches – Single plate multi plate.
2.13 Working of Hydraulically operated single plate clutch.

3.0 Propeller Shaft and rear axle.

3.1 The functions of propeller shaft.
3.2 The construction of propeller shaft with a neat sketch.
3.3 Various universal joints in automobiles.
3.4 The function and operation of differential in an automobile.
3.5 The general arrangement of a live rear axle.
3.6 Different loads on rear axle.
3.7 Different methods of supporting rear axle shafts with sketch.
3.8 The difference between semi-floating and fully floating rear axle.

4.0 Suspension System

4.1 The objectives of vehicle suspension
4.2 The factors to be considered for suspension system.
4.3 Different types of suspension springs.
4.4 The construction of leaf spring and how it is mounted on rear and front axles with neat sketch.
4.5 Different types of rubber springs.
4.6 The action of air springs
4.7 The schematic diagram showing the layout of an air suspension system and describe its working
4.8 The principle, construction and working of a telescope type of shock absorber.

5.0 Front Axle and Steering

5.1 Introduction to front axle.
5.2 Stub axle connection- ELLIOT – Reversed ELLIOT – LAMOINE – Reversed LAMOINE – brief Description.

5.3 Description of front wheel stub axle assembly.

5.4 Factors influencing of wheel alignment .

5.5 Factors pertaining to wheels – Balance of Wheels - Inflation of tyres – Brake adjustment-Concept of Steering Geometry – Camber – Kingpin Inclination – combined angle - castor – Toe-in & Toe-out.

5.6 Steering linkage – principle of correct steering angle (without mathematical analysis) simple equation

5.7 Details of Ackerman steering mechanism.

5.8 Concept of cornering force-self righting torque.

5.9 Concept of under steering & over steering.

6.0 Brakes

6.1 The requirements of a automobile brake.

6.2 The transfer of weight during braking operation.

6.3 The wheel skidding and describe techniques to prevent wheel Skidding.

6.4 Various factors influencing braking effect.

6.5 Classification of brakes.

6.6 The mechanical shoe brake with a neat sketch.

6.7 The layout of a hydraulically operated four wheel brake system with a simple diagram and explain its working in detail.

6.8 The schematic diagram showing the layout of complete air brake system and explain the working of its main units in detail.

REFERENCE BOOKS:

1. The motor vehicle - Newton steeds & Garret
2. Automotive Chassis - P.M. Heldt.
3. Mechanism of the car - A.W. Judge
4. Automotive mechanism - Joseph Heitner.
5. Automotive Engineering - G.B.S. Narang

CAM LAB PRACTICE

Subject Title	**:**	**CAM Lab Practice**
Subject Code	**:**	**M-607**
Periods/ week	**:**	**06**
Periods per Semester	**:**	**90**

OBJECTIVES

Up on completion of the course the student shall be able to

1. Identify the parts and functions of CNC lathe
2. Use incremental system and absolute system on dimensioning.
3. Write simple part program using G-Codes and M-Codes.
4. Edit and execute a part program using CNC lathe machine simulation package.
5. Prepare part program as per the drawing.
6. Produce part as per the drawing using CNC lathe machine.

COURSE CONTENT

1. CNC Introduction
2. Study of turning.
3. G – codes and M- codes
4. Simulation software practice.
5. Structure of program.
6. Turning exercise – step turning using canned cycle.
7. Turning exercise – circuits interpolation CW, CCW.
8. Turning Exercise - Taper turning and Peck drilling.
9. Turning exercise – Thread cutting and grooving.

Note: The simulation software available in the market:
FANUC, SIEMENS, HI NUMERIC, GSK etc.,

Key competencies to be achieved by the student

	Exercise	Key competencies expected
1	Hands on practice on CNC machine	A. Identify the various parts and switches B. Operate the various parts and knobs of the machine - Switch on / off
2	Practice turning Operation on CNC machine	A. Use incremental system and absolute system of co-ordinate system B. Use appropriate tools for turning C. Select the speeds and feeds used for turning D. Select the depth of cut to be employed
3	Use G-Codes and M-Codes to write part program	A. Identify the preparatory and miscellaneous functions of CNC B. Understand the meanings of various G-Codes and M-Codes C. Identify frequently used G-Codes and M-Codes
4	Practice with Simulation software	A. Understand the concept of simulation B. Practice the setting of software in simulation mode C. Open an existing part program D. Practice simulation for the program
5	Read the Structure of program	A. Understand the block numbers B. Understand various steps in the program
6	Practice step turning canned cycle (Turning exercise)	A. Understand the canned cycle B. Write a part program to produce the part as per the given drawing C. Enter the program in the software D. Fix the job and set the tool E. Select proper cutting speed, depth of cut and feed for the given job F. Simulate the program and edit if necessary G. Execute the part program
7	Practice Turning exercise circuits interpolation CW, CCW	A. Understand interpolation B. Use the codes for interpolation in part program C. Write and enter the program in the system D. Simulate and execute the program

