C-16

DME – I SEMESTER

DIPLOMA IN MECHANICAL ENGINEERING (C-16)

SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(FIRST 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:								
M-101	English-I	3	-	45	3			100
M-102	Engineering Mathematics - I	5	-	75	3			100
M-103	Engineering Physics-I	4	-	60	3			100
M-104	Engineering Chemistry &Environmental Studies-I	4	-	60	3			100
M-105	Engineering Mechanics-I	4	-	60	3			100
M-106	Workshop Technology-I	4	-	60	3			100
PRACTICAL:								
M-107	Engineering Drawing practice -I	-	6	90	3			100
M-108	Basic Work shop practice -I	-	6	90	3			100
M-109	Physics Lab-I	-	1½	45	1½			50
M-110	Chemistry Lab-I	-	1½		1½			50
M-111	Computer fundamentals Lab practice -I	-	3	45	3			100
	TOTAL	24	18	630				1000

English for Polytechnics
(Common to All the Branches)
First Semester

Subject Code :M-101
No. of periods per week : 3
No. of periods per year : 45

Objectives and Key Competencies

Sl. No.	Name of the Unit	Objectives	Key Competencies
01	**Need for English**	• Understand the need to learn English • Find solutions to some problems of Learning English	• Know the need to learn English • Identify the problems students face in learning |English • Discuss the various solutions to overcome them
02	**Classroom English**	• Identify expressions useful in the classroom • Use classroom expressions meaningfully	• How to greet the teacher and other students • Learn the expressions frequently used by the teacher • Practise to express one's ideas in English
03	**Expressing Feelings**	• Express feelings • Speak about what others feel	• Know the structures to express feelings • Use the vocabulary related to feelings
04	**Expressing Likes and Dislikes**	• Express likes and dislikes • Express likes and dislikes of others	• Study the different ways to express likes and dislikes • Learn several words and phrases to express likes and dislikes
05	**Making requests**	• Learn some ways of making requests • Learn some ways of offering help	• Examine the various structures to make requests • Learn to make requests in formal and informal situations
06	**The Mighty**	• Comprehend the central idea	• Understand the main idea

	Mountain and Little Lads of Telangana	• Learn about Expeditions	• Practise to read aloud • Learn new vocabulary
07	**Adventures of Toto**	• Read and comprehend the main idea • Appreciate a humorous narrative	• Understand the central idea • Learn to make inferences • Learn new vocabulary • Complete a story
08	**Tiller Turns Engineer – An Innovation**	• Read and understand the main idea • Improve your vocabulary	• Focus on minute details • Develop innovative skills • Present one's view
09	**The Present Tense- I**	• Differentiate between time and tense • Describe habits and facts	• Learn the three broad categories of tense • Learn the action words and auxiliary words • Learn the simple present tense structure • Talk about routine, habits and facts • Make negative sentences
10	**The Present Tense- II**	• Describe the actions happening in the present • Describe past actions as relevant to the present	• Express the actions happening in the present • Express the actions that have been completed in the recent past • Make sentences in the present perfect continuous tense
11	**The Past Tense- I**	• Understand what irregular verbs are • Describe actions which took place in the past	• Learn the irregular verbs • Narrate the stories or incidents in simple past tense
12	**The Past Tense- II**	• Describe an action that was happening in the past • Describe a past action that took place before another past action	• Describe the actions in progress in the past • Use past perfect tense
13	**The Future Tense**	• Describe future actions • Understand various aspects of future tense	• Express the actions that are going to happen in the future

			• Know the uses of the modals
14	**Basic Sentence Structures- I**	• Understand basic sentence structures • Use basic sentence structures in spoken and in written forms • Identify common errors in the usage of basic sentence structures	• Learn how English is different from Indian Languages from structures point of view • Learn intransitive verbs • Use Subject +Verb structure • Use Subject + Verb + Subject Complement structure
15	**Basic Sentence Structures- II**	• Understand basic sentence structures • Form basic sentence structures	• Learn transitive verbs which are followed by only one object • Learn transitive verbs which are followed by two objects • Identify the structures • Use Object complement structure
16	**Voice – I**	• Identify and use the passive voice • Know when the passive voice is used • Use the passive voice	• Learn when to use the active voice and passive voice • Observe the language used in sign boards and newspaper headlines • Change the voice
17	**Voice – II**	• Identify the two objects of a verb • Omit the object in a passive voice sentence	• Change the voice when two objects are given
18	**Asking Yes/No Questions**	• Understand the word order in questions • Ask yes/no questions	• Communicate using yes/no questions • Invert the position of helping verb to make questions • Know the common errors in framing questions
19	**Asking Wh-Questions**	• Frame wh- questions • Seek information using such questions	• Learn wh- words • Ask for specific information using wh- questions
20	**Paragraph Writing – I**	• Generate ideas for writing a paragraph • Organize ideas before writing	• Write a paragraph using hints • Organize the ideas • Write the rough draft • Edit the paragraph to make final

		• Write a short paragraph	copy
21	**Paragraph Writing – II**	• Identify a topic sentence • Write a cohesive paragraph • Write supporting sentences	• Write a short paragraph using the first sentence • Learn a few ways of beginning paragraph • Write a few supporting sentences • Write a short paragraph
22	**Letter Writing – I**	• Understand the format of a personal letter • Write a personal letter	• Learn the main components (the format) of a personal letter • Practise a few ways of greetings, openings and closures • Write a personal letter
23	**Letter Writing - II**	• Understand the format of an official letter • Write an official letter	• Know the format of official letters • Learn the expressions often used in official letters • Write an official letter using the hints

Weightage Table

Sl. No	Module	Short Questions	Essay questions
1	Speaking	8	1
2	Grammar	12	1 (questioning)
3	Reading	---	2
4	Writing	---	4 (2 from paragraph writing and 2 from letter writing)

ENGINEERING MATHEMATICS - I

(Common to all branches)

Subject title : Engineering Mathematics-I
Subject code : M-102
Periods per week : 5
Total Periods per Semester : 75

Time Schedule with BLUEPRINT

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	2	1	2	0	1	0	0	0	0
2	Partial Fractions	5	1	9	1	1	0	½	0	0
3	Matrices and Determinants	18	6	25	2	3	0	0	½	1
	Unit - II Trigonometry									
4	Compound Angles	4	2	14	1	1	0	1	0	0
5	Multiple and Submultiple angles	6	3	16	1	2	0	0	1	0
6	Transformations	6	3	17	1	0	0	0	½	1
7	Inverse Trigonometric Functions	6	2	17	1	0	0	½	1	0
8	Properties of triangles	2	0	4	2	0	0	0	0	0
9	Hyperbolic Functions	2	0	2	1	0	0	0	0	0
10	Complex Numbers	4	2	14	1	1	0	1	0	0
	Total	55	20	120	11	9	0	3	3	2
	Marks				22	18	0	30	30	20

R: Remembering type : 52 marks
U: Understanding type : 48 marks
App: Application type : 20 marks

ENGINEERING MATHEMATICS – I

COMMON TO ALL BRANCHES – 102

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
3. Improper

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

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

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

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 Solve simple problems on Compound Angles

4.1 Define compound angles and state the formulae of Sin (A±B), Cos (A±B), tan (A±B) and Cot (A±B)

4.2 Give simple examples on compound angles to derive the values of $Sin15^0$, $Cos15^0$, $Sin75^0$, $Cos75^0$, $\tan 15^0$, $\tan 75^0$ etc.

4.3 Derive identities like Sin (A+B) .Sn (A–B) = $Sin^2 A – Sin^2 B$ etc.

4.4 Solve simple problems on compound angles.

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

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

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

5.3 Solve simple problems using the above formulae

6.0 Apply Transformations for solving the problems in Trigonometry

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

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

7.0 Use Inverse Trigonometric Functions for solving engineering problems

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

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

7.3 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.

7.4 State various properties of inverse trigonometric functions and identities like

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

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

8.0 Appreciate Properties of triangles

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

9.0 Represent the Hyperbolic Functions in terms of logarithm functions

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

9.2 Represent inverse hyperbolic functions in terms of logarithms.

10.0 Represent Complex numbers in various forms

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

10.2 Define the operations on complex numbers with examples.

10.3 Define amplitude of a complex number

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

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 Cramer's rule, Matrix inversion method-examples-Elementary row operations on matrices -Gauss-Jordan method to solve a system of equations.

Unit-II

Trigonometry:

4. Compound angles: Formulas of sin (A±B), cos (A±B), tan (A±B), cot (A±B) and related identities with problems.
5. Multiple and sub-multiple angles: trigonometric ratios of multiple angles 2A, 3A and submultiple angle A/2 with problems.
6. Transformations of products into sums or differences and vice versa simple problems
7. Inverse trigonometric functions: definition, domains and ranges-basic properties-problems.
8. Properties of triangles: relation between sides and angles of a triangle- sine rule, cosine rule, tangent rule and projection rule – statements only.
9. Hyperbolic functions: Definitions of hyperbolic functions, identities of hyperbolic functions, inverse hyperbolic functions and expression of inverse hyperbolic functions in terms of logarithms.
10. Complex Numbers: Definition of a complex number, Modulus and conjugate of a complex number, Arithmetic operations on complex numbers, Modulus- Amplitude (polar) form, Exponential (Euler) form of a complex number- Problems.

Reference Books:

1. A text book of matrices by Shanti Narayan,
2. Plane Trigonometry, by S.L Loney

ENGINEERING PHYSICS-I

Subject Title : Engineering Physics - I
Subject Code : M -103
Periods per week : 04
Total periods per semester : 60

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type (2 marks)	Essay Type (10 marks)
1.	Units and Dimensions	08	08	4	-
2.	Modern Physics	12	28	4	2
3.	Heat and Thermodynamics	12	28	4	2
4.	Elements of Vectors	14	28	4	2
5.	Kinematics	14	28	4	2
	Total:	**60**	**120**	**20**	**8**

INTERNAL ASSESSMENT

UNIT TEST 1 : UNITS 1,2 and 3

UNIT TEST 2 : UNITS 4 and 5

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 (without problems)
1.15 State the limitations of dimensional analysis

2.0 Understand the concept of Modern physics

2.1 Explain Photo-electric effect

2.2 Write Einstein's photoelectric equation
2.3 State the laws of photoelectric effect
2.4 Explain the Working of a photoelectric cell
2.5 List the Applications of photoelectric effect
2.6 Recapitulate refraction of light and its laws
2.7 Define critical angle
2.8 Explain the Total Internal Reflection
2.9 Explain the basic principle of optical Fiber
2.10 Mention types of optical fibbers
2.11 List the applications of optical Fiber
2.12 Define super conductor and superconductivity
2.13 List the examples of superconducting materials
2.14 List the applications of superconductors

3.0 Understand the concept of Heat and thermodynamics

3.1 Explain the concept of expansion of gases
3.2 Explain Boyle's law
3.3 State Charle's laws in terms of absolute temperature
3.4 Define absolute zero temperature
3.5 Explain absolute scale of temperature
3.6 Define ideal gas
3.7 Derive the ideal gas equation.
3.8 Define gas constant and Universal gas constant
3.9 Explain why universal gas constant is same for all gases
3.10 State SI unit of universal gas constant
3.11 Calculate the value of universal gas constant
3.12 State the gas equation in terms of density
3.13 Distinguish between r and R
3.14 Define Isothermal process
3.15 Define adiabatic process
3.16 Distinguish between isothermal and adiabatic process
3.17 State first and second laws of thermodynamics
3.18 Define specific heats & molar specific heats of a gas
3.19 Derive the relation $C_p - C_v = R$
3.20 Solve the related numerical problems

4.0 Understand the concept of Elements of Vectors

4.1 Explain the concept of Vectors
4.2 Define Scalar and Vector quantities
4.3 Give examples for scalar and vector quantities
4.4 Represent a vector graphically
4.5 Classify the Types of Vectors
4.6 Resolve the vectors
4.7 Determine the Resultant of a vector by component method
4.8 Represent a vector in space using unit vectors (i, j, k)
4.9 State triangle law of addition of vectors
4.10 State parallelogram law of addition of vectors
4.11 Illustrate parallelogram law of vectors in case of flying bird and sling.
4.12 Derive an expression for magnitude and direction of resultant of two vectors
4.13 State polygon law of addition of vectors
4.14 Explain subtraction of vectors

4.15 Define Dot product of two vectors with examples (Work done, Power)
4.16 Mention the properties of Dot product
4.17 Define Cross products of two vectors and state formulae for torque and linear velocity
4.18 Mention the properties of Cross product.
4.19 Solve the related numerical problems

5.0 Understand the concept of Kinematics

5.1 Write the equations of motion in a straight line
5.2 Explain the acceleration due to gravity
5.3 Derive expressions for vertical motion
a) Maximum Height, b) time of ascent, c) time of descent, and d) time of flight
5.4 Derive an expression for height of a tower when a body projected vertically upwards from the top of a tower.
5.5 Explain projectile motion with examples
5.6 Explain Horizontal projection
5.7 Derive an expression for the path of a projectile in horizontal projection
5.8 Explain Oblique projection
5.9 Derive an expression for the path of projectile in Oblique projection
5.10 Derive formulae for projectile in Oblique projection
a) Maximum Height, b) time of ascent, c) time of descent, d) time of flight
e) Horizontal Range and f) Maximum range
5.11 Solve the related numerical problems

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- Applications and limitations of Dimensional analysis.

2. 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 of an optical fiber-types of optical fibers - Applications of optical fibers- concepts of superconductivity - applications

3. Heat and Thermodynamics:

Expansion of Gases- Boyle's law- Absolute scale of temperature- Charle's 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

4. 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

5. 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

REFERENCE BOOKS

1. Intermediate physics Volume- I & 2	Telugu Academy
2. Text book of physics	Resnick & Holiday
3. Engineering physics	Gaur and Gupta
4. Fundamental Physics Volume -1 & 2	K.L.Gomber and K.L.Gogia

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES - I

Subject Title	**:**	**Engineering Chemistry and Environmental Studies - I**
Subject Code	**:**	**M-104**
Periods per week	**:**	**04**
Total periods per semester	**:**	**60**

TIMESCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type (2 marks)	Essay Type (10 marks)
1.	FUNDAMENTALS OF CHEMISTRY	18	40	5	3
2.	SOLUTIONS	10	18	4	1
3.	ACIDS & BASES	10	18	4	1
4.	WATER TECHNOLOGY	14	28	4	2
5.	ENVIRONMENTAL STUDIES – 1	08	16	3	1
	Total:	**60**	**120**	**20**	**8**

OBJECTIVES

Upon completion of the course the student shall be able to

A. ENGINEERINGCHEMISTRY

1.0 Fundamentals of Chemistry

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 at omic theory and its limitations

1.4 Explain the concept of Quantum numbers with examples

1.5 Explain 1.Aufbau'sprinciple, 2.Hund'sruleand 3.Pauli'sexclusion principle with examples.

1.6 Define Orbital.

1.7 Draw the shapes of s,pandd Orbitals.

1.8 Distinguish between Orbitand Orbital

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

1.10 Define chemical bond.

1.11 Explain the Postulates of Electronic theory of valancy

1.12 Define and explain three types of Chemical bonding viz., Ionic Covalent, Coordinate covalent bond with examples.

1.13 Explain bond formation in NaClandMgO

1.14 List the Properties of Ionic compounds

1.15 Explain covalent bond formation in Hydrogen molecule, Oxygen molecule, and Nitrogen molecule using Lewis dot method.

1.16 List the Properties of Covalent compounds

1.17 Distinguish between ionic compounds and covalent compounds.

1.18 Define the terms 1.Oxidation, 2.Reduction 3.Oxidation number 4. Valency, with examples.

1.19 Calculate the Oxidation Number

1.20 Differentiate between Oxidation Number and Valency.

2.0 Solutions

2.1 Define the terms 1.Solution, 2.Soluteand 3.Solvent

2.2 Classify solutions based on physical state.

2.3 Define solubility, unsaturated, saturated and super saturated solutions.

2.4 Define mole.

2.5 Explain Mole concept with examples.'

2.6 Define the terms 1. Atomic weight, 2.Molecular weight and 3. Equivalent weight

2.7 Calculate Molecular weight and Equivalent weight of Acids, Bases and Salts.

2.8 Define 1.Molarity and Normality.

2.9 Solve Numerical problems on Mole, Molarity and Normality

3.0 Acids and bases

3.1 Explain Arrhenius theory of Acids and Bases

3.2 State the limitations of Arrhenius theory of Acid sand Bases

3.3 Explain Bronsted–Lowry theory of acids and bases.

3.4 State the limitations of Bronsted–Lowry theory of acids and 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 and give examples.

3.11 State the applications of buffer solutions.

4. 0 Water Technology

4.1 State the various Sources of water.

4.2 Define the terms soft water and hardwater with examples

4.3 Define hardness of water.

4.4 Explain temporary and permanent hardness of water.

4.5 List the usual chemical compounds causing hardness (with Formulae)

4.6 Define Degree of hardness, units of hardness in ppm(mg/L) and numerical problems related to hardness.

4.7 Disadvantages of using hardwater in industries.

4.8 Explain the methods of softening of hardwater:a) permut it process b).Ion-Exchange process.

4.9 Essential qualities of drinking water.

4.10 Explain municipal treatment of water for drinking purpose.

4.11 Define Osmosis and Reverse Osmosis(RO).

4.12 List the advantages of RO

5.0. ENVIRONMENTALSTUDIES

5.1 Define the term environment

5.2 Explain the scope and importance of environmental studies

5.3 Explain the following terms 1).Lithosphere, 2).Hydrosphere, 3).Atmosphere,4).Biosphere, 5)Pollutant, 6).Contaminant 7) Pollution 8)receptor 9)sink 10) particulates, 11)Dissolved oxygen(DO), 12).Threshold limit value(TLV), 13).BOD, and 14).COD

5.4 Explain the growing energy needs

5.5 Explain renewable(non-conventional) and non renewable(conventional) energy sources with examples.

5.6 Define an Ecosystem. understand biotic and abiotic components of ecosystem.

5.7 Define the terms:

1).Producers, 2).Consumers and 3).Decomposers with examples.

5.8 Explain biodiversity and threats to biodiversity

COURSE CONTENT

A. ENGINEERINGCHEMISTRY

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 – Valency, types of chemical bonds – Ionic, covalent and co-ordinate covalent bond with examples–Properties of Ionic and Covalent compounds

Oxidation-Reduction: Concepts of Oxidation- Reduction, Oxidation Number-calculations,

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. Water technology

Introduction–soft and hardwater–causes of hardness–types of hardness –disadvantages of hard water – degree of hardness (ppm) – softening methods – permut it 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'.

5. ENVIRONMENTALSTUDIES

Introduction–environment–scopeandimportanceofenvironmentalstudies important terms– renewable and nonrenewable energy sources–Concept of ecosystem, producers, consumers and decomposers – Biodiversity, definition and threats to Biodiversity.

INTERNAL ASSESSMENT

UNIT TEST 1 : UNITS 1 and 2

UNIT TEST 2 : UNITS 3,4 and 5

REFERENCEBOOKS

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

Subject Title : Engineering Mechanics - I
Subject Code : M-105
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	Statics	22	42	04	03
2	Friction	18	29	03	02
3	Geometrical properties of sections	20	39	03	03
	Total	**60**	**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 Solve the related numerical problems

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).

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- I

Subject Title : Workshop Technology- I
Subject Code : M-106
Periods per Week : 04
Periods per Year : 60

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	16	29	03	02
	(2) Fitting	20	34	03	02½
	(3) Forging	12	26	02	02
	(4) Sheet metal	12	21	02	1½
	Total	60	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. 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 machine forgoing operations such as upsetting, drawing down and punching with legible sketch
e. 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

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 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 **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 **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.

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- I

Subject Title : Engineering Drawing- I
Subject Code : M–107
Periods/Week : 06
Periods Per Year : 90

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	05	1	-
4	Dimensioning Practice	01	09	05	1	-
5	Geometrical constructions	03	24	25	1	02
6	Projection of points, Lines, Planes & Solids	03	21	25	1	02
7	Sectional views	03	24	20	-	02
Total		**12**	**90**	**80**	**04**	**06**

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

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

1.0 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 Four 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 8 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)

7.0 Appreciate the need of Sectional Views

7.1 Explain the need to draw sectional views.
7.2 Select the section plane for a given component to reveal maximum information.
7.3 Explain the positions of section plane with reference planes
7.4 Differentiate between true shape and apparent shape of section
7.5 Draw sectional views and true sections of regular solids discussed in 6.0
7.6 Apply principles of hatching.

Drawing Plate– 9: Having problems of section of solids (6 exercises)
Drawing Plate–10: Having problems of section of solids (6 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.	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

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 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

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 - I

Subject Title : Workshop Practice - I
Subject Code : M -108
Periods/Week : 06
Periods Per Year : 90

TIME SCHEDULE

S.No	Major Title	No of Periods
1.	Fitting shop	18
2.	Forging shop	15
3.	Carpentry shop	30
4.	Sheet metal work	27
	Total	90

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	– 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	– 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	– 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

Title of the Job	Competencies	Key Competencies
Forging shop 4.Conversion of Round to Square	– 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
5.Conversion of Round to Hexagon	– 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 6.Cutting of wood with hand saw	– 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
7.Planning of wood	– 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	• Identify the direction for planning wood stock • Prepare the jack plane for planning • Plane the surfaces on all four sides using jack plane

	appropriate tool – Fix the work in the vice – Plane the surfaces on all four sides using jack plane	
Title of the Job	**Competencies**	**Key Competencies**
Contd.,,, 8.Chiselling of wood	– 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
9.Preparation of a Dove tail joint	- 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

Title of the Job	Competencies	Key Competency
Sheet metal Work 10.Practice on cutting of sheet	– 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
11.Formation of joints like grooved joint, locked groove joint	– 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.
12.Preparation of a rectangular open type tray	– 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
13.Preparation of hollow cylinder	– 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	• 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

	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	

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

FORGING SHOP

1. Conversion of round to square.
2. Conversion of round to Hexagon.

CARPENTRY SHOP

1. Cutting of wood with hand saw.
2. Planning of wood.
3. Planning and chiselling of wood.
4. Orientation of wood grain.
5. Preparation of dovetail joint.

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

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)

PHYSICS LAB - I

(Common for all branches)

Subject Title	**:**	**Physics Lab - I**
Subject Code	**:**	**M -109**
Periods per week	**:**	**03**
Total periods per semester	**:**	**22**

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.	Boyle's law verification	03
5.	Refractive index of solid using traveling microscope	03
6.	Meter bridge	03
	Revision	02
	Test	02
	Total:	**22**

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 of forces.

4.0 Verify the Boyle's law employing a Quill tube

5.0 Determine the refractive index of a solid using travelling microscope

6.0 Determine the specific resistance of wire material using Meter Bridge

Competencies and Key competencies to be achieved by the student

Name of the Experiment **(No of Periods)**	**Competencies**	**Key competencies**
1. Hands on practice on Vernier Calipers(03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate the volume of given object	• Read the scales • Calculate the volume of given object
2. Hands on practice on Screw gauge(03)	• Find the Least count • Fix the specimen in position • Read the scales • Calculate thickness of glass plate and cross section of wire	• Read the scales • Calculate thickness of given glass plate • Calculate cross section of wire
3. Verification of Parallelogram law of forces and Triangle law of forces(03)	• Fix suitable weights • Note the positions of threads on drawing sheet • Find the angle at equilibrium point • Construct parallelogram • Compare the measured diagonal • Construct triangle • Find the length of sides • Compare the ratios	• Find the angle at equilibrium point • Constructing parallelogram • Construct triangle • Compare the ratios of force and length

4. Boyle's law verification (03)	• Note the atmospheric pressure • Fix the quill tube to retort stand • Find the length of air column • Find the pressure of enclosed air • Find and compare the calculated value P x l	• Find the length of air column • Find the pressure of enclosed air • Find the value P x l
5. Refractive index of solid using traveling microscope(03)	• Find the least count of vernier on microscope • Place the graph paper below microscope • Read the scale • Calculate the refractive index of glass slab	• Read the scale • Calculate the refractive index of glass slab
6. Meter bridge(03)	• Make the circuit connections • Find the balancing length • Calculate unknown resistance • Find the radius of wire • Calculate the specific resistance	• Find the balancing length • Calculate unknown resistance • Calculate the specific resistance

CHEMISTRY LAB - I

(Common for all branches)

Subject Title	**:**	**Chemistry Lab - I**
Subject Code	**:**	**M-110**
Periods per week	**:**	**03**
Total periods per semester	**:**	**22**

TIMESCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Familiarization of methods of Volumetric Analysis	03
2.	Preparation of Std Na_2CO_3 solution and making solutions of different dilution	03
3.	Estimation of HCl solution using Std. Na_2CO_3 solution	03
4.	Estimation of NaOH using Std. HCl solution	03
5.	Estimation of H_2SO_4 using Std. NaOH solution	03
6.	Estimation of Mohr's Salt using Std. $KMnO_4$	03
	Revision	02
	Test	02
	Total:	**22**

*C**OMPUTER FUNDAMENTALS LAB -1***

(Common To All Branches)

Subject Title : Computer Fundamentals Lab - 1
Subject Code : M - 111
Periods/Week : 3
Periods/Semester : 45

LIST OF EXPERIMENTS

1.0 BASICS

1.1. Identify the various components of a Computer system

1.2. Differentiate between hardware and software

1.3. State the configuration of a computer system

1.4. Exercise on creation of Text Files using Notepad, WordPad

1.5. Exercise on creation of .jpeg, .bmp Files using MS Paint

1.6. Exercise how to use calculator

2.0 DOS Operating System

2.1. Practice on Internal and External commands.

2.2. Create and use Batch Files.

2.3. Know the usage of Editors.

3.0 WINDOWS Operating System

3.1. Exercise on creation of folders and organizing files in different folders

3.2. Exercise on use of Recycle Bin

3.3. Exercise on use of My Computer and My Documents

3.4. Exercise on creation of shortcut to files and folders (in other folders) on Desktop

3.5. Exercise on arranging of icons – name wise, size, type, Modified

3.6. Exercise on searching of files and folders

3.7. Exercise on using of explorer for accessing of files and folders

3.8. Exercise on organizing files / folders using copy and paste of files and folders

3.9. Change resolution, colour, appearance, screen server options of Display

3.10. Change the system date and time.

4.0 Internet

4.1. Importance of web browser software

4.2. Structure of URL

4.3. Create an E-mail account

4.4. Send an E-mail

4.5. Receive an E-mail

4.6. Browse the Internet using various search engines

OBJECTIVES AND KEY COMPETENCIES

S. No	Name of Experiment	Objectives	Key Competencies
1.	Identify the various components of a Computer system	Identify various Components of a System	❖ Check whether components are identified correctly ❖ Identify all components inside computer ❖ Identify all Peripherals connected ❖ Observe the functionality of all components like CPU, RAM, HDD, FDD, Motherboard
2.	Differentiate between hardware and software	To Differentiate between hardware and software	❖ Observe differences between hardware and software
3.	State the configuration of a computer system	Able to observe configuration of given system	❖ Use System icon in control panel ❖ Use system information in Accessories
4.	Practice on Internal and External commands.	To use internal commands To use External commands	❖ Check whether able to use all internal commands using DOS ❖ Check whether able to use all external commands using DOS
5.	Create and use Batch Files.	Able to create Batch files Able to create Autoexe.bat file	❖ Check whether able to create by taking set files in creating batch file ❖ Check whether able to create AUtoexe.bat file properly
6.	Know the usage of Edline Editor	Able to use edline command to create a file Able to edit a file using edline command	❖ Check whether able to use edline command in DOS environment ❖ Check whether able to edit a file using edline command
7.	Exercise on creation of folders and organizing files in different folders	Able to create folder Able to organize file in different folders	❖ Check whether able to create folder using right click on desktop ❖ Check whether able to create folder using windows explorer ❖ Observer in organizing files in different folders using windows explorer ❖ Observer in organizing files in different folders using My Computer

8.	Exercise on creation of .jpeg, .bmp Files using MS Paint	Able to create picture file in .jpeg format Able to create picture file in .bmp format	❖ Check whether able to create picture file .jpeg format properly ❖ Check whether able to create picture file in .bmp format properly
9.	Exercise on using Recycle Bin	Able to Use Recycle Bin	❖ Check Recycle bin whether able to use delete files ❖ Observe files were properly restored files
10.	Exercise on use of My Computer and My Documents	Able to Access files and folders in C: Drive Able Access files and folders in other drives Able to use My Documents so that organize and access files and folders in it Able to use My Documents so that Organizing files in My Music, My Pictures, My Videos Able to create short cut for My Documents on desktop properly	❖ Check whether able to access files in C: Drive using My Computer correctly or not ❖ Check whether able to access files in other drives using My Computer correctly or not ❖ Check whether able use CD/DVD drive using My Computer ❖ Check whether able to organize files and folders in My Documents ❖ Check Whether able to organize files in My Music, My Pictures, My Videos in My Documents ❖ Check able to create short cut for My Documents on desktop properly
11.	Exercise on creation of shortcut to files and folders (in other folders) on Desktop	Able to create shortcut of files and folders on desktop	❖ Check whether can able to create shortcut for any files created on desktop ❖ Check whether can able to create shortcut for any folder created on desktop
12.	Exercise on arranging of icons – name wise, size, type, Modified	Able to arranging of icons – name wise, size, type, Modified on desktop	❖ Observe whether able to arrange of icons – name wise, size, type, Modified
13.	Exercise on searching of files and folders	Able to search of files and folders	❖ Check searching of files and folders
14.	Exercise on using of explorer for accessing of files and folders	Able to use of explorer for accessing of files and folder	❖ Check use of explorer for accessing of files and folders
15.	Exercise on organizing files / folders using copy	Able to organizing files / folders using copy and paste of files and folders using explorer	❖ Check organizing files / folders using copy and paste of files and folders

	and paste of files and folders	Able to organizing files / folders using copy and paste of files and folders using My Computer	❖ Check organizing files / folders using copy and paste of files and folders using my computer
16.	Exercise using Calculator from Accessories and through Run	Able to use calculator in Standard mode Able to use calculator in Scientific mode	❖ Check calculator in Standard mode ❖ Check calculator in Scientific mode
17.	Exercise on shutdown of computer system	Able to shutdown of computer system	❖ Check shutdown of computer system
18.	Exercise on understanding the use of Taskbar	Able to understand the use of Taskbar by opening some applications	❖ Check the use of Taskbar by opening some applications
19.	Exercise on using of Internet Explorer or any other browser	Able to use of Internet Explorer Able to use of Mozilla Firefox Able to use of Google Chrome Able to use of opera	❖ Check use of Internet Explorer ❖ Check use of Mozilla Firefox ❖ Check use of Google Chrome ❖ Check use of opera
20.	Change resolution, color, appearance, screen server options of Display	Able to change resolution, color, appearance, screen server options of Display	❖ Check resolution, color, appearance, screen server options of Display
21.	Change the system date and time	Able to change system date and time	❖ Check change system date and time
22.	Create an E-mail account	Able to create an E-mail account	❖ Check able to create an E-mail account
23.	Send an E-mail	able to send an E-mail	❖ Check able to send an E-mail
24.	Receive an E-mail	able to receive an E-mail	❖ Check able to receive an E-mail
25.	Browse the Internet using various search engines	Able to search for a content in the Internet using various search engines	❖ Check able to search for a content in the Internet using various search engines

C-16

DME – II SEMESTER

DIPLOMA IN MECHANICAL ENGINEERING (C-16)

SCHEME OF INSTRUCTIONS AND EXAMINATIONS
(SECOND 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:								
M-201	English-II	3	-	45	3			100
M-202	Engineering Mathematics - II	5	-	75	3			100
M-203	Engineering Physics-II	4	-	60	3			100
M-204	Engineering Chemistry &Environmental Studies-II	4	-	60	3			100
M-205	Engineering Mechanics-II	4	-	60	3			100
M-206	Workshop Technology-II	4	-	60	3			100
PRACTICAL:								
M-207	Engineering Drawing practice -II	-	6	90	3			100
M-208	Basic Work shop practice -II	-	6	90	3			100
M-209	Physics Lab-II	-	1½	45	1½			50
M-210	Chemistry Lab-II	-	1½		1½			50
M-210	Computer fundamentals Lab practice -II	-	3	45	3			100
	TOTAL	24	18	630				1000

English for Polytechnics

(Common to All the Branches)
Second Semester

Subject Code : M-201
No. of periods per week : 3
No. of periods per year : 45

Objectives and Key Competencies

Sl. No.	Name of the Unit	Objectives	Key Competencies
01	**Expressing Obligations**	• Express obligation • Express an order or a strong suggestion	• Learn the words to express suggestion and obligation • Express suggestions and obligations
02	**Fixing and Cancelling Appointments**	• Fix appointments • Reschedule or cancel appointments	• Know the importance of appointment • Learn expressions used in fixing an appointment • Know the ways of rescheduling and cancelling appointments
03	**Extending and Accepting Invitations**	• Extend invitations • Accept invitations	• Identify the phrases used to extend and accept invitations • Practise a few ways of extending invitations • Learn the expressions used for accepting invitations
04	**Giving Instructions**	• Understand instructions • Give instructions	• Know the need to give instructions • Learn the steps involved in giving instructions • Practise giving instructions
05	**Asking for and**	• Ask for directions	• Know the words and