	Exercise	Key competencies expected
8	Practice Turning exercise – Taper turning and Peck drilling	A. Select proper values of cutting speeds and feeds for taper turning and peck drilling B. Write part program for taper turning and peck drilling as per the given drawing C. Select suitable cutting tools for the two operations separately D. Fix the tools in the turret E. Fix the job F. Simulate and edit the part program if necessary G. Execute the part program
9	Practice Turning exercise – Thread cutting and grooving	A. Select proper values of cutting speeds and feeds for Thread cutting and grooving B. Write part program for Thread cutting and grooving as per the given drawing C. Select suitable cutting tools for the two operations separately D. Fix the tools in the turret E. Fix the job F. Simulate and edit the program if necessary G. Execute the part program

THERMAL ENGINEERING & REFRIGERATION AND AIR CONDITIONING LABORATORY PRACTICE

Subject Title : Thermal Engineering& Refrigeration and Air Conditioning Lab Practice
Subject Code : M – 608
Periods per Week : 03
Periods per Semester : 45

A.THERMAL ENGINEERING LABORATORY PRACTICE

TIME SCHEDULE

S.No	Name	Number of Periods
1	Economic Speed Test	03
2	Water Cooling Curves	03
3	Morse Test	03
4	Performance Curves	06
5	Heat Balance Sheet	06
6	Mercet Boiler	03
Total		**24**

OBJECTIVES

Up on completion of the course the student shall be able to

1. **Understand the importance of economic speed of given S.I. / C.I. engine.**
   - 1.1 Identify the type of engine and its parts
   - 1.2 Circulating cooling water through the engine jacket before starting the engine and after shutting the engine
   - 1.3 Cranking the engine and operating decompression lever
   - 1.4 Maintain constant load
   - 1.5 Varying the fuel supply by operating the lever
   - 1.6 Record the corresponding readings of fuel consumption and speed

2. **Appreciate the importance of drawing water cooling curves on IC engines.**
   - 2.1 Identify the type of engine and its parts
   - 2.2 Circulate cooling water through the engine jacket before starting the engine and after shutting the engine
   - 2.3 Crank the engine and operating decompression lever
   - 2.4 Maintain constant load and speed
   - 2.5 Control flow rate of cooling water into the engine
   - 2.6 Record the readings of cooling water temperatures at inlet and outlet.
   - 2.7 Record the fuel consumption rate by using stop watch

3. **Understand the importance of Morse test on multi-cylinder petrol / diesel engine**
    - 3.1 Identify the type of engine
    - 3.2 Circulate cooling water through the engine jacket before starting the engine and after shutting the engine
    - 3.3 Crank the engine and operating decompression lever
    - 3.4 Vary the load
    - 3.5 Maintain constant speed
    - 3.6 Disconnect engine cylinders one by one by operating the lever
    - 3.7 Record the readings in spring balance without parallax error

4. **Understand the importance of performance characteristics of given IC engine.**
    - 4.1 Identify the type of engine and its parts
    - 4.2 Circulate cooling water through the engine jacket before starting the engine and after shutting the engine
    - 4.3 Crank the engine and operating decompression lever
    - 4.4 Vary the load
    - 4.5 Record the load
    - 4.6 Record the speed by using tachometer
    - 4.7 Handle the stop watch for measuring time for 10c.c consumption of fuel
    - 4.8 Draw the graphs (B.P. Vs R.P.M., B.S.F.C. Vs R.P.M., B.M.E.P. Vs R.P.M., Mechanical Efficiency Vs R.P.M.,)

5. **Understand the importance of heat balance of given IC engine.**
    - 5.1 Identify the type of engine and its parts
    - 5.2 Circulate cooling water through the engine jacket before starting the engine and after shutting the engine
    - 5.3 Crank the engine and operating decompression lever
    - 5.4 Adjust the load
    - 5.5 Identify the cooling water inlet and outlet
    - 5.6 Record the reading of cooling water temperature at inlet and outlet
    - 5.7 Record time taken for 10c.c fuel consumption
    - 5.8 Record exhaust gas temperature
    - 5.9 Calculate on of quantity of heat liberated by the fuel and the heat equivalent of brake power, heat carried away the jacket cooling water and heat carried away by the exhaust gases.