	Giving Directions	• Give directions	phrases used often in giving directions • Learn how to ask for and give directions • Know the common errors in giving directions
06	**Describing Words**	• Listen for general comprehension • Listen for specific details • identify adjectives and know what an adjective is • use adjectives accurately	• Listen for main idea and minute details • Learn several adjectives • Know the common errors in the use of adjectives
07	**The Here and Now**	• Listen for general comprehension • Listen for specific details • identify prepositions and understand what prepositions are • Use prepositions	• Listen for main idea and minute details • Learn the prepositions of place • Learn the prepositions of time • Learn the common errors in the use of prepositions
08	**An Environmental Challenge**	• Comprehend the main idea • Learn new words	• Learn how to identify the central idea • Learn some new words
09	**The Will to Succeed**	• Understand the main idea • Learn narrative style of writing	• Know the secret of success of a woman entrepreneur • Know the narrative style of writing • Learn new words
10	**Waiting for Mr. Clean**	• Understand the main idea • Identify conversational style of writing • Learn new words	• Learn to note down the central idea of a paragraph • Learn new words
11	**Reported Speech**	• Understand what reported speech is • Report something spoken by others	• Learn two ways of reporting a speaker's words • Learn how to change from direct speech to indirect

			speech
12	**Error Analysis-I**	• Identify common errors in sentences • Correct errors in the usage of nouns, pronouns and verbs	• Know the various errors in spoken and written English • Identify the common errors • Correct the errors in nouns, pronouns and verbs
13	**Error Analysis – II**	• Identify the errors in usage of English • Correct errors in the usage of articles, adjectives, adverbs, prepositions and conjunctions	• Correct the errors in the usage of articles, adjectives, adverbs, prepositions and conjunctions • Rewrite a paragraph correcting the errors
14	**Error Analysis – III**	• Correct errors in vocabulary, questions, subject-verb agreement, homophones • Identify errors of redundancy	• Correct the errors in the usage of vocabulary and in framing questions • Correct the errors in concord and redundancy
15	**Data Interpretation - I**	• Study and understand the information in flow charts • analyse/interpret flow charts • Write a paragraph using the data given	• Study the data given in flow charts • analyse the data given in flow charts • Write a paragraph using the data given
16	**Data Interpretation – II**	• Understand the information in a tree diagram • Analyse the data • Write a paragraph using the data given	• Study the data given in tree diagrams • analyse the data given in tree diagrams • Write a paragraph using the data given
17	**Data Interpretation – III**	• Understand the data in the table • Present the data given in a table • Write a paragraph using he data given	• Study the data given in tables • analyse the data given in tables • Write a paragraph using the data given

18	**Resume**	• Understand what a resume is • Prepare a resume	• Learn the salient features of a resume • Observe a sample resume given • Prepare a resume
19	**Cover Letter**	• Understand what a cover letter is • Write a cover letter	• Know the importance of a cover letter • Read the sample cover letter • Write a cover letter
20	**Note Making**	• Identify important words and ideas in a text • Learn how to make notes using the cue method	• Know the importance of making notes • Look for the key words given in the text • Observe the sample outline using cue method • Make notes using cue and mapping methods
21	**Writing a Report**	• Understand the format of a report of an industrial visit • Write a report using the format	• Learn the various kinds of reports • Observe the format of a report of an industrial visit • Learn the tips to write a report • Write a report

Weightage Table

Sl. No	Module	Short Questions	Essay questions
1	Speaking	8	1
2	Grammar	12	--
3	Reading	---	2
4	Writing	---	5

ENGINEERING MATHEMATICS - II

(Common to all branches)

Subject title	**:**	**Engineering Mathematics-II**
Subject code	**:**	**M-202**
Periods per week	**:**	**5**
Total Periods per Semester	**:**	**75**

Time Schedule with BLUEPRINT

S. No	Major Topic	No of Periods		Weightage of Marks	Short Type			Essay Type		
S.No	**Unit-I Co-ordinate Geometry**	**Theory**	**Practice**		**R**	**U**	**App**	**R**	**U**	**App**
1	Straight Lines	6	2	13	2	2	0	0	1/2	0
2	Circle	6	2	13	2	2	0	0	1/2	0
	Unit -II Differential Calculus									
3	Limits and Continuity	6	2	10	2	3	0	0	0	0
4	Differentiation	20	10	48	2	2	0	2	2	0
	Unit -III Applications of Differentiation									
5	Geometrical Applications	8	3	19	2	0	0	0	1/2	1
6	Maxima and Minima	7	3	17	1	0	0	0	1/2	1
	Total	53	22	120	11	9	0	2	4	2
	Marks				22	18	0	20	40	20

R:	**Remembering type**	**:**	42 marks
U:	**Understanding type**	**:**	58 marks
App:	**Application type**	**:**	20 marks

Objectives

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

UNIT - I

Coordinate Geometry

1.0 Solve the problems on Straight lines

1.1 Write the different forms of a straight line – point slope form, two point form, intercept form, normal form and general form

1.2 Solve simple problems on the above forms

1.3 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.

2.0 Solve the problems on Circles

2.1 Define locus of a point – circle and its equation.

2.2 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

2.3 Write the general equation of a circle and find the Centre and radius.

2.4 Write the equation of tangent and normal at a point on the circle.

2.5 Solve the problems to find the equations of tangent and normal.

UNIT - II

Differential Calculus

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

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

3.2 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).

3.3 Solve the problems using the above standard limits

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

3.5 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.

4.0 Appreciate Differentiation and its meaning in engineering situations

4.1 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.

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

4.3 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.

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

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

4.6 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)** $\log\left(\sin(\cos x)\right)$.

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

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

4.9 Find the derivatives of hyperbolic functions.

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

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

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

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

4.14 Explain the definition of Homogenous function of degree n

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

UNIT - III

Applications of the Differentiation

5.0 Understand the Geometrical Applications of Derivatives

5.1 State the geometrical meaning of the derivative as the slope of the tangent to the curve y=f(x) at any point on the curve.

5.2 Explain the concept of derivative to find the slope of tangent and to find the equation of tangent and normal to the curve y=f(x) at any point on it.

5.3 Find the lengths of tangent, normal, sub-tangent and sub normal at any point on the curve y=f(x).

5.4 Explain the concept of angle between two curves and procedure for finding the angle between two given curves with illustrative examples.

6.0 Use Derivatives to find extreme values of functions

6.1 Define the concept of increasing and decreasing functions.

6.2 Explain the conditions to find points where the given function is increasing or decreasing with illustrative examples.

6.3 Explain the procedure to find the extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima.

6.4 Solve problems on maxima and minima in applications like finding areas, volumes, etc.

COURSE CONTENT

UNIT-I

Coordinate geometry

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

2. Circle: locus of a point, Circle definition-Circle equation given (i) center and radius, (ii) two ends of a diameter (iii) Centre and a point on the circumference (iv) three non collinear points and (v) Centre and tangent equation - general equation of a circle - finding center, radius: tangent, normal to circle at a point on it.

UNIT-II

Differential Calculus

3. Concept of Limit- Definition- Properties of Limits and Standard Limits -Simple Problems- Continuity of a function at a point- Simple Examples only.
4. Concept of derivative- definition (first principle)- different notations-derivatives of elementary functions - problems. Derivatives of sum, product, quotient, scalar multiplication of functions - problems. Chain rule, derivatives of inverse trigonometric functions, derivative of a function with respect to another function, derivative of parametric functions, derivative of hyperbolic, implicit functions, logarithmic differentiation – problems in each case. Higher order derivatives - examples – functions of several variables – partial differentiation, Euler's theorem-simple problems.

UNIT-III

Applications of Derivatives:

5. Geometrical meaning of the derivative, equations of Tangent and normal to a curve at any point. Lengths of tangent, normal, sub tangent and subnormal to the curve at any point. Angle between the curves - problems.
6. 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.

Reference Books:

1. Co-ordinate Geometry, by S.L Loney
2. Thomas Calculus, Pearson Addison-Wesley publishers
3. Calculus – I, by Shanti Narayan and Manicavachgam Pillai, S.V Publications

ENGINEERING PHYSICS-II

Subject Title : Engineering Physics - II
Subject Code : M -203
Periods per week : 04
Total periods per semester : 60

TIME SCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type (2 marks)	Essay Type (10 marks)
1.	Friction	08	14	2	1
2.	Work, Power and Energy	10	18	4	1
3.	Simple Harmonic Motion	12	28	4	2
4.	Sound	12	26	3	2
5.	Properties of matter	06	06	3	-
6.	Electricity & magnetism	12	28	4	2
	Total:	**60**	**120**	**20**	**8**

INTERNAL ASSESSMENT

UNIT TEST 1 : UNITS 1,2 and 3

UNIT TEST 2 : UNITS 4,5 and 6

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the concept of Friction

1.1 Define friction and state its causes
1.2 Classify the types of friction
1.3 Explain the concept of Normal reaction
1.4 State the laws of friction
1.5 Define coefficients of friction
1.6 Explain the Angle of friction
1.7 Derive an expression for acceleration of a body on a rough horizontal surface
1.8 Derive an expression for the displacement and time taken to come to rest over a rough horizontal surface
1.9 List the Advantages and Disadvantages of friction
1.10 Mention the methods of minimizing friction
1.11 Solve the related numerical problems

2.0 Understand the concept of Work, Power, and Energy

2.1 Define the terms Work, Power and Energy.
2.2 State SI units and dimensional formula for Work, Power, and Energy
2.3 Define potential energy
2.4 Derive an expression for Potential energy with examples
2.5 Define kinetic energy
2.6 Derive an expression for kinetic energy with examples
2.7 State and prove Work- Energy theorem
2.8 Explain the relation between Kinetic energy and momentum
2.9 State the law of conservation of energy
2.10 Verify the law of conservation of energy in the case of a freely falling body
2.11 Solve the related numerical problems

3.0 Understand the concept of Simple harmonic motion

3.1 Define Simple harmonic motion
3.2 State the conditions of Simple harmonic motion
3.3 Give examples for Simple harmonic motion
3.4 Show that the tip of the projection of a body moving in circular path with uniform speed is SHM
3.5 Derive an expression for displacement of a body executing SHM
3.6 Derive an expression for velocity of a body executing SHM
3.7 Derive an expression for acceleration of a body executing SHM
3.8 Derive expressions for Time period and frequency of S H M
3.9 Define phase of S H M
3.10 Derive expression for Time period of a simple pendulum
3.11 State the laws of simple pendulum
3.12 Explain seconds pendulum
3.13 Solve the related numerical problems

4.0 Understand the concept of Sound

4.1 Define the term sound
4.2 Explain longitudinal and transverse wave motion
4.3 Distinguish between musical sound and noise
4.4 Explain noise pollution and state SI unit for noise
4.5 Explain causes of noise pollution
4.6 Explain effects of noise pollution
4.7 Explain methods of minimizing noise pollution
4.8 Explain the phenomenon of beats
4.9 List the applications of beats
4.10 Define Doppler effect
4.11 List the Applications of Doppler effect
4.12 Explain reverberation and reverberation time
4.13 Write Sabine's formula
4.14 Explain echoes
4.15 State conditions of a good auditorium
4.16 Solve the related numerical problems

5.0 Understand the properties of matter

5.1 Define terms Elasticity and plasticity
5.2 Define the terms stress and strain
5.3 State the units and dimensional formulae for stress and strain

5.4 State the Hooke's law
5.5 Define the surface tension
5.6 Explain Surface tension with reference to molecular theory
5.7 Define angle of contact
5.8 Define capillarity and state examples
5.9 Write the formula for surface tension based on capilarity
5.10 Explain the concept of Viscosity
5.11 Provide examples for surface tension and Viscosity
5.12 State Newton's formula for viscous force
5.13 Define co-efficient of viscosity
5.14 Explain the effect of temperature on viscosity of liquids and gases
5.15 State Poiseulle's equation for Co-efficient of viscosity
5.16 Solve the related numerical problems

6.0 Understand the concept of Electricity and Magnetism

6.1 Explain the concept of Electricity
6.2 State the Ohm's law
6.3 Explain the Ohm's law
6.4 Define specific resistance, conductance and their units
6.5 State Kichoff's laws
6.6 Explain Kichoff's laws
6.7 Describe Wheatstone's bridge with legible sketch
6.8 Derive an expression for balancing condition of Wheatstone's bridge
6.9 Explain the basic concept of Meter Bridge with legible sketch
6.10 Explain the concept of magnetism
6.11 State the Coulomb's inverse square law of magnetism
6.12 Define magnetic field and magnetic lines of force
6.13 State the Magnetic induction field strength-units and dimensions
6.14 Describe the moment of couple on a bar magnet placed in a uniform magnetic field
6.15 Solve the related numerical problems

COURSE CONTENT

1. Friction:

Introduction to friction- Causes- Types of friction- Laws of friction -Angle of friction— Motion of a body over a horizontal surface- Advantages and disadvantages of friction- Methods of reducing friction – Problems

2. 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

3. Simple Harmonic Motion:

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

4. Sound:

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

5. 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

6. Electricity & Magnetism:

Ohm's law and explanation- Specific resistance- Kirchoff's laws- Wheatstone's bridge - Meter bridge- Coulomb's inverse square law- magnetic field- magnetic lines of force-Magnetic induction field strength-moment of couple- problems.

REFERENCE BOOKS

1. Intermediate physics Volume- I & 2	Telugu Academy
2. Text book of physics	Resnick & Holiday
3. Engineering physics	Gaur and Gupta
4. Fundamental Physics Volume -1 & 2	K.L.Gomber and K.L.Gogia

ENGINEERING CHEMISTRY AND ENVIRONMENTAL STUDIES- II

Subject Title	**:**	**Engineering Chemistry and Environmental Studies- II**
Subject Code	**:**	**M-204**
Periods per week	**:**	**04**
Total periods per semester	**:**	**60**

TIMESCHEDULE

S.No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Type (2 marks)	Essay Type (10 marks)
1.	PRINCIPLES OF METALLURGY	10	16	3	1
2.	ELECTRO CHEMISTRY	14	30	5	2
3.	CORROSION	08	14	2	1
4.	POLYMERS	12	28	4	2
5.	FUELS	06	14	2	1
6.	ENVIRONMENTAL STUDIES	10	18	4	1
	Total:	**60**	**120**	**20**	**8**

1.0 Principles of Metallurgy

1.1 List the Characteristics of Metals.

1.2 Distinguish between Metals and Non Metals

1.3 Define the terms 1.Mineral, 2.Ore, 3. Gangue, 4.Fluxand 5.Slag

1.4 Describe Froth Floatation method of concentration of ore.

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

1.6 Explain the purification of Metals by Electrolytic Refining

1.7 Define an Alloy

1.8 Write the Composition of the following alloys:1.Brass, 2.Germansilver, and Nichrome

1.9 List the uses of following Alloys: Brass, German silver, Nichrome

2.0 Electrochemistry

2.1 Define the terms1. conductor, 2. Insulator, 3.Electrolyteand 4.Non–electrolyte

2.2 Types of electrolytes.- strong and weak with examples.

2.3 Distinguish between metallic conductors and Electrolytic conductors.

2.4 Explain Arrhenius theory of electrolytic dissociation

2.5 Explain electrolysis of fused NaCl.

2.6 ExplainFaraday'slawsofelectrolysis

2.7 Define Chemicalequivalent, Electrochemicalequivalent.

2.8 Solve the NumericalproblemsbasedonFaraday'slawsofelectrolysis

2.9 DefineGalvaniccell

2.10 Explain the construction and working of Galvaniccell

2.11 Distinguishbetweenelectrolyticcellandgalvaniccell

2.12 Explain thestandardelectrodepotentials

2.13 Defineelectrochemicalseriesand explainitssignificance.

2.14 Define and explainemfofacell.

2.15 Solve the numericalproblemsonemfofcell

3.0 Corrosion

3.1 Define the term corrosion

3.2 Explain the Factorsinfluencingtherateofcorrosion

3.3 Explaintheconceptofelectrochemicaltheoryofcorrosion

3.4 Describetheformationofa)compositioncell,b)stresscell c)concentrationcell

3.5 Define rust and explainthemechanismofrustingofiron with equations.

3.6 Explainthemethodsofpreventionofcorrosion: a)Protectivecoatings

b) Cathodicprotection(SacrificialanodeprocessandImpressed–voltage process)

4.0 Polymers

4.1 Explain theconceptofpolymerisation

4.2 Describe the methods of polymerisationa) addition polymerisationb) condensation polymerization with examples.

4.3 Definethetermplastic

4.4 Types of plasticswithexamples.

4.5 Distinguishbetweenthermoplasticsandthermosettingplastics

4.6 List the Characteristicsofplastics.

4.7 State the advantagesof plasticsovertraditionalmaterials

4.8 State the disadvantagesofusingplastics.

4.9 Explain the methodsofpreparation and uses of the followingplastics:

1.Polythene, 2. PVC, 3.Teflon, 4. Polystyrene and 5. Urea formaldehyde 6. Bakelite (only flow chart i.e. without chemical equations).

4.10 Definethetermnaturalrubber

4.11 StatethestructuralformulaofNaturalrubber

4.12 ExplaintheprocessingofNaturalrubberfrom latex

4.13 List the Characteristicsofnaturalrubber

4.14 ExplaintheprocessofVulcanization

4.15 List the CharacteristicsofVulcanizedrubber

4.16 DefinethetermElastomer

4.17 Describe the preparation and uses of the following synthetic rubbers a) Butyl rubber, b) Buna-s and c)Neoprenerubber

5.0 Fuels

5.1 Definethetermfuel

5.2 Classify thefuelsbasedonphysicalstate –solid, liquidandgaseous fuels with examples.

5.3 Classify thefuelsbasedonoccurrence-primaryandsecondaryfuels with examples.

5.4 List the characteristicsof a goodfuel.

5.5 Statethecompositionandusesof the following gaseousfuels: a)watergas, b)producergas, c)naturalgas, d)coalgas, e)Biogas and f) acetylene

6.0. ENVIRONMENTALSTUDIES

6.1. Defineairpollution

6.2 Classify the airpollutants-basedonoriginandstateofmatter

6.3 Explainthecausesofairpollution

6.4 Explaintheuseandoverexploitationofforestresourcesanddeforestation

6.5 Explaintheeffectsofairpollutiononhumanbeings,plantsandanimals

6.6 Explainthegreenhouseeffect -ozonelayerdepletionandacidrain

6.7 Explainthemethodsofcontrolofairpollution

6.8 Definewaterpollution

6.9 Explainthecausesofwaterpollution

6.10 Explaintheeffectsofwaterpollutiononlivingandnonlivingthings

6.11 Understandthemethodsofcontrolofwaterpollution.

COURSE CONTENT

1. PrinciplesofMetallurgy

Characteristics of Metals and distinctions between Metals and Non Metals, Metallurgy, ore, Gangue, Flux, Slag - Concentration of Ore –Froth floatation - Methods of Extraction of crude Metal – Roasting, Calcination, Smelting – Alloys – Composition and uses of Brass, German silverandNichrome

2. 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– emfandnumericalproblemsonemfofacell

3. Corrosion

Introduction - factors influencing corrosion - electrochemical theory of corrosion-

composition,stressandconcentrationcells–rustingofiron and its mechanism – prevention of corrosion by coating methods, cathodic protection

4. Polymers

Introduction – polymerization – types of polymerization – addition, condensation with examples – plastics – types of plastics – advantages of plastics over traditional materials – Disadvantages of using plastics – preparationandusesofthefollowingplastics:1.Polytehene2.PVC 3.Teflon 4.Polystyrene 5.Urea formaldehyde 6. Bakelite – Rubber – Natural rubber – processing from latex – Vulcanization – Elastomers – Butyl rubber, Buna-s, Neoprene rubberandtheiruses.

5. Fuels

Definitionandclassificationoffuels–characteristicsofgoodfuel-compositionand usesofgaseousfuels- a)watergas,b)producergas, c)naturalgas, d)coalgas, e)Biogas and f) acetylene

6. ENVIRONMENTALSTUDIES

airpollution-causes-Effects– forestresources:uses and over exploitation, deforestation, acid rain, green house effect –ozone depletion – control of air pollution – Water pollution – causes – effects – controlmeasures

INTERNAL ASSESSMENT

UNIT TEST 1 : UNITS 1,2 and 3

UNIT TEST 2 : UNITS 4 and 5

REFERENCEBOOKS

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

ENGINEERING MECHANICS – II

Subject Title : Engineering Mechanics- II
Subject Code : M-205
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	Moment of Inertia	16	26	02	02
2	Dynamics	28	58	06	04
3	Simple machines	16	26	02	02
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Explain the meaning of the term moment of Inertia.
1.1 Define the term polar moment of inertia
1.2 Explain the term radius of gyration
1.3 State the necessity of finding Moment of Inertia for various engineering applications
1.4 Determine Moment of Inertia and Radius of gyration for regular geometrical sections like T, L, I, Channel section, Z section, unsymmetrical I section
1.5 State Parallel axis theorem and perpendicular axis theorem
1.6 Determine MI of standard sections by applying parallel axes theorem
1.7 Determine MI of standard sections by applying parallel axes theorem
1.8 Calculate the moment of Inertia of composite sections.
1.9 Calculate radius of gyration of standard sections.
1.10 Determine the polar M.I for solid and hollow circular section applying perpendicular axes theorem.
1.11 Solve the related numerical problems

2.0 Understand the concept of Dynamics

2.1 Define the terms Kinematics and Kinetics
2.2 Classify the motion types
2.3 Define the terms displacement,speed, velocity and acceleration
2.4 State the Newton's Laws of motion (without derivation)
2.5 Solve the problems related to the rectilinear motion of a particle
2.6 Explain the Motion of projectile
2.7 Solve the numerical problems
2.8 State the D'Alembert's principle
2.9 Define the Law of conservation of energy
2.10 Explain the Work, Power and Energy principle
2.11 Define the Law of conservation of momentum
2.12 Explain the Impulse –momentum equation
2.13 Solve the problems using the above principles

2.14 Explain the Rotary motion of particle
2.15 Define Centripetal force.
2.16 Define Centrifugal force.
2.17 Differentiate Centripetal and Centrifugal forces

3.0 Comprehend the Principles involved in Simple Machines

3.1 Define the important terms of simple machines
a) Machine, b) Mechanical Advantage, c) Velocity Ratio, d) Efficiency.
3.2 Illustrate the use of three classes of simple lever.
3.3 Show that an inclined plane is a simple machine to reduce the effort in lifting loads.
3.4 Derive expression for VR in cases of wheel & axle, simple pulley, screw jack and rack & pinion.
3.5 Compute the efficiency of a given machine.
3.6 Compute effort required to raise or lower the load under given conditions.
3.7 Interpret the law of machine.
3.8 State the conditions for self-locking and reversibility.
3.9 Calculate effort lost in friction and load equivalent of friction.

COURSE CONTENT

1.1 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.
1.2 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

2.0 Dynamics

2.1 Definition of Kinematics and Kinetics
2.2 Classification of motion
2.3 Definition of displacement, speed, velocity and acceleration
2.4 Laws of motion (without derivation)
2.5 Solving the problems related to the rectilinear motion of a particle
2.6 Motion of projectile and solving the numerical problems
2.7 Newton's laws of motion.
2.8 D'Alembert's principle
2.9 Defination Law of conservation of energy
2.10 Work, power and Energy
2.11 Law of conservation of momentum
2.12 Impulse –momentum equation
2.13 Solving the kinetic problems using the above principles
2.14 Rotary motion of particle and laws of motion
2.15 Definition and Differentiate Centripetal and Centrifugal forces.

3.0 Simple Machines

3.1 Definition of Simple machine, and uses of simple machine, levers and inclined plane.
3.2 Fundamental terms like mechanical advantage, velocity ratio and efficiency.

3.3 Expressions for VR in case of Simple pulley, Rack and pinion, Wheel and axle and Screw jack.
3.4 Conditions for reversibility and self locking.
3.5 Law of Simple Machine.
3.6 Effort lost in friction, Load Equivalent of Friction

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- II

Subject Title : Workshop Technology- II
Subject Code : M-206
Periods per Week : 04
Periods per Year : 60

TIME SCHEDULE

S. No	Major Topics	No. of Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Checking and Measuring Instruments	06	13	01	01
2	Drilling	18	34	03	02 ½
3	Foundry	20	37	04	02 ½
4	Mechanical working of metals	16	26	02	02
	Total	60	110	10	08

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Acquaint with various checking and measuring instruments.

1.1 List various checking and measuring instruments.

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.

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

1.0 Checking and measuring instruments

1.1 Checking instruments.

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

1.2 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.

2.0 Drilling

2.1 Type of drilling machines: sensitive & radial and their constructional detail and specifications.
2.1 Drill bits: Terminology - geometry of twist drill - functions of drill elements.
2.2 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.
3.1 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.

3.2 Sands: Properties of moulding sand - porosity, flowability, collapsibility, adhesiveness, cohesiveness and refractoriness.
3.3 Types of moulding sand : green sand, dry sand, loam sand, facing sand, backing sand, parting sand, core sand, system sand their ingredients and uses.

3.4 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.

3.5 Cores: Need of cores, types of cores.

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

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- II

Subject Title : Engineering Drawing- II
Subject Code : M–207
Periods/Week : 06
Periods Per Year : 90

TIME SCHEDULE

S.No	Major Topics	No. of Drawing plates	Periods	Weightage of Marks	Short Answer Questions	Essay type Questions
1	Auxiliary views	01	06	10	1	½
2	Orthographic Projection	03	33	25	1	2
3	Pictorial drawing	03	30	25	1	2
4	Development of surfaces	03	21	20	1	1½
Total		**10**	**90**	**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 need of auxiliary views
- 1.1 State the need of Auxiliary views for a given engineering drawing.
- 1.2 Draw the auxiliary views of a given engineering component
- 1.3 Differentiate between auxiliary view and apparent view

Drawing plate No.1: (Having 4 exercises)

2.0 Apply principles of orthographic projection
- 2.1 Explain the principles of orthographic projection with simple sketches.
- 2.2 Draw the orthographic view of an object from its pictorial drawing.
- 2.3 Draw the minimum number of views needed to represent a given object fully.

Drawing Plate No. 2 : (Having 8 to 10 exercises)
Drawing Plate No. 3 : (Having 8 to 10 exercises)
Drawing Plate No. 4 : (Having 8 to 10 exercises)

3.0 Prepare pictorial drawings
- 3.1 State the need of pictorial drawings.
- 3.2 Differentiate between isometric scale and true scale.
- 3.3 Prepare Isometric views for the given orthographic drawings.

Drawing plate No 5: (Having 10 to 12 exercises)

Drawing plate No. 6: (Having 10 to 12 exercises)
Drawing plate No. 7: (Having 10 to 12 exercises)

4.0 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. 8: (Having 05 exercises)
Drawing plate No. 9: (Having 05 exercises)
Drawing plate No. 10: (Having 05 exercises)

Competencies and Key competencies to be achieved by the student

S.No	Major topic	Key Competency
1.	Auxiliary views	• Draw the auxiliary views of a given Engineering component • Differentiate between Auxiliary view and apparent view
2.	Orthographic Projection	• Draw the minimum number of views needed to represent a given object fully.
3.	Pictorial drawing	• Differentiate between isometric scale and true scale. • Draw the isometric views of given objects,.
4.	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 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.

2.0 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.

3.0 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

4.0 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 : Basic Workshop Practice-II
Subject Code : M -208
Periods/Week : 06
Periods Per Year : 90

TIME SCHEDULE

S.No	Major Title	No of Periods
1.	Fitting shop	18
2.	Forging shop	18
3.	Carpentry shop	27
4.	Sheet metal work	27
	Total	90

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.Tapping and Dieing on a MS flat of 2 mm thick	– 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
2.Assembling of two pieces, matching by filing	– 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
Forging shop 3.Preparation of a Chisel from round rod	– 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
4.Preparation of a ring and hook from M.S round	– 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
5.Preparation of a hexagonal bolt and nut	– 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

Carpentry Shop 6..Preparation of Mortise and Tenon joint	- 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 – 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	• Mark the dimensions to make Tenon and mortise on two pieces using mortise gauge • Cut tenon with tenon saw along the marked lines • Use mortise chisel to provide recess in the second piece to accommodate tenon Assemble the two pieces by fitting the tenon into mortise
7.Wood turning on lathe	– 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
Contd.,,, 8.Preparation of any household article (ex: stool)	– 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	• Prepare the drawings of a stool required for a particular drawing table • Identify the operations to be made and their sequence • Perform operations to

	– Perform operations to produce pieces of joint – Assemble all joints as per the drawing	produce pieces of joint • Assemble all joints as per the drawing

Title of the Job	Competencies	Key Competency
Sheet metal Work 09. Preparation of pipe elbow	– 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
10.Preparation of funnel	– 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
11.Preparation of utility articles such as dust pan, kerosene hand pump	– Draw the development of given dust pan – Scribe the lines on the sheet and cut to required size – Hem all the four sides to	• Identify the marking and cutting tools • Drawing development of objects • Cut the sheet

	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	• Perform bending along the marked lines and to form the article

COURSE CONTENT

FITTING SHOP

1. Marking, cutting, drilling, Chamfering and tapping on a M.S. Flat 12 mm thick.
2. Assembling of two pieces, Matching by filing (6 mm thick M.S. Plate)

FORGING SHOP

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

6. Preparation of Mortise and tenon joint.
7. Wood turning on a lathe.
8. Preparation of one household article.

SHEET METAL WORK

9. Preparation of pipe elbow
10. Preparation of mug.
11. Preparation of funnel
12. 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)

PHYSICS LAB – II

(Common for all branches)

Subject Title	**:**	**Physics Lab - II**
Subject Code	**:**	**M -209**
Periods per week	**:**	**03**
Total periods per semester	**:**	**23**

TIME SCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Focal length and Focal power of convex lens (Separate & Combination)	03
2.	Simple pendulum	03
3.	Velocity of sound in air – (Resonance method)	03
4.	Surface tension of liquid using traveling microscope	03
5.	Coefficient of Viscosity by capillary method	03
6.	Mapping of magnet lines of force	03
	Revision	03
	Test	02
	Total:	**23**

Objectives:

Upon completion of the course the student shall be able to

1.0 Determine the Focal length and focal power of convex lenses using U-V and graphical method

2.0 Determine the value of acceleration due to gravity using Simple Pendulum and verify with L-T^2 graph.

3.0 Determine the velocity of sound in air at room temperature

4.0 Determine the surface tension of a liquid using travelling microscope

5.0 Determine the viscosity of a liquid using capillary method

6.0 Practice the mapping of magnetic lines of force

Competencies and Key competencies to be achieved by the student

Name of the Experiment (No of Periods)	**Competencies**	**Key competencies**
1. Focal length and Focal power of convex lens (Separate & Combination) (03)	• Fix the object distance • Find the Image distance • Calculate the focal length and power of convex lens and combination of convex	• Calculate the focal length and power of convex lens • Draw u-v and 1/u – 1/v graph
2. Simple pendulum(03)	• Fix the simple pendulum to the stand • Adjust the length of pendulum • Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph	• Find the time for number of oscillations • Find the time period • Calculate the acceleration due to gravity • Draw l-T and l-T^2 graph
3. Velocity of sound in air –Resonance method (03)	• Arrange the resonance apparatus • Adjust the reservoir level for booming sound • Find the first and second resonanting lengths • Calculate velocity of sound	• Adjust the reservoir level • Find the first and second resonanting lengths • Calculate velocity of sound • Calculate velocity of sound at 0^0 C
4. Surface tension of liquid using traveling microscope(03)	• Find the least count of vernier on microscope • Focus the microscope to the lower meniscus & bent pin • Read the scale • Calculate height of liquid rise • Calculate the surface tension of water	• Read the scale • Calculate height of liquid rise • Calculate the surface tension of water

5. Coefficient of viscosity by capillary method(03)	• Find the least count of vernier • Fix the capillary tube to aspiratory bottle • Find the mass of collected water • Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water using capillary method	• Find the pressure head • Calculate rate of volume of liquid collected • Find the radius of capillary tube • Calculate the viscosity of water
6. Mapping of magnet lines of force(03)	• Draw magnetic meridian • Placed the bar magnet in NN and NS directions • Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines	• Draw magnetic lines of force • Locate the neutral points along equatorial and axial lines

PREPARED BY BIFURCATION COMMITTEE

1. Dr M.E. JAYARAJ, HGS, GPW(M) BADANGPET, R.R. DIST
2. Dr V.V.M. JAGANNADHA RAO, HGS, GPT, NARAYANKHED, SANGAREDDY DIST
3. SRI V. DAYAKAR, LECTURER IN PHYSICS, SGM GPT ABDULLAPURMET, R.R. DIST

CHEMISTRY LAB – SEMESTER -II

(Common for all branches)

Subject Title : Chemistry Lab - II

Subject Code : M-210

Periods per week : 03

Total periods per semester : 23

TIMESCHEDULE

S.No	Name of the Experiment	No. of Periods
1.	Determination of acidity of water sample	03
2.	Determination of alkalinity of water sample	03
3.	Determination of total hardness of water using Std. EDTA solution	03
4.	Estimation of Chlorides present in water sample	03
5.	Estimation of Dissolved Oxygen (D.O) in water sample	03
6.	Determination of pH using pH meter	03
	Revision	03
	Test	02
	Total:	**23**

PREPARED BY BIFURCATION COMMITTEE

1. Dr . V. RAJANARENDER REDDY , HGS, GIOE, SECUNDERABAD
2. Dr. SRISAILAM L/Chemistry., GPT, PARKAL
3. SMT. L.SEETHA, LECTURER IN CHEMISTRY, SGM GPT ABDULLAPURMET, R.R. DIST

*C**OMPUTER FUNDAMENTALS LAB -2***

(Common to All Braches other than CME & IT)

Subject Title : Compute Fundamentals Lab-2
Subject Code : M-211
Periods/Week : 3
Periods/Semester : 45

LIST OF EXPERIMENTS

1.0 MS-WORD

1.1. Open MS-word and Identify the components on the screen
1.2. Create a document using MS-word and save it.
1.3. Create a table using MS-Word and save it.
1.4. Apply formulas in table & sort the table
1.5. Convert text into table & table into text.
1.6. Insertion of new rows and columns in the existing table and changing background colour in Table
1.7. Merging and splitting of cells in a Table
1.8. Changing the formatting of font
1.9. Exercise with Headers and Footers, paragraph tool bar
1.10. Insert objects into the document like pictures, shapes, charts, word-art.
1.11. Create mailing letters using mail merge tool of MS-word
1.12. Printing a document , page setting, different views of a document
1.13. Import & export files to & from Word.