6. **Appreciate the pressure Vs temperature relationship of saturated steam by using Mercet Boiler.**
    - 6.1 Identify type of boiler and various parts of it.
    - 6.2 Heat the water filled in boiler drum by using Bunsen burner
    - 6.3 Identify the formation of saturated steam
    - 6.4 Record the readings of pressure and temperature
    - 6.5 Draw the graph between Pressure Vs Temperature.

COURSE CONTENT

1. Economic speed Test.
2. Water cooling curves.
3. Morse test on petrol / diesel engine.
4. Performance curves.
5. Heat Balance Sheet.
6. Investigation of Pressure Vs Temperature relationship of saturated steam by using Mercet boiler.

Key competencies Expected from the student for Thermal Engineering Lab (M-608A)

S.No	Exercise	Key competency
1	Economic speed Test	a. Circulate cooling water through the engine jacket before starting the engine and after shutting the engine b. Maintain a constant load c. Vary the fuel supply by operating the lever d. Record the corresponding readings of fuel consumption and speed
2	Water cooling curves	a. Identify valve to allow cooling water into the engine b. Maintain constant load and speed c. Record load and speed d. Control flow rate of cooling water into the engine e. Record the readings of cooling water temperatures at inlet and outlet. f. Record the fuel consumption rate by using stop watch g. Draw graphs (s.f.c. Vs exit temperature of cooling water)
3	Morse test on multi-cylinder diesel / petrol engine	a. Vary the load b. Maintain constant speed c. Disconnect engine cylinders one by one by operating the lever d. Record the readings in spring balance without parallax error

4	Performance curves	a. Vary the load b. Record the load c. Record the speed by using tachometer d. Handle the stop watch for measuring time for 10c.c consumption of fuel e. Draw the graphs (B.P. Vs R.P.M., B.S.F.C. Vs R.P.M., B.M.E.P. Vs R.P.M., Mechanical Efficiency Vs R.P.M.,)
5	Heat balance sheet	a. Allow cooling water to enter the cylinder jacket. b. Adjust the load c. Record the load and speed d. Record the reading of cooling water temperature at inlet and outlet e. Record time taken for 10c.c fuel consumption f. Record exhaust gas temperature
6	Mercet boiler	a. Record the readings of pressure and temperature b. Draw the graph between pressure Vs temperature.

B. REFRIGERATION & AIR CONDITIONING LAB PRACTICE

TIME SCHEDULE

S.No	R & AC Lab	Number of Periods
1	Familiarisation with R&AC Tools Basic Operations on soft Copper tube	03
2	C O P of Vapour Compression cycle test rig	03
3	C O P of domestic refrigerator test rig	03
4	C O P of water cooler test rig	03
5	Leak detection of refrigeration equipment	03
6	Evaluate the C.O.P. of A.C. system	03
7	Vaccumisation and Charging of compressor	03
Total		**21**

OBJECTIVES

Up on completion of the course the student shall be able to

1. Identify various tools used in R&AC
2. Perform basic fabrication operations viz., flaring, swaging, bending and brazing on soft copper tubes.
3. Identify the various components of a Vapour Compression cycle test rig and to draw the refrigerant circuit and the electrical circuit.
4. Evaluate the c.o.p of a given Vapour Compression cycle test rig.
5. Evaluate the c.o.p of a Domestic Refrigerator test rig
6. Evaluate the c.o.p of a water cooler test rig
7. Identify various types leak detection methods of a refrigeration system
    a. Detect the leakages of given vapour compression refrigeration system by using soap solution method.
    b. Apply the methods of arresting leakages
    c. Arrest the leakages if any by soldering
8. Evaluate the C.O.P. of given air-conditioning system
9. Apply the method of vaccumization and refrigerant charging for a given vapour compression system.
    a. Evacuate the given V.C.R. system using a vacuum pump
    b. Charge the given V.C.R. system by using suitable refrigerant gas
    c. Run the system for at least 15 min. and check for the build up of pressure in the pressure gauge.