2.0 MS-EXCEL

2.1. Open MS-Excel and identify the components on the screen
2.2. Create a Worksheet in MS-Excel and save it in .xls or .xlsx format
2.3. Inserting column and row in Excel
2.4. Creation of new worksheet in the existing Excel Book file
2.5. Generate a Chart using the data in Excel-worksheet
2.6. Automate calculations in a worksheet using formula
2.7. Sort and filter data in a worksheet

2.8. Protecting a worksheet, working with multiple sheets

3.0 MS-POWERPOINT

3.1. Create a simple Power point presentation for a small topic and saving in .ppt or pptx format

3.2. Inserting a new slide in the existing PowerPoint file

3.3. Inserting chart or image in a PowerPoint slide

3.4. Exercise with animation and sound features in PowerPoint

3.5. Exercise with Rehearse Timings feature in PowerPoint

3.6. Exercise in printing the PowerPoint file in (a) Slides (b) Handouts

OBJECTIVES AND KEY COMPETENCIES

S. No	Name of Experiment	Objectives	Key Competencies
1.	Open MS-Word from (i) Programs (ii) Run and Identify the components on the screen	Able to Open MS-word and Identify the components on the screen	❖ Check whether able to Identify the components on the screen ❖ Check whether able to Identify all components on the screen of MSWORD are identified and learnt thoroughly
2.	Insertion of new rows and columns in the existing table and changing the background colour of the table	Able to Insert new rows and columns in the existing table Able to Change the background colour of the table	❖ Check whether able to Insert new rows and columns in the existing table ❖ Check whether able to Insert new rows and columns as per requirement ❖ Check whether able to Change the background colour of the table
3.	Merging and splitting of cells in a Table	Able to Merge and split cells in a Table using right click method	❖ Check whether able to Merge and split cells in a Table using right click method
4.	Changing the formatting of font	Able to Change the formatting of font using right click menu Able to Change the formatting of font using menu options	❖ Check whether able to Change the formatting of font using right click menu ❖ Check whether able to Change the formatting of font using menu options
5.	Exercise with Headers and	Able to change Headers and Footers using menu option	❖ Check whether Able to change Headers and Footers using menu

	Footers	Able to change Headers and Footers by clicking top and bottom document	option ❖ Check whether able to change Headers and Footers by clicking top and bottom document
6.	Create mailing letters using mail merge tool of MS-word	Able to use mail merge tool of MS-word using start mail merge option in mail menu	❖ Check whether Able to use mail merge tool of MS-word in creating letter using mail merge option in mail menu
7.	Open MS-Excel and identify the components on the screen	Able to Open MS-Excel and identify the components on the screen	❖ Check whether Able to Open MS-Excel and identify the components on the screen ❖ Check whether all components are known on screen
8.	Create a Worksheet in MS-Excel and save it in .xls or .xlsx format	Able to Create a Worksheet in MS-Excel Able to save it in .xls or .xlsx format	❖ Check whether Able to Create a Worksheet in MS-Excel ❖ Check whether Able to save it in .xls or .xlsx format
9.	Inserting column and row in Excel	Able to Insert column and row in Excel using menu options Able to Insert column and row in Excel by right clicking rows or columns appropriately	❖ Check whether able to Insert column and row in Excel using menu option ❖ Check proper addition rows and columns in given sheet ❖ Check whether able to Insert column and row in Excel by right clicking rows or columns appropriately
10.	Creation of new worksheet in the existing Excel Book file	Able to create worksheet in the existing Excel Book file by using Insert worksheet option besides existing sheets	❖ Verify whether able to create worksheet in the existing Excel Book file by using Insert worksheet option
11.	Generate a Chart using the data in Excel-worksheet	Able to Generate a Chart using the data in Excel-worksheet	❖ Check whether able to Generate a Chart using the data in Excel-worksheet ❖ Verify whether chart prepared is as per the data given
12.	Automate calculations in a worksheet using	Able to Automate calculations in a worksheet using fx formula Able to use sigma function	❖ Check whether Able to Automate calculations in a worksheet using fx formula

	formula	➢ Able to use function library option in formula menu	❖ Verify whether Able to use sigma function ❖ Check whether Able to use function library option in formula menu
13.	Sort and filter data in a worksheet	➢ Able to Sort data in a worksheet using sort option in Data menu ➢ Able to Sort data in a worksheet using sort option in right click ➢ Able to filter data in a worksheet in data menu ➢ Able to filter data in a worksheet in right click	❖ Verify whether Able to Sort data in a worksheet using sort option in Data menu ❖ Verify whether Able to Sort data in a worksheet using sort option in right click ❖ Check whether Able to filter data in a worksheet in data menu ❖ Check whether Able to filter data in a worksheet in right click
14.	Inserting a new slide in the existing powerpoint file	➢ Able to Insert a new slide in the existing powerpoint file using newslide option in home menu ➢ Able to Insert a new slide in the existing powerpoint file using slide layout option in home menu	❖ Check whether Able to Insert a new slide in the existing powerpoint file using newslide option in home menu ❖ Check whether Able to Insert a new slide in the existing powerpoint file using slide layout option in home menu
15.	Create a simple Power point presentation for a small topic and saving in .ppt or pptx format	➢ Able to create a simple Power point presentation for a given topic ➢ Able to Save the presentation in both .ppt or pptx format	❖ Check Able to create a simple Power point presentation for a given topic ❖ Check Able to Save the presentation in both .ppt or pptx format
16.	Inserting chart or image in a powerpoint slide	➢ Able to Insert chart in a power point slide using Insert menu option ➢ Able to Insert image in a power point slide using insert menu option	❖ Check Able to Insert chart in a power point slide ❖ Check Able to Insert image in a power point slide
17.	Exercise with animation and sound features in powerpoint	➢ Able to work with animation and sound features in power point using custom animation option in Animations menu ➢ Able to work with Media clip options in insert menu	❖ Check Able to work with animation and sound features in power point using custom animation option in Animations menu ❖ Check Able to work with Media clip options in insert menu
18.	Exercise with Rehearse Timings feature in powerpoint	➢ Able to work with Rehearse Timings feature in powerpoint using slide show menu rehearse option	❖ Check able to work with rehearse timings features

19.	Exercise in printing the powerpoint file in (a) Slides (b) Handout	Able to print the powerpoint file in Slides using File menu Print option Able to print the powerpoint file in Handout using file menu print option	❖ Check to print the powerpoint file in Slides using File menu Print option ❖ Check to print the powerpoint file in Handout using file menu print option

C-16

DME – III SEMESTER

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:								
M- 301	Engineering Mathematics - III	4	-	60	3			100
M -302	Strength of Materials	5	-	75	3			100
M -303	Basic Electrical& Electronics Engineering	4	-	60	3			100
M-304	Engineering Materials	5	-	75	3			100
M-305	Manufacturing Technology -I	4	-	60	3			100
M-306	Machining Drawing Practice	6	-	90	3			100
PRACTICAL:								
M-307	Material Testing & Electrical Engg.Lab practice	-	3	45	3			100
M-308	Communication & Life skills lab	-	3	45	3			100
M-309	Manufacturing and Fabrication Engg. Lab Practice - I	-	3	45	3			100
M-310	CAD Lab Practice	-	3	45	3			100
	TOTAL	28	12	600				1000

ENGINEERING MATHEMATICS – III
(Common to all Branches)

Subject Title : Engineering Mathematics-III
Subject Code : M- 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	32	2	2	0	1	1	0
	Unit - II								
2	**Definite Integration and its applications**	17	31	0	1	1	1/2	1	1
	Unit - III								
3	**Numerical Integration**	05	10	0	0	0	0	0	1
	Unit - IV								
4	**Differential Equations of first order**	20	37	2	2	0	1/2	1	1
	Total	60	110	4	5	1	2	3	3
			Marks:	12	15	3	20	30	30

R: Remembering type 32 marks
U: Understanding type 45 marks
App: Application type 33 marks

OBJECTIVES
Upon completion of the subject the student shall be able to
Unit-I

1.0 Use IndefiniteIntegration 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 Evaluateintegrals 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.

Unit –III

3.0 Understand Numerical Methods

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

Unit –IV

4.0 Solve Differential Equations in engineering problems.

4.1 Define a Differential equation, its order, degree

4.2 Form a differential equation by eliminating arbitrary constants.

4.3 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.)

4.4 Solve simple problems leading to engineering applications

COURSE CONTENT

Unit-I

Indefinite Integration:

1**.** Integration regarded as anti-derivative – Indefinite integral of standard functions. Properties of indefinite integral. Integration by substitution or change of variable. Integrals of the form $\sin^m\theta.\ \cos^n\theta.$ where m and n are positive integers. Integrals of tan x, cot x, sec x, 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.

Unit-III

Numerical Integration :

3 Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a definite integral.

Unit –IV

Differential Equations:

4. 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.

Reference Books:

1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan
2. Thomas' Calculus, Pearson Addison –Wesley Publishers

STRENGTH OF MATERIALS

SUBJECT TITLE : STRENGTH OF MATERIALS

SUBJECT CODE : M-302

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

Upon 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 moduli

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 State the bending equation $M / I = \sigma_b / y = E / R$. Explain the terms involved.

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 for point load and UDL.

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 State the torque equation $T / J = \tau / R = G\theta / L$ and explain the terms involved.

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

6.2 Define longitudinal and hoop stress

6.3 Derive the expression for longitudinal and hoop stress for seamless and seam shells.

6.4 Design thin cylindrical shells.

COURSE CONTENT

1 Simple Stresses and Strains

Types of forces. Stress, Strain and their nature. Mechanical properties of common engineering materials. Significance of various points on stress - strain diagram for M.S. and C.I. specimens. Significance of factor of safety. Relation between elastic constants. Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces. Thermal stresses in bodies of uniform section and composite sections. Related numerical problems on the above topics

2 Strain Energy

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

3 Shear Force & Bending Moment Diagrams

Types of beams with examples.

a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam.

Types of Loads - Point load, UDL and UVL.

Definition and explanation of shear force and bending moment. Calculation of shear force and bending moment and drawing the diagrams by the analytical method only for the following cases.

Cantilever with point loads, b)Cantilever with uniformly distributed load.

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

Explanation of terms,

a) Neutral layer, b) Neutral Axis, c) Modulus of Section,

d) Moment of Resistance, e) Bending stress, f) Radius of curvature.

Assumptions in theory of simple bending. Bending Equation

$M / I = \sigma_b / Y = E / R$ **without** derivation. Problems involving calculations of bending stress modulus of section and moment of resistance. Calculation

of safe loads and safe span and dimensions of cross- section. Definition and explanation of deflection as applied to beams. Deflection formulae without proof for cantilever and simply supported. beams with point load and uniformly distributed load only (Standard cases only). Related numerical problems.

5. Torsion in Shafts and Springs

Definition and function of shaft. Calculation of polar M.I. for solid and hollow shaft.

Assumptions in simple torsion. Torsion equation without derivation $T / J = \tau / R = G\theta / L$.

Problems on design of shaft based on strength and rigidity. Numerical

Problems related to comparison of strength and weight of solid and hollow shafts. Explanation about spring. Classification of springs. Nomenclature of closed coil helical spring. Deflection formula for closed coil helical spring (without derivation). Explanation about stiffness of spring. Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

6. **Thin Cylindrical Shells**

Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell. Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells. 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 Ramsamrutham

BASIC ELECTRICAL & ELECRONICS ENGINEERING

Subject Title	**:**	**Basic Electrical & Electronics Engg.**
Subject Code	**:**	**M - 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	14	29	03	02
2.	D.C. Machines	14	26	02	02
3.	A.C. Fundamentals	12	19	03	01
4.	A.C.Machines	12	23	01	02
5.	Electrical measuring instruments & Safety procedures	08	13	01	01
Total		**60**	**110**	**10**	**08**

OBJECTIVES

Upon completion of this 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 and compare Work, Power and Energy from electrical and mechanical aspects and understand their units.

1.4 State and explain Kirchhoff's laws.

1.5 Define

a. Magnetic field strength
b. Flux
c. Permeability
d. Reluctance and state their units

1.6 Define

a. Electric field
b. Electric field intensity
c. Permittivity and state their units

1.7 State capacitance and its units

1.8 State Faraday's laws of Electro Magnetic Induction.

1.9 Explain Dynamically and Statically induced E.M.F.

1.10 State Lenz's Law.

1.11 Explain Fleming's Right Hand rule.

1.12 Explain inductance

a. Self inductance
b. Mutual inductance
c. Co-efficient of coupling and state their units

1.13 Explain energy stored in a magnetic field.

2.0 Understand D.C. Machines.

2.1 Explain the working principle of D.C. Generators.

2.2 Know the constructional features of D.C. Generators and materials used.

2.3 Classify D.C. Generators and draw their schematic diagrams.

2.4 State E.M.F equation of D.C. Generator and solve formula substitution problems.

2.5 Write the relation between currents and voltages in various D.C generators.

2.6 Label the terminals of D.C. Generators for armature, field and inter pole windings.

2.7 Draw power flow diagram of a D.C. Generator.

2.8 Sketch the connection of welding generator.

2.9 Explain the principle of operation of D.C. Motors.

2.10 Classify D.C. motors and draw their Schematic diagrams..

2.11 a) Explain back e.m.f in D.C. motors.

(b) Write the relation between currents and voltages in various D.C. motors.

2.12 Write formula for speed of D.C. Motor in terms of supply voltage, current and flux.

2.13 Explain necessity of starters for D.C. motors.

2.14 Describe with sketch the connection diagram of a D.C. 3 point starter.

2.15 List the applications of D.C. motors

3.0 Understand A.C. Fundamentals

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

3.3 Define Phase and phase difference.

3.4 Explain the concept of Poly-phase and 3-phase system.

3.5 Explain phase difference and Phase sequence in 3 phase system.

3.6 Comprehend Star and Delta connections.

3.7 Write the relation between Line and Phase values.

3.8 Solve simple conversion problems on line and phase values.

4.0 Understand the working of A.C.Machines

4.1 Explain working principle of alternators.
4.2 State frequency and speed relations in alternators.
4.3 Explain working principle of transformers and their ratings.
4.4 Define and relate Transformation, Turns, Voltage and Current ratios.
4.5 Describe the operation of a welding Transformer with sketch.
4.6 Explain working Principle of 3-phase induction motors.
4.7 State the applications of 3-phase induction motors.
4.8 Explain the working principle of Single-phase induction motors.
4.9 List out types of 1-phase induction Motors.
4.10 Applications of 1-phase induction Motors.

5.0 Understand Electrical Measuring Instruments and Safety Procedures.

5.1 Explain the construction and working principle of Moving Coil instruments.
5.2 Explain the construction and working principle of Moving Iron instruments.
5.3 Explain the construction and working principle of Dynamometer type Wattmeter.
5.4 Explain the construction and working principle of 1-phase induction type energy meters.
5.5 Explain effect of electrical shock and burn.
5.6 Explain the remedial procedures to be adopted in case of electric shocks.
5.7 State purpose of earthing of electrical equipment and machinery.
5.8 Describe the procedure of i) Pipe earthing and ii) Plate earthing.

Note : Where ever mentioned, simple formula substitution problems only be solved and no problems in the other specific objectives.

COURSE CONTENT

1.0 Basic Concepts and Electro Magnetic Induction

Definitions: Ohm's Law, Laws of resistance work, power, energy with units. Kirchoff's Laws, Definitions and units of magnetic field strength, flux, flux density, permeability, reluctance. Definitions and units electric field, field strength, permittivity, capacitance. Faraday's laws of Electro – magnetic induction. Dynamically and statically induced e.m.f. Lenz's Law, Fleming's right hand rule, Inductance – self and mutual – coefficient of coupling. Energy stored in a magnetic field.

2.0 D.C. Machines

D.C. Generators

Principle of operation - Parts of generator and materials used - Types of generators and schematic diagrams - E.M.F equation, voltage and current relations - Nomenclature used for determining armature, field and inter-pole windings - Power flow diagram - Welding Generator

D.C. Motors

Principle of operation - Types of motors and schematic diagrams - Back e.m.f and speed equation and relation between voltages and currents - Starters and their necessity - Connection diagram of 3 point starter - Speed control – Field and Armature control - Applications of motors

3.0 A.C. Fundamentals and Machines

Definition – alternating current, voltage amplitude, time period frequency, instantaneous value, Average value, r.m.s. value, form factor - Graphical representation of Alternating quantities - Phase difference - A.C. Circuits - Single phase series circuits – Definition of poly-phase and 3 Ø circuits - Phase difference in 3 Ø - Star and delta connections, definitions of phase values and line values.

4.0 Understand the working of A.C.Machines

Alternators – principle of working. Constructional features of alternators. Speed and frequency relations. Transformers working principle. Single phase transformers - Voltage ratio, Current ratio, Turns ratio - Welding transformer - 3-Phase Induction Motor - Working principle, Construction - Squirrel cage and Wound Rotor - Single phase Induction Motors - Types and applications of single phase induction motors.

5.0 Electrical Measuring Instruments & Safety Procedures

Construction and principle of operation of moving coil permanent magnet type. ammeter and voltmeter and moving iron ammeter and voltmeter - Construction and working principle of Dynamometer type wattmeter - Single phase induction type Energy meter - Electrical safety Procedures - Effects of shock and burns - Remedial procedures to be adopted in case of electrical shocks - Plate earthing - Pipe earthing.

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.

ENGINEERING MATERIALS

Subject Title	**:**	**Engineering Materials**
Subject Code	**:**	**M-304**
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 & their application.

1.3 Define the following properties

i) Tensile, Compressive and Shear strength, ii) Ductility, iii)Hardness, iv) Toughness, v) Brittleness, vi) Impact strength, and 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, Magnetic flux, Ultrasonic and penetrate test.

3.0 Identify 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 rate of cooling on grain formation.

3.7 Identify the factors promoting grain size.

3.8 Identify important stages in the phenomenon of recrystallization.

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, and 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, and 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

Engineering Materials – importance - applications - mechanical properties of engineering materials – Tensile strength, Compressive strength, Ductility, Malleability, Hardness, Toughness, Brittleness, Impact strength, Fatigue, Creep resistance

2.0 Testing of materials

Destructive testing tests - tensile, compressive and shear strengths – Tests on Brinell & Rock Well hardness test – Impact test on Izod & Charpy tester.

Non destructive testing – Procedure for testing materials by X-ray, gamma ray, magnetic flux and ultrasonic testing.

3.0 Structure of Materials

Crystals structures of metals, Space lattices, Unit cell, three main types of metallic space lattices, namely Face Centered Cubic, Body Centered Cubic, Hexagonal Close Packed.

Crystallization 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.

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

5.0 Iron - Carbon Equilibrium Diagram.

Cooling curve for pure metal. - Allotropic forms of pure Iron. - Iron carbon equilibrium diagram.

6.0 Heat Treatment of Steels.

Importance of heat treatment. - Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding with specific examples of engineering applications of the above - Sub Zero treatment – its importance - Vacuum hardening – its importance.

7.0 Ferrous, Non- Ferrous metals and their alloys.

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

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

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

Properties and uses of Copper, Aluminum, Tin, Zinc, Lead, Nickel, Magnesium and Chromium, Muntz metal, Admiral Metal, Phosphour Bronze, Gun Metal, Aluminum Bronze, Constantan, Monel Metal.

Properties of bearing metals, Babbit metals.

8.0 Powder Metallurgy.

Primary manufacturing process – definition, important characteristic of metal powders - Methods of producing powders - Forming to shape – pressing, centrifugal compacting. Extruding, Gravity - Sintering, Rolling, isostatic moulding explosive compacting, sintering, hot pressing, spark sintering - Finishing operation - Advantages and limitations of powder metallurgy.

REFERENCE BOOKS

1.	Powder Metallurgy	by	TTTI,ECH
2.	Material Science	by	Raghavan
3.	Introduction to Engineering Materials	by	B.K Agarwak (McGraw-Hill)
4..	Material science and metallurgy	by	Dr. O.P.KHANNA

MANUFACTURING TECHNOLOGY - I

Subject Title : Manufacturing Technology - I

Subject Code : M–305

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	16	29	3	2
2	Shaper, Slotter, Planner	12	21	2	1 1/2
3	Broaching Machine	04	10	0	1
4	a)Welding, b)Cutting Fluids, Coolants and Lubricants	14	27	4	1 1/2
5	Milling , Gear making	14	23	1	2
	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 joining process of Welding.

4.1 State the necessity of welding.

4.2 Classify the welding processes.

4.3 State the advantages and limitations of welding.

4.4 Explain the principle of arc welding.

4.5 List the tools and equipment of arc welding.

4.6 Name the proper electrodes for given metals.

4.7 Explain the principle of gas welding.

4.8 List the tools and equipment of oxy-acetylene welding.

4.9 Explain different welding procedures in arc and gas welding.

4.10 Define the terms soldering & brazing.

4.11 Differentiate soldering from brazing.

4.12 Explain the principles of soldering & brazing.

4.13 Select correct soldering materials for a given job.

4.14 Explain soldering / brazing techniques.

4.15 List the gas cutting equipment.

4.16 State the principle of flame cutting.

4.17 State the relative advantages of flame cutting over other types of cutting.

4.18 List the various defects in welds.

4.19 List the reasons for the above.

4.20 Explain non-destructive testing of welds.

4.21 List various (special) modern welding techniques.

4.22 State the principle of at least four modern welding techniques.

4.23 Explain the principle of TIG and MIG welding.

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

4.24 State the properties of cutting fluids and coolants.

4.25 Mention the types of fluids.

4.26 State the composition of cutting fluids and coolants.

4.27 List the relative merits of the cutting fluids and coolants.

4.28 Select the proper cutting fluids and coolants for various machining operations.

4.29 Classify the lubricants.

4.30 List all the properties of lubricants.

5. Understand the concept of Milling, Gear making

5.1 Explain the principle of working of a Milling machine.

5.2 Classify the milling machines.

5.3. Illustrate the constructional details of milling machine

5.4. Explain the functions of each part of the milling machine.

5.5. Explain the various milling operations.

5.6. List the different milling cutters.

5.7. Explain selection of tool and work holding devices.

5.8. Explain the different indexing methods.

5.9. Explain the specifications of milling machines.

5.10. List the different methods of producing gears.

5.11. illustrate gear shaping

5.12. Explain the different methods of finishing & checking gear teeth dimensions.

5.13. Specify the gear

5.14. List the various gear materials.

5.15. State the different heat treatment processes applied to gears.

COURSE CONTENT

1.0 Lathe and Lathe Work

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

2.0 Shaping, Slotting, and Planning

Introduction to shaper, slotter, planer, Constructional details and specifications of shaper, slotter and planer. Operations on these machines. Tools and

materials. Driving mechanisms - quick return arrangement - crank & slotted lever mechanism, whit worth mechanism, hydraulic drive.

3.0 Broaching Machines

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

4.0 a) Welding

Introduction., Classification of welding processes. Advantages and limitations of welding. Principles of arc welding., Arc welding equipment., Choice of electrodes for different metals. Principle of gas (oxy – acetylene) welding. Equipment of gas welding.

Welding procedures (arc & gas),Soldering and Brazing techniques., Types and applications of solders & fluxes ,Various flame cutting processes. Advantages and limitations of flame cutting, Defects in welding., Testing and inspection. Modern welding methods, (Submerged, CO_2, Atomic – Hydrogen, ultrasonic welding),Brief description of MIG & TIG Welding.

b) Cutting Fluids, Coolants & Lubricants

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

5.0.The concept of Milling

The principle of working of a Milling machine..Classify the milling machines.

The constructional details of milling machine. The functions of each part of the milling machine. The various milling operations. The different milling cutters. The selection of tool and work holding devices. The different indexing methods. The specifications of milling machines.

The concept of Gear Making

The different methods of producing gears, Gear shaping, Different methods of finishing & checking gear teeth dimensions.. Specification of gear. Various gear materials. Different heat treatment processes applied to gears.

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)
6. Production technology by RK Jain

MACHINE DRAWING PRACTICE

Subject Title : Machine Drawing Practice
Subject Code : M-306
Periods/ Week : 06
Periods/Semester : 90

TIME SCHEDULE

S.No	Major Topics	Periods	Weightage of Marks	Short answer Questions	Essay type Questions
1	Introduction	06	-	-	-
2	Fastening Devices	21	10	02	-
3	Assembly Drawings	42	80	-	02
4	Piping Layouts and Joints	12	05	01	-
5	Welding Fabrication Drawings	09	05	01	-
	Total	**90**	**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

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

2.0 Fastening Devices

Temporary and Permanent fastenings and their areas of application-thread nomenclature, forms of screw thread profiles, metric, B.A., Acme, Knuckle, etc.

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 - Keys and cotters: Types of keys and cotters: Difference between key and cotter uses.

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

Need and functions of assembly and detailed drawings - Steps in preparing assembly drawings - Bill of materials and parts list. - 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

Classification of pipes and tubes- Components of pipes lay-out.-Screw fitting bend, elbow, tee, lateral Cross-nipple, reducing socket and plug - Unions: Screwed ground and flanged - Valves: Gate valve: angle valve, check valve - 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

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. - Elements of welding symbol and their standard location the symbol as per IS standards reference code arrow head, weld symbol supplementary symbol dimensions of welds, method of welding process, special reference - 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.- Supplementary symbols and special instructions: surface of reference line; as per I.S. standards with reference to fillet, V-Butt an stud welds.- Dimensions of welds: length, location and spacing of welds as per I.S., B.I.S., standards with showing dimensions required on a welding - 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)

MATERIAL TESTING AND ELECTRICAL ENGINEERING. LABORATORY PRACTICE

Subject Title : Material Testing Laboratory practice
Subject Code : M- 307 A

Periods/Week : 03
Periods/Sem : 45

TIME SCHEDULE

S. No.	Major Title	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

Title of the experiment	Competencies	Key competency
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	• Record load, elongation, diameter without error • Plot graph stress vs strain • Locate points of elastic limit, yield stress, ultimate stress on the graph
2. Compression test	A. Place the specimen in the machine properly B. Apply load on the specimen C. Record load	• Apply load on the specimen • Record load
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	• Release load to hit the specimen precautious • Record load
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	• Make indent on the specimen properly • Measure diameter of indentation
5. Torsion test of springs	A. Measure spring diameter and spring wire diameter with vernier callipers B. Measure deflection applying load	• Measure spring diameter and spring wire diameter with vernier callipers • Measure deflection

	C. Calculate modulus of rigidity of spring material.	applying load
6. Study of micro structure of Metals and alloys	A. Prepare specimen B. Handling microscope to observe micro structure C. Plot microstructure	• Handling microscope to observe micro structure • Plot microstructure

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.

Electrical Engg. Laboratory practice

Subject Title	:	Electrical Engg. Laboratory practice (M- 307 B)
Subject Code	:	M- 307 B
Periods/Week	:	03
Periods/Year	:	45

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
1	Network Laws & Theorems	09
2	Calibration of meters	09
3	Measurement of Power	09
4	Speed control of DC Motor	09
5	Earthing and Safety	09
	TOTAL	45

OBJECTIVES

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

I Verify Network Laws & Theorems

1. a) Verify Ohm's Law
   b) Verify the limitations of Ohm's law
2. Verify Kirchoff's current Law
3. Verify Kirchoff's Voltage law

II Calibrate the different meters

4. Calibrate Dynamometer type of wattmeter
5. Calibrate single phase Energy meter

III Measure Power in DC and AC circuit

6. Measure power across a Resistor using voltmeter and ammeter when connected across a DC supply
7. Measure power and Power factor in 1 - Ø inductive circuit by using Wattmeter, Volt meter and Ammeter when connected across an AC supply

IV PerformSpeed control of DC Shunt Motor

8. Rheostatic control method
9. Field control method

V Demonstrate Earthing and Safety

10. a) Demonstrate Pipe Earthing
    b) Demonstrate Plate Earthing
11. Demonstrate Procedure of first aid on Electric shock

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

S.No	Experiment title	Competencies
I (1a,b, 2,3)	Verification of Network Laws & Theorems	• Draw the relevant circuit diagram • Select proper supply and load. • Select proper meters with proper ranges • Select proper wires to make connections as per circuit diagram • Ensure that all the meters are connected with proper polarity • Perform the experiment by carefully following the experimental procedure and precautions • Observe the readings without any scope for errors and tabulate
II (4,5)	Calibration of meters	• Short M & C terminals of wattmeter • Connect for proper Current range. • Calculate Multiplication factor • Calculate P, Error, %Error • Draw graph between W and % Error

III **(6,7)**	Measure Power in DC and AC circuit	• Select proper supply and load. • Select proper meters with proper ranges • Short M & C Terminals of wattmeters and connect for proper current coil range • Find out the M.F of Wattmeter • Reverse wattmeter terminals for negative readings (Lead values)
IV **(8,9)**	Perform Speed control of DC Shunt Motor	• Draw the relevant circuit diagram • Select the proper DC supply voltage • Choose the proper range of voltmeter, ammeter and rheostat. • Make the connections according to circuit diagram. • Ensure that all the instruments are connected in proper polarity • Keep the Rheostat connected to armature in maximum position in Rheostatic control method • Keep the Rheostat in field in minimum position in Field control method • Observe the speed variation with respect to rated speed
V **(10)**	Demonstrate Earthing	• . Draw Earthing diagram with specifications • Select suitable GI plate, GI wire and funnel with wire mesh • Prepare the earth pit of 1.5 m below the surface of the ground • Place Earth plate in vertical position • Draw GI wire to the GI pipe fastened to GI plate / copper plate with bolts & nuts. • Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe. • Test the earth resistance with Megger. • Verify the earth resistance.
(11)	Practice Safety Precautions.	• Practice the various first aid techniques. • Know the safety precautions.

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

(IV) Earthing and Safety

Demonstrate Pipe Earthing, Plate Earthing, First aid.

Communication Skills and Life Skills

(Common to all the branches)

Subject Title : Communication Skills and Life Skills
Subject Code : M-308
No. of periods per week : 3
No. of periods per semester : 45

Communication Skills

Sl. No	Unit	Objectives	Key Competencies
1	Listening- I	• Listen for the main idea • Listen for specific details	• Learn to listen for main idea • Listen for specific details • Listen and understand varied material • Make inferences • Know appropriate vocabulary
2	Listening-II	• Listen for and identify the main idea • Listen for and identify specific details	• Learn to listen for main idea • Listen for specific details • Listen and understand varied material • Make inferences • Know appropriate vocabulary
3	Introducing |Oneself	• Introduce oneself • Learn vocabulary relevant to making introductions • Learn the difference between an informal and formal introduction	• Use formal and informal introduction appropriately • Know relevant vocabulary to talk about skills hobbies, strengths and weaknesses
4	Describing Objects	• Learn vocabulary and expressions useful for describing objects • Describe objects	• Learn to describe an object • Use relevant vocabulary
5	Reporting Past Incidents	• Report past incidents • Use appropriate grammar and vocabulary for reporting	• Use appropriate tense • Learn appropriate vocabulary • Know how to express past incidents
6	Just A Minute	• Speaking fluently and accurately for a minute	• Learn to speak on any given topic\To organize one's thought • Sequencing ideas • Know how to introduce a given topic • Learn how to give a good closure • Know and avoid common mistakes
7	Group Discussion	• Understand the concept of a group discussion	• Participate in a group discussion • Learn appropriate vocabulary and

		• Participate in a group discussion • Learn the do's and don'ts of group discussion	expressions • Use good body language • Know group dynamics • Be aware of group do's and don'ts in a group discussion • Know appropriate etiquette
8	Interview Skills	• Prepare for an interview • Face an interview	• Get the confidence to face an interview • Learn good body language • Know frequently asked questions and answer them appropriately • Learn to dress for an interview • Know the do's and don'ts

Life Skills

Sl. No	Unit	Objectives	Key Competencies
1	Positive Attitude	Concept of positive attitude	• Learn to think positively • Become confident
2	Goal Setting	Importance of setting goals	• Learn to set goals • Know how to achieve goals • Know about personal and professional goals
3	Time Management	To manage time in an optimum manner	• Know about time wasters • Learn to plan, prioritize, schedule • Learn to become productive • Learn to manage time productively
4	Problem Solving and Decision Making	Learn to solve problems and take appropriate decisions	• Learn the steps in problem solving • To think out of the box • Learn to solve the problems rationally
5	Creativity	To become creative	• Think innovatively • Learn to think out of the box • Learn to look at old things in a new way • Think differently
6	Managing Emotions	Understand different emotions	• Learn to manage stress • Know about anger management • Understanding and managing emotions
7	Teamwork	Importance of teamwork	• Learn to be a team player • Know the importance of teamwork • Learn the traits of a good team

			• Know the stages in a team formation
8	Leadership Skills	Concept of leadership	• Learn leadership traits • Know leadership styles • Be a future leader

Total Marks: 100

Internal: 40 marks

External: 60 marks

End Examination:

- Listening skill: **10 marks**
- Speaking Skill: **10 marks**
  (Describing Objects, Reporting past incidents, JAM)
- Interview Skills or Group Discussion: **10 marks**
- Life Skills: **30 marks**

Internal Assessment:

- Attendance, Discipline: **5 marks**
- Lab manual Submission: **15 marks**
- Classroom presentations: **20 marks**

MANUFACTURING AND FABRICATION ENGINEERING LAB PRACTICE-I

Subject Title : Manufacturing and Fabrication Engg.Lab Practice-I
Subject Code : M – 309
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
- 1.8 Core making and uses

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 Tapper turning – Hands on experience in swivelling the compound rest method

4.0 Practice the joining of metals in Arc Welding, Gas welding, brazing

4.1 Prepare the edges for welding

4.2 Select the suitable electrode, voltage and current

4.3 Handle the Electrode Holder for laying welding beads.

4.4 Operate the welding transformer and generator.

4.5 Perform various weld joint operations.

KEY competencies to be achieved by the student.

Title of the experiment	Key competency
Core making	-Core making and using for practical purposes
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 – Cut the gates and runners – Pour the sufficient quantity of molten metal
Moulding and Casting of split bearing	– Prepare and place the core – Cut 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	• Just an introduction of 4 methods. Student is expected to show how they work on machine. • Hands on exposure to swiveling compound rest method

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.

Subject Title : **CAD Lab Practice**

Subject Code : **M-310**

Periods per week : **03**

Period per semester : **45**

TIME SCHEDULE

Sl No.	Major Topics	No. of periods
1.	Introduction to CAD	1.5
2.	Selecting commands & Working with drawing	1.5
3.	Viewing drawing and Working with coordinates	01
4	Creating simple entities by using draw commands	06
5.	Modifying entities	06
6	Getting Drawing information	02
7.	Working with text and practice	03
8.	Dimensioning drawing and practice	03
9.	2D Drawing practice	12
10	Layers	03
11	Isometric views	03
12	Working with blocks	03
TOTAL		45

OBJECTIVES

1.0 Upon completion of the course the student shall be able to Understand about the Computer Aided Drafting and its software

1.1. Define Computer Aided Drafting

1.2. List the Advantages of CAD and also various CAD software's

1.3. Explain the importance of CAD software

1.4. Explain the features of Graphic Work station

1.5. Explain CAD Screen, Various tool bars and menus.

1.6. Explain the benefits of Templates

2.0 Use appropriate selection commands

2.1. Practice commands using toolbars, menus, command bar

2.2. Practise 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, saving the drawing with .drawing extension and Opening Existing drawing

2.6. Practice the setting up a drawing with drawing limits and drawing units.

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

4.0 Use coordinate systems of the drawing

4.1. Practice how the coordinate system work and it is displayed

4.2. Practice the Find tool to determine the coordinates of a point

4.3. Practice the Two dimensional coordinates such as Absolute Cartesian, Relative Cartesian , Polar coordinates and direct method to draw a line.