Key competencies Expected from the student for M-608B Refrigeration & Air Conditioning Lab

S.No	Exercise	Key competency
1	Basic fabrication operations on soft copper tube	a. Use the tools to perform flaring, swaging, bending and brazing operations
2	C O P of Vapour Compression cycle test rig.	a. Identify the components of vapour compression system b. Record the values of pressure and temperature when the pressure gauges are stabilized c. Record the energy meter reading d. Read the values from Pressure Vs Enthalpy diagram of the given refrigerant e. Evaluate c.o.p
3	C.O.P. of domestic refrigerator test rig	a. Identify the components of domestic refrigerator test rig. b. Record the values of pressure and temperature when the pressure gauges are stabilized c. Record the energy meter reading d. Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant e. Evaluate c.o.p
4	C.O.P. of water cooler test rig	a. Identify the components of water cooler test rig. b. Record the values of pressure and temperature when the pressure gauges are stabilized c. Record the energy meter reading d. Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant e. Evaluate c.o.p

5	Leak detection of refrigeration equipment	a. Apply soap solution over suction lines, discharge lines and various joints b. Detect the leaks by observing the air bubbles c. Arrest the leaks if any by using soldering
6	Evaluate C.O.P. of A.C. system	a. Identify the components of given vapour compression air-conditioning test rig. b. Insert thermometers in suction line and discharge line c. Run the given V.C. A.C. system for some time d. Record the pressure and temperature readings when the pressure gauges are stabilized. e. Record the energy meter reading f. Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant g. Evaluate c.o.p
7	Vacuumization and charging of refrigeration system	a. Detect the leaks in the given refrigeration system b. Arrest the leaks if any c. Evacuate the system by using a vacuum pump d. Charge the system by suitable refrigerant gas e. Run the system for some time and check for the build up of pressure by observing the pressure gauge reading.

COURSE CONTENT

1. Basic fabrication operations on soft copper tube.
2. Determination of COP of Vapour Compression cycle test rig.
3. Determination of COP of domestic refrigerator test rig.
4. Determination of COP of water cooler test rig.
5. Leak detection of refrigeration equipment.
6. Conduct a performance test on given air-conditioning system and evaluate C.O.P. of the system.
7. Vaccumization & Charging, pressure testing of given refrigeration system.

MANUFACTURING /SERVICING AND MAINTANANCE LAB PRACTICE

Subject Title	**:**	**Manufacturing /Servicing and Maintenance Lab Practice**
Subject Code	**:**	**M-609**
Periods/Week	**:**	**03**
Periods per Semester	**:**	**45**

Objectives

Up on completion of the course the student shall be able to

A. Understand various operations in machine shop

1. Practice the cutting operation on slotter
2. Practice the cutting operation on planer
3 Practice the principle of indexing on milling machine.
4 Perform Cutting operation on milling machine
5 Perform Cutting operation on V-block on shaping machine.

B. Understand various operations in Welding

1. Produce utility articles such as shoe rack, garden chair, wash basins, stools etc

C. Understand various operations in Foundry

1. Prepare a mould for flange coupling.
2. Understand the operation of cupola and pit furnace.
3. Prepare a metal casting of simple objects in Aluminium.

D. Understand various activities in servicing and maintenance

1. Use the servicing methods of IC-Engine parts.
2. Overhaul petrol and diesel Engines.
3. Locate faults and rectify the same.
4. Select Appropriate recovery methods for a given machine elements and Performing recovery processes by using appropriate methods such as Arc/gas welding, metal spraying, applying adhesives etc.,
5. Use the servicing methods of sewing machine, pumps
6. Use the testing and inspection methods of machine tools.
7. Dismantle and assemble machine tools.
8. Recondition the parts.
9. Service and overhaul machine of general nature.
10. Prepare maintenance schedules and estimates.

COURSE CONTENT

A. Machine Shop

1. V-Block, 2. Gear Cutting on Milling Machine, 3.Splines on Slotting Machines, 4. Practice on Planning machines, 5.Key way cutting, 6.Various Milling operations,7.T-slot cutting on milling machine

B. Welding

1.Shoe Rack 2. Garden Chair. 3. Stools 4. Pot Stands etc.,

C. Foundry

1.Solid bearing 2. Flange coupling 3.Operation of cupola 4. Metal casting and fettling.

D. Service and Maintenance

Carburettor, Injectors , Piston Assembly , Gear Box, Clutch , Valve Assembly, Propellar Shaft and Universal Joint, Differential , Axles etc.,

Sub – assembly of small components such as, Tail stock, checks of lathes, 3-jaw chuck,4-jaw chuck. Measurement of wear on M/c elements such as, lathe beds, guide ways &shapers. Selection of appropriate recovery methods for a given M/c element and performing recovery processes by using appropriate methods such as: Arc/Gas Welding, Metal spraying, Applying adhesives etc. Fault finding and repairs of equipment such as machine tools, washing machines. Maintenance of various machine tools & engines including preparation of preventive maintenance schedule of a typical workshops .