4.4. Explain importance and use of Osnap/ Esnap points.

4.5. Practice to draw with other drawing commands like circle, polygon and other.

5.0 Create the simple and complex entities

5.1. Draw the lines, circles, arcs, ellipses, elliptical arcs, rays and infinite lines and shapes like Rectangles, Polygons, Polylines, Splines, donuts

5.2. Practice the adding of hatch with required pattern and adjusting line angle and line space..

6.0 Use the modifying tools to modify the properties of entities

6.1. Practice the various methods of entity selection like window, cross window, fence, last and previous methods and deselection method

6.2. Practice the Deletion , breaking and trimming of entities

6.3. Practice the Copying of entities within a drawing, between drawings

6.4. Practice the Chamfering and Filleting of entities

6.5. Practice the making of parallel copies, Mirroring entities and Arraying entities

6.6. Practice the Rearranging of entities by Moving, Rotating and Reordering

6.7. Practice the Resizing of entities by Stretching, Scaling, Extending.

6.8. Practice the Editing of polylines: Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices

6.9. Practice the Exploding of entities

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

7.1. Divide the entities in to required number of segments

7.2. Calculate the areas defined by points, of closed entities, and Combined entities

7.3. Calculate the distance between the entities

7.4. Calculate the angle between the entities

7.5. Display the information about the entities and drawing status

7.6. Track time spent working on a drawing

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 properties like arrow types, size, dim line adjustment, dim offset, text size , primary and secondary units and format

9.6. 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. Explain the need and importance of Layers.

11.2. Practice creating new layer, naming the layer and assigning properties like Layer colour, Line type and line weight and setting the current layer

11.3. Practice the locking and unlocking of layers

11.4. Practice the Freezing and thawing of layers

11.5. Practice the layer visibility and layer printing

11.6. Practice the loading of additional line types

12.0 Create Isometric Views

12.1. Practice setting the screen to Isometric mode

12.2. Practice identification of iso top, iso left and iso right plane.

12.3. Practice drawing in different iso planes with line and circle(ellipse)

12.4 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

KEY competencies to be achieved by the student

S.No	Experiment Title	Key components
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
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

S.No	Experiment Title	Key components
7.	Use the drawing tools Measure, Divide, Calculate, Display, to track and retrieve the information	• Divide the entities in to required number of segments • Calculate the areas defined by points, of closed entities, and Combined entities • Use filters in two and three dimensions
8.	Use the Text tool to create various types of text fonts and its styles	• Draw the simple shapes like lines, circles, arcs and complex shapes like polygons, planes etc., • Practice the adding of hatch pattern
9.	Dimensioning drawing	• Practice the Controlling of dimension properties like arrow types, size, dim line adjustment, dim offset, text size , primary and secondary units and format • 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
		• Create , insert and explode a block

13.	Working with blocks	• Attach attribute to blocks ○ Edit and extract attributes attached to blocks

COURSE CONTENT

1 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 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, saving of drawing, setting up a drawing. Setting and changing the grid and snapping alignment, and the Entity snaps.

3 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 Line weight.

4 Use of coordinate systems of the drawing

Two dimensional coordinates such as Absolute, Cartesian, Relative Cartesian and Polar coordinates and direct method of drawing line.

5 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 shapes like rectangles, polygons, polylines, Splines, donuts, and adding of hatch pattern

5.0 Use the drawing information retrieving tools Measure, Divide, Calculate,

6 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.

6.0 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. Editing of polylines: Opening, Closing, Curving, Decurving, Joining, Changing width and editing vertices, The Exploding of entities, the Chamfering and Filleting of entities

7 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.

8 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.

9 2D Drawings

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

10 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.

11 Isometric Views

Create Isometric views of simple objects

12 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.

.**REFERENCE BOOKS**

Auto cad by George Omura

4MCAD User Guide- IntelliCAD Technology Consortium

4MCAD Software:

- 4MCAD Viewer,
- 4MCAD Classic,
- 4MCAD Standard,
- 4MCAD Professional

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:								
M - 401	Engineering Mathematics - IV	4		60	3	20	80	100
M - 402	Hydraulic and Pneumatic systems	4		60	3	20	80	100
M - 403	Basic Thermodynamics	5		75	3	20	80	100
M - 404	Design of Machine Elements - I	5		75	3	20	80	100
M - 405	Manufacturing Technology - II	4		60	3	20	80	100
M - 406	Production Drawing practice	6	-	90	3	40	60	100
PRACTICAL:								
M - 407	Hydraulics & Pneumatics Lab practice	-	3	45	3	40	60	100
M - 408	Fuels Lab practice	-	3	45	3	40	60	100
M - 409	Manufacturing & Fabrication Engg. Lab **Practice - II**	-	3	45	3	40	60	100
M - 410	Programming in C lab	-	3	45	3	40	60	100
	TOTAL	28	12	600				1000

ENGINEERING MATHEMATICS – IV
(Common to all Branches)

Subject Title : Engineering Mathematics-IV
Subject Code : M - 401
Periods per week : 04
PeriodsperSemester : 60

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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	09	1	2	0	0	0	0
	Unit – II								
2	Non-homogenous Linear Differential equations with constant coefficients	15	26	1	1	0	1	1	0
	Unit – III								
3	Laplace Transforms	25	49	2	1	0	2	1	1
	Unit – IV								
4	Fourier Series	15	26	1	1	0	1/2	1/2	1
	Total	60	110	5	5	0	3 1/2	2 1/2	2
			Marks	15	15	0	35	25	20

R: Remembering type 50 marks
U: Understanding type 40 marks
App: Application type 20 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.

Unit-II

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-III

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-IV

4.0 Understand the 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 $(-\pi, \pi)$.

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, cosax, 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 $(0,\ 2\pi)$.

Reference Books

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

Hydraulics & Pneumatic Systems

Subject Title : Hydraulics & Pneumatics Systems

Subject Code : M-402

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	Properties of Fluids	04	13	1	1
2	Flow of Liquids	08	13	1	1
3	Flow through pipes	08	13	1	1
4	Impact of jets	08	13	1	1
5	Water Turbines	10	16	2	1
6	Hydraulic Pumps & Motors	08	13	1	1
7	Fluid power Hydraulics	08	13	1	1
8	Pneumatics	04	13	1	1
9	Hydro-pneumatic systems	02	03	1	0
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

On the completion of the course the student should be able to

(Know the importance of Hydraulics in the present day industry and will be in a position to distinguish Hydraulics, Hydraulic Machines, fluid power systems, pneumatics and hydro pneumatic systems.)

1.0 Understand the various properties of fluids

1.1 Define a fluid

1.2 Differentiate between compressible and incompressible fluids

1.3 State the various units used in Hydraulics

1.4 Define various properties of fluids and state their units

1.5 Define intensity of pressure, differentiate between gauge pressure and absolute pressure .

1.6 Define the term the Pressure and state their units

1.7 Explain the working principle of manometer

2.0 Understand the behaviour of liquids in motion

2.1 Distinguish between laminar flow and turbulent flow and concept on Reynold‘s number.

2.2 State the various type of energies and the total energy.

2.3 Understand the concept of velocity of a flowing liquid

2.4 Understand the discharge equation and equation of continuity of flow.

2.5 State Bernoulli‘s equation and its application in hydraulics.

2.6 Explain the working principle of venturimeter, pitot tube, water and current meters.

2.7 Define coefficient of velocity(Cv),Coefficient of contraction (Cc)and Coefficient of discharge

2.8 Solve simple problems on law of continuity, Bernoulli‘s equation, Venturimeter.

3.0 Evaluate frictional losses during flow of liquids through pipes

3.1 Mention the equation for loss of head due to friction in pipes

3.2 State Darcy‘s and chezy‘s formulae

3.3 Explain the hydraulic gradient and total energy line

3.4 Calculate the velocity of flow, discharge and diameter of pipes connecting two reservoirs

3.5 Explain the function of siphon and state the reason for limiting the height of the pipes

3.6 Explain how the power can be transmitted through pipes carrying liquid under pressure

3.7 Express the condition for maximum H.P. through pipes

3.8 Solve simple problems on power transmission through pipes

4.0 Analyse forces during the impact of jets

4.1 Derive an expression for force of jet on fixed vertical, flat plate, fixed inclined flat plate, moving flat plate.

4.2 Derive an 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 Find the expressions for work done, power and efficiency in the above

5.0 Understand the working of 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 and also sub-classify them based on the direction of flow of water

5.4 Explain the working of Pelton wheel, Francis turbine and Kaplan turbine

5.5 Describe the governing of water turbines

5.6 Solve simple problems on water turbines

6.0 Understand the working of hydraulic pumps and motors

6.1 Explain the function of pump

6.2 Classify the pumps

6.3 Explain the principle of operation of a reciprocating pump

6.4 Describe the constructional details of single acting and double acting Pumps with legible sketch.

6.5 Solve simple problems on power required to drive a reciprocating pump

6.6 Explain the principle of operation of centrifugal pumps with legible sketch.

6.7 Describe the constructional details of centrifugal pump with legible sketch

6.8 Compare the centrifugal pump with a reciprocating pump

6.9 Appreciate the importance of priming in centrifugal pump

6.10 Identify the effects of leakages of air, its prevention

6.11 Define the efficiency of a centrifugal pump

6.12 Explain the phenomenon of cavitation and state its effect

6.13 Solve simple problems on centrifugal pumps

6.14 Draw the layout of a centrifugal pump installation

6.15 Discuss various classifications of hydraulic motor and applications in fluid power

6.16 Explain the construction and working of gear ,vane, axial plunger and radial piston motors

7.0 Fluid power Hydraulics

7.1 Appreciate the use of Hydraulic control system

7.2 State merits and demerits of hydraulic control system.

7.3 State the essential components of hydraulic circuits and their functions.

7.4 State the purpose of intensifier.

7.5 State the purpose of accumulators.

7.6 Explain the working principle of Hydraulic Jack with neat sketch

7.7 Explain the working principle of Hydraulic crane with neat sketch

7.8 Identify the elements of a Fluid Reservoir

7.9 Illustrate graphical symbols for hydraulic components and hydraulic cylinders

7.10 Classifications of valves

7.11 Explain the working principle of Pressure control valves with legible sketch

7.12 Explain the working principle of Directional control valves with legible sketch

7.13 Explain the working principle of Flow control valves with legible sketch

8.0 Pneumatics

8.1 State the elements of pneumatic circuits

8.2 State the areas of application of pneumatic power unit

8.3 Compare with hydraulic power unit Pneumatic power

8.4 Explain the principle of working of power operator holding devices.

8.5 Explain the pneumatic safety circuits.

9.0 Hydro Pneumatic Systems

9.1 Explain the advantages and applications of combined air and oil systems.

9.2 Explain the principle of combination system.

9.3 Describe the use of air as cushion for hydraulics system.

COURSE CONTENTS

1.0 Properties of fluids

1.1 Definition of fluid, compressible and incompressible fluids

1.2 Units used in Hydraulics

1.3 Density, specific weight, specific gravity, viscosity and surface tension, compressibility and capillarity.

1.4 Intensity of pressure, gauge and absolute pressures.

1.5 Measurement of pressures by U-Tube – manometer – simple Problems

2.0 Flow of Liquids

2.1 Types of Fluid flow

2.2 Concept on Reynold‘s Number – Laminar & Turbulant flow

2.3 Pressure, potential and kinetic energy of liquids - Total energy,

2.4 Bernoulli‘s equation (no derivation) – assumptions made

2.5 Continuity equation for compressible and incompressible fluids

2.6 Simple problems on continuity equation

2.7 Simple problems on Bernoulli‘s equation

2.8 Simple problem on Coefficient of velocity(Cv),Coefficient of contraction (Cc)and Coefficient of discharge

2.8 Working principle of Venturimeter

2.9 Working principle of Pitot tube and applications

2.9 Simple Problems on Venturimeter.

3.0 Flow through pipes

3.1 Concept of loss of head in pipes due to friction

3.2 Darcy‘s & Chezy‘s formula (without proof)

3.3 Simple problems on Darcy‘s and Chezy‘s formulae

3.4 Hydraulic gradient line and Total energy line-illustration

3.5 Calculation of discharge, velocity, diameter of pipe etc., for pipes connecting two reservoirs (considering frictional losses only)

3.6 Siphon – principle of working (Numerical problems omitted)

3.7 Expression for power transmitted through pipes.

3.8 Expression for transmission efficiency.

3.9 condition for maximum efficiency (without proof.)

3.10 Simple problems on power transmission.

4.0 Impact of jets

4.1 Derivation of formulae for the force of jet on Fixed vertical flat plate

4.2 Derivation of formulae for the force of jet on Fixed inclined flat plate

4.3 Simple problems on the above

4.4 Derivation of formulae for the force of jet on moving vertical flat plate

4.5 Derivation of formulae for the force of jet on series of moving plates fixed on the rim of a wheel

4.6 Simple problems on the above

4.7 Force of jet striking at the centre of Fixed curved blade –velocity triangles

4.8 Force of jet striking at the top of a moving curved blade - velocity triangles

4.9 Work done, power and efficiency in the above cases.

4.10 Simple problems on the above.

5.0 Water turbines

5.1 Introduction to water turbines

5.2 Table showing the various Water turbine installations in India

5.3 Use of water turbines

5.4 Hydro-electric power stations line sketch showing layout of hydroelectric power plant with head race, dam, sluice gate, pen stock turbine, generator and tail race

5.5 Classification of turbines-impulse and reaction turbines

5.6 Brief sub-classification as axial, radial and tangential flow type

5.7 Working principle of Pelton wheel-velocity triangles

5.8 Simple problems

5.9 Working principle of Francis turbine - velocity triangles

5.10 Simple problems

5.11 Working principle of Kaplan turbine - velocity triangles

5.12 Simple problems

5.13 Differences between Pelton wheel and Francis Turbines

5.14 Differences between Francis and Kaplan turbines

5.15 Governing of methods of Water turbines

6.0 Pumps and Motors

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 Expression for theoretical power required to drive the pump(without proof).

6.6 Simple problems

6.7 Working principle of centrifugal pump

6.8 Installation of centrifugal pump, showing its mountings and other Accessories with neat sketch

6.9 Priming of centrifugal pump – necessity - Cavitation and its effect

6.10 Simple problems on work, power and efficiency of Centrifugal Pumps

6.11 Types of hydraulic motors.

6.12 Working principles different types of motors with legible sketch.

7.0 **Fluid power hydraulics**

7.1 Introduction to hydraulic control system.

7.2 Merits and demerits of hydraulic control system.

7.3 Essential components of Hydraulics circuits and their functions.

7.4 Intensifiers – purpose - principle of working

7.5 Accumulators – purpose – principle of working

7.6 Hydraulic jack and Crane.

7.7 Elements of Fluid Reservoir – Filter, Air vent, Strainer, Baffles etc.

7.8 Hydraulic control valves – types

8.0 Pneumatics

8.1 Introduction to Pneumatic control - applications

8.2 Comparison with hydraulic circuits

8.3 Principle of working of Pneumatic clamp

8.4 Principle of working of Pneumatic collets

8.5 Principle of working of Pneumatic safety circuit against overload

9.0 Hydro - Pneumatic System

9.1 Advantages and Applications of combined Air and oil system.

9.2 Air controlled hydraulic valve

REFERENCE BOOKS

1. Hydraulic Machines By S.Anantha Swamy
2. Hydraulic Machines By R.C. Patel
3. Hydraulics By Malhotra & Malhotra
4. Hydraulic Machinery By Abdulla Shareef
5. Hydraulics & Hydraulic Machinery By Yeaple
6. Hydraulics and Pneumatics By Reya and Rao.
7. Pneumatics by SRIHARI RAO
8. Pneumatic controls by FESTO
9. Fluid Power Pneumatics by ALAN H. JOHN
10. Pneumatics by FLIPPO
11. Pneumatics By TTI
12. Fluid Power & Pneumatics by AUDEL

BASIC THERMODYNAMICS

Subject Title : Basic Thermodynamics

Subject Code : M-403

Periods/Week : 05

Periods per Semester : 75

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Fundamentals and laws of thermo-dynamics	10	16	02	01
2	Laws of perfect gases	06	08	01	½
3	Thermodynamic processes in gases	18	26	02	02
4	Fuels and combustion	12	18	01	1½
5	Air Standard Cycles	10	16	02	01
6	I C Engines	19	26	02	02
	Total	**75**	**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 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 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.

5 .0 Appreciate the study of air standard cycles.