Key competencies to be achieved by the student

S.No	Exercise	Key competencies expected
1.	Key way cutting by slotting machine	A. Fix the job on slotting machine table B. Set the tool and give the table feed C. Set the stroke of the ram
2.	Indexing on slotting / milling machine	A. Identify of suitable indexing method B. Calculate revolutions of indexing crank C. Select index plate D. Select of hole circle
3.	T-slot cutting on milling machine	A. Identify T-slot cutter B. Exact setting of work-tool location
4.	Bevel / Helical gear cutting on milling machine	A. Calculate no. of teeth on meshing gears for compound indexing B. Identify suitable HOB C. Select suitable holder for bevel gear blank
5	Servicing of Carburetor, Injectors, Piston, assembly, Gear Box, Clutch , Valve Assembly, Propeller Shaft and Universal Joint, Differential , Axles etc.,	A. Select suitable dismantling/assembly tools. B. Identify the problem C. Rectify the defect D . Select suitable lubricant. E. Locate lubricating points.
6	Assembly of small components such as, Tail stock, chucks of Lathes, 3-jaw chuck, 4-jaw chuck.	A. Select suitable dismantling/assembly tools. B. Identify the problem C. Rectify the defect D. Select suitable lubricant. E. Locate lubricating points.

PROJECT WORK

Subject Title	**:**	**Project work**
Subject Code	**:**	**M-610**
Periods/Week	**:**	**06**
Periods/Semester	**:**	**90**

OBJECTIVES

Up on completion of the course the student shall be able to

1.0 Prepare technical project report.

1.1 Identify component with mechanical bias.
1.2 Design and draw the production drawings.
1.3 Prepare a project report with details of materials, processes etc.
1.4 Develop a proto type/model of the product with the facilities available in polytechnic.

2.0 Conduct survey to establish a small scale unit.

2.1 Identify and select a product with an aim to set up a small scale industry.
2.2 Conduct a detailed market survey.
2.3 List the raw materials, equipment and tools needed for the manufacture of a specified quantity.
2.4 Explore the various financial arrangements to start the manufacture of a product under technocrat scheme in small scale industrial sector.
2.5 Make a survey of requirements of the department of industries, municipal, health, inspectorate of factories for staring an industry.
2.6 Plan for a type of organisation.
2.7 Select a site.
2.8 Prepare a techno feasibility report consisting of drawings, plant layouts, building requirements, machinery and equipment requirements, raw material, labour, production and administrative staff requirements, working capital, material flow sheet, cash flow sheet, financial analysis etc.
3.0 Develop working models to show scientific and engineering principles studied in the curriculum and repair, up gradation and maintenance of equipment which are exist.

COURSE CONTENT

The following activities are envisaged in this course at study

1. Identification and selection of a product with an aim to set small scale industry.
2. Conduct of detailed market survey.
3. Preparation of production drawings.
4. List of the raw materials, equipment and tools needed for manufacturing a specified quantity.
5. Development of a prototype model of the product in workshop (if possible) with the available facilities in the Polytechnics.
6. Exploration of the various financial arrangements to start the manufacturing of the product under technocrat scheme in small scale industrial sector.

7. Detailed survey of requirements of the department of industry, municipal, health inspectorate of factories, electrical inspectorate, banks, other financial agencies etc., for starting an industry.
8. Planning for type of organisation.
9. Selection of site.
10. Preparation of techno feasibility report consisting of production drawings, plant layout, building requirements, equipment requirement, list of raw materials and their availability, tools and other items, labour force production, ministerial staff requirement, material flow sheet, cash flow sheet, financial analysis etc.
11. Working models, repairs up gradation maintenance of equipment.

Note: 1. Product selection may be done by the Polytechnic in consultation with the local industries and other agencies.

The student should submit techno feasibility report on a product selected with an aim to set up an industry in small scale sector.

Key competencies to be achieved by the student

Project work	**Key competencies expected**
Technical project report	A. Select a Product B. Design a product C. Prepare production drawings as per design D. Develop prototype model of product E. Prepare technical project report
Conduct survey to establish a small scale unit	A. Conduct market survey to identify product to be produced B. Prepare feasibility report of product C. Convince financial organizations D. Approach government agencies for technical and financial help E. Learn leadership qualities
Develop working models and upgrade/repair existing equipment	A. Develop working model using scientific and engineering principles B. Repair equipment of existing machines