5.1 Define the term 'Air Standard cycle'

5.2 Define the term 'Reversible Cycle'.

5.3 Explain with a line diagram the Working of carnot cycle.

5.4 State the assumptions made in Carnot cycle.

5.5 Derive the formula for the air standard efficiency of a Carnot cycle.

5.6 Solve simple problems on Carnot Cycle.

5.7 Explain the working of Otto Cycle with help of a line diagram.

5.8 State the assumptions made in Otto Cycle.

5.9 Derive the formula for air standard Efficiency of Otto Cycle.

5.10 Solve simple problems on Otto Cycle.

5.11 Explain the working of a Diesel cycle with line diagrams.

5.12 State assumptions made in Diesel Cycle.

5.13 Derive the formula for Air Standard Efficiency of Diesel Cycle.

5.14 Solve the simple problems on Diesel Cycles.

5.15 State the reasons for Carnot cycle being highly efficient than any other cycle working between the same temperature limits.

6.0 Understand the concept of IC Engines

6.1 Define “Heat Engine”.

6.2 Classify heat engines.

6.3 Give examples for each type.

6.4 Summarise the advantages of internal combustion engines over external combustion engines.

6.5 Classify Internal Combustion Engines

6.6 Draw the legible sketch of an I.C. engines and name the various parts.

6.7 Explain with line diagram the working of a four-stroke diesel engine.

6.8 Explain with a line diagram the working of a two-stroke diesel engine.

6.9 Explain with a legible sketch the working of a four-stroke petrol engine.

6.10 Explain with a legible sketch the working of a two-stroke petrol engine.

6.11 Compare two stroke engines with four stroke engines.

6.12 Compare diesel engines with petrol engines.

6.13 Draw the valve time diagrams for

a) Two-stroke petrol and diesel engines, and

b) Four-stroke petrol and diesel engines.

6.14 Name the various elements of the fuel systems of diesel engine .

6.15 Explain with legible sketch the working of the elements of fuel system of diesel engine.

6.16 Name the various elements of the fuel system of a petrol engine.

6.17 Explain the functions of the elements of the fuel system in a petrol engine.

6.18 Explain with a line diagram the working of a simple carburettor.

6.19 Explain with a line diagram the working of a zenith carburettor.

6.20 State the methods of cooling in I.C. engine cylinders.

6.21 Explain with a legible sketch air – cooling in I.C. engine.

6.22 Explain with line sketch the working of water cooling system with thermo syphon method of circulation.

6.23 Explain with legible sketch the working of water – cooling system with a radiator and forced circulation.

6.24 Compare air cooling system with water – cooling system.

6.25 Name the ignition systems used in petrol engines.

6.26 Explain with line sketch the working of a battery – coil ignition system.

6.27 Explain with legible sketch the working of a magneto ignition system.

6.28 Compare the battery ignition system with magneto ignition system.

6.29 Name the different methods of lubricating systems in I.C. engines.

6.30 Explain with legible sketch the methods of lubricating systems in I.C. engines.

6.31 Name the different methods of governing I.C. engines.

6.32 Explain the hit and miss method governing of I.C. engines.

6.33 Explain the quality method of governing of I.C engines.

6.34 Explain with line sketch the quantity method of governing of petrol engines.

6.35 Explain the concept of super charging of I.C. engines.

6.36 List the objectives of super charging in I.C. engines.

6.37 Write the formula for brake power.

6.38 Write the formula for indicated powder.

6.39 Write the formula for Mechanical Efficiency.

6.40 Write the formula for Thermal Efficiency.

6.41 Write the formula for Relative Efficiency.

6.42 Explain the Heat balance sheet

6.43 Solve simple problems on the performance of I.C. engines using brake test data.

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 and change in internal energy 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.

5.0 Air standard cycles.

5.1 Meaning of air standard cycle-its use-Reversible and irreversible process – reversible and irreversible cycles conditions for reversibility of a cycle.

5.2 Brief description of Carnot cycle with P.V. and T-S diagrams, Assumption made – Efficiency - Problems on Carnot cycle.

5.3 Brief explanation of Otto cycle with P.V. and T-S diagrams, assumptions made – Efficiency - Simple problems on Otto cycle.

5.4 Brief description of Diesel cycle with P.V. and T-S diagrams, Assumption made – Efficiency - Simple problems on Diesel cycle.

5.5 Reasons for the highest efficiency of Carnot cycle over other cycles working between same temperature limits.

6.0 The construction and working principle of Internal Combustion Engines.

6.1 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.

6.2 Brief explanation on the principle of working of four-stroke diesel engine and two-stroke diesel engine.

6.3 Brief explanation on the principle of working of four stroke and two stroke petrol engines.

6.4 Comparison of two stroke engines and four stroke engines. Comparison of diesel engine and petrol engine.

6.5 Draw the valve time diagrams for two stroke and four stroke engines.

6.6 Descriptive treatment, with sketches of a diesel fuel system, fuel tanks, fuel filter, fuel pump & fuel injector

6.7 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.

6.8 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.

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

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

6.11 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.

6.12 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.

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

4.0 Fundamentals of I.C.Engines by Heywood

DESIGN OF MACHINE ELEMENTS- I

Subject Title : Design of Machine Elements - I
Subject Code : M–404
Periods/Week : 05
Periods/Semester : 75

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.	Basic Link Mechanisms	10	08	01	½
3.	Bolted Joints	14	21	02	1 1/2
4.	Riveted Joints and Welded Joints	12	18	01	1 1/2
5.	Shafts, Keys and Couplings	17	26	02	02
6.	Bearings	10	16	02	01
Total		**75**	**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 without derivation

2.0 **Understand the concept of Basic Link mechanism**

2.1 Define important terms of Basic link mechanism

a) Link, b) kinematics pair, c) Kinematic chain, d) Mechanism, structure and machine

2.2 Explain kinematic pair and kinematic chain with the help of legible sketch

2.3 List examples for Lower and Higher pairs.

2.4 List examples of inversion.

3.0 Understand the design of Bolted Joints and power screws

3.1 Explain screw thread nomenclature and specifications of screw threads

3.2 List the different threaded fasteners with legible sketch

3.3 Explain power screw mechanism with legible sketch

3.4 Explain the strength of screwed fasteners

3.5 List the stresses in bolts

3.6 Design the size of bolt for a given load requirement.

3.7 Design the size of eye bolt for a given load requirement

3.8 Draw an eye bolt (not to scale) showing the proportions

3.9 Solve numerical problems related to the above cases

4.0 Understand the design of Riveted Joints and Welded Joints

4.1 List the basic types of riveted joints with legible sketch

4.2 Explain the terms used in riveted joints

4.3 List the types of failures in riveted joints

4.4 Evaluate the strength of a riveted joint

4.5 Design a riveted joint under the given conditions (E.g.Direct loading)

4.6 Explain the concept of Diamond or Lozenge joint

4.7 Design the diamond (structural) joint

4.8 List the types of welded joints

4.9 List the welded symbols with legible sketch

4.10 Explain the terms related to welded joints

4.11 List the merits and demerits of welded joints

4.12 Explain the lap and butt joints with legible sketch

4.13 Design the welded joints subjected to simple loading

4.14 Solve the numerical problems related to the above cases

5.0 Understand the design of Shafts, Keys and Couplings

5.1 Define the terms shaft and axle

5.2 State the functions of shaft

5.3 List the types of shafts

5.4 Distinguish between the shaft and axle

5.5 List the standard sizes of shafts as per I.S

5.6 Write the formula for power transmitted by the shaft

5.7 Design the shaft subjected to only torsion

5.8 Design the shaft subjected to only bending load (Design of axle)

5.9 Design the shaft subjected to bending and torsion based on Rankine and Guest theories

5.10 Design the shaft against the rigidity

5.11 Compare the strength and rigidity of solid and hollow shafts

5.12 Explain the function of keys and splines.

5.13 Name the recommended materials used for keys and splines.

5.14 Design the keys based on different modes of failure and also based on empirical relations

5.15 Write all the proportions of a spline for a given application referring tables.

5.16 Write the specifications of parallel, gib-head and taper sunk keys as per B.I.S.

5.17 Explain the function of a coupling

5.18 Classify the couplings

5.19 Design the muff coupling for a shaft of given size using empirical relations.

5.20 Design the cast iron flange-coupling (rigid type) for a given torque

5.21 Draw the above couplings according to the standard specifications

6.0 Understand the design of Bearings

6.1 State the function of bearing

6.2 Classify the bearings

6.3 List the types of lubrication

6.4 Explain the construction and working principle of journal bearing

6.5 Explain the nomenclature of roller bearing

6.6 List the types of roller bearings

6.7 List the types of thrust bearings

6.8 List the Advantages and disadvantages of sliding contact bearings

6.9 List all the differences between sliding contact and roller bearings

6.10 Explain about the bearing material

6.11 Define the terms- Rating life, Bearing load, Basic load rating and equivalent radial load

6.12 Select a bearing for given loads using tables

6.13 List all the advantages and disadvantages of anti-friction bearings

6.14 Derive the expressions for the load and torque carried by thrust and collar bearings under uniform pressure and wear conditions

6.15 Design a simple journal bearing using McKee's equation

6.16 Calculate heat generated and dissipated in journal bearing

6.17 Calculate heat generated and dissipated in collar bearing based on uniform pressure and uniform wear conditions

6.18 Specify a bearing

6.19 Solve the numerical problems

COURSE CONTENT

1. Introduction

Design philosophy, Derivation of normal and shear stresses 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. Basic Link Mechanism

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

Quadric cycle chain and its inversions,

Slider Crank chain and its inversion.

3. 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,

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

4. 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.

5. 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 hollow 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.

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

MANUFACTURING TECHNOLOGY - II

Subject Title : Manufacturing Technology-II

Subject Code : M–405

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	Grinding and finishing processes	16	29	3	2
2	Modern Machining Process	12	21	2	1 1/2
3	Plastic processing	08	21	2	1 1/2
4	Press Tools, Jigs and Fixtures	16	26	2	2
5	Metrology	08	13	1	1
Total		**60**	**110**	**10**	**08**

OBJECTIVES

Up on completion of the course the student shall able to

1. **Understand the concept of Grinding and finishing Processes**
   - 1.1 Explain the principle of metal removal by grinding.
   - 1.2 List the different abrasives.
   - 1.3 Explain the bonds and binding processes in grinding wheel manufacturing
   - 1.4 Identify the grinding wheel from the standard code (Marking system or designation of wheel).
   - 1.5 State the factors for selecting the grinding wheels.
   - 1.6 State the methods of grinding.
   - 1.7 Classify the grinding machines.
   - 1.8 Illustrate the cylindrical, surface, tool and cutter grinders.
   - 1.9 List the different work holding devices.
   - 1.10 State the methods of wheel maintenance.

1.11 State different finishing processes by grinding.(Honing, Lapping, Super finishing)

1.12 Explain the principle of electro–plating with a legible sketch.

1.13 Explain the principle of hot dipping processes namely galvanising, tin coating, Parkerizing and anodising.

1.14 List the various organic coatings.

1.15 Describe the processes of various organic coatings

1.16 State the principles of metal spraying.

1.17 State the features of wire process and powder process.

1.18 Select the appropriate process for surface roughness of a given application

2.0 Understand the concept of Modern Machining Processes

2.1 Distinguish between non-conventional machining processes and traditional methods.

2.2 State their relative advantages.

2.3 Explain the principle of working of ultrasonic machining.

2.4 List the equipment used in U.S.M. processes.

2.5 Explain the principle of electric discharge machining with a legible sketch.

2.6 Explain the working of Abrasive jet machining with a legible sketch

2.7 Explain the working of Laser beam machining with a legible sketch

2.8 State the principle of chemical machining.

3. 0.Understand the principle of manufacturing plastic products.

3.1 Explain the methods of injection moulding, compression moulding, transfer moulding with legible sketches

3.2 Explain the principle of extruding, casting and calendaring with legible sketches

3.3 State the principle of machining and welding plastics

3.4 Explain the different fabrication methods – Sheet forming, Blow moulding,

Laminating and Reinforcing

3.5 List Engineering applications of plastics

4. 0. **Understand the concept of Press Tools, Jigs and Fixtures.**

4.1 Explain the Importance of Press Tools

4.2 Classify presses based on power and design of frame.

4.3 Explain the constructional details of a power press with the help of a legible sketch

4.4 State the meaning of Press size.

4.5 Explain Press Tools – Punch and die.

4.6 Explain Die-clearance and Die Accessories

4.7 Explain shear action in die cutting operation – Punch and die clearances,

Angular clearance, centre of pressure, cutting forces.

4.8 Explain various press working operations.

4.9 Explain different types of dies.

4.10 List various die operations

4.11 List types of jigs and explain their constructional details with the help of legible sketches

4.12 State general considerations in design of drill jigs

4.13 State the function of drill bush.

4.14 List different types of fixtures and explain their constructional details with the help of legible sketches.

4.15 Differentiate between jigs and fixtures.

4.16 List the advantages of Jigs and Fixtures

4.17 Explain basic principle of location.

4.18 Identify different locating methods and devices.

4.19 Explain the basic principle of clamping.

4.20 Identify different types of clamps and their constructional details with the help of legible sketches

5. . Understand the concept of Metrology

5.1 Identify various linear and angular measuring instruments.

5.2 Explain the principle of working of (at least 4 types) comparators with a legible sketch.

5.3 Predict the amount of measuring accuracy using the comparator.

5.4 Identify the in-accuracies in surface finish.

5.5 Suggest the surface finish measuring instrument.

5.6 State the use of collimator and microscope.

5.7 State the principle of working of interferometer.

COURSE CONTENT

1.0 Grinding and finishing processes

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

2. 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 and Finishing specifications.

3.0 Plastics Processing.

Processing of plastics - Injection moulding - Compression moulding - Transfer moulding – Extruding - Casting – Calendaring, Applications of Plastics

4.0 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.

Explanation of constructional details of the above jigs.

General consideration in the design of drill jigs

Explanation of 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.

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

5.0 Metrology

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

Subject Title : Production Drawing
Subject Code : M-407

Period/Week : 06

Period per Semester : 90

TIME SCHEDULE

S.No	Major Topics	Number of Periods	Weightage of *Marks*	Short Answer Questions	Essay Type Questions
1	Introduction	06			
2	Limits, fits and tolerances	12	05	1	
3	Geometrical Tolerances	12	05	1	
4	Surface finish	06			
5	Standard Mechanical component specifications	06	05	1	
6	Standard conventional representation and reprographic methods	06	05	1	
7	Process sheet Preparation	06			
8	Exercises in Production Drawing	36	80		02*
	Total	**90**	**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 each question carries 40 marks and distributed for

-component drawing views.....25marks,

-limits fits and tolerances.....3 marks,

-geometrical tolerances.....3 marks,

-surface finish.....3 marks,

-process sheet .....6 marks.

3.Standard components in part-B question need not be drawn.

They are to be designated as per BIS. The marks for them are included in component drawing views

OBJECTIVES

On the completion of the course the student should be able to

1.0 Understand the need of production drawing.

Distinguish the machine drawing from a production drawing.

State the factors that govern the preparation of a production drawing.

Identify the components of a production drawing.

List the function of the component.

Prepare the relevant views of the part and dimension the part.

Indicate the details of specific processes like, heat treatment, welding,

counter boring etc.

2.0 Interpret dimension to obtain Limits, fit and Tolerance as per BIS standards.

State the need of Limits, allowance and tolerance

Definition of fit, allowance and tolerance.

Identify tolerance zones and tolerance grades

Classify types of fits, Material conditions, System of limits, specification tolerances

Selection of suitable fit for a given mating part.

Compute the fit from tables.

Indicate fits on the drawings.

3.0 Apply geometrical tolerances to a component

Need of geometrical tolerances, Types of geometrical tolerances

Guidelines for indication of feature controlled by geometrical tolerances

Datum features, guidelines for indication of datum features, datum planes in space,

General principles for applying geometrical tolerances on a component

Indicate geometrical tolerances on the drawings

4.0 Identify the standard symbol and indication added to it, to represent surface finish.

Indicate Profile of a surface and important characteristics of a surface ,

Identify the surface texture symbols. Identify Lay direction, surface roughness achievable from different manufacturing processes, Equivalent surface roughness symbols,

Indicate the roughness values or grade number and corresponding symbol as per BIS.

Indicate surface roughness on drawings.

5.0 Interpret the standard Mechanical component specification.

Identify the standard part that can be procured directly from the market and specify the part as per commercial/BIS Standards for procurement.

6.0 Identify standard conventional representation & reprographic methods

Draw standard conventional representation of metals, glass etc.

Draw standard conventional representation of Mechanical parts like bearing,

Threads, springs, knurling, shafts, gears etc

Identify the need of reprographic and methods like Xerox print etc.

7.0 Write the process sheet of production.

Indicate the sequence of process of production.

Specify the relevant tools to obtain the accuracy and finish.

Indicate the suitable equipment.

Specify the type of measuring instruments to be used to check the prescribed accuracy.

8.0 Preparation of Production drawing exercises.

Prepare exercises on production drawing as mentioned in the contents.

COURSE CONTENTS

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 Geometrical tolerances

Importance of geometrical tolerances, Types of geometrical tolerances

Tolerance of form : straightness ,flatness, roundness, cylindricity.

Tolerance of profile: profile of a line, profile of a surface.

Tolerance of orientation or attitude : angularity, perpendicularity, parallelism

Tolerance of location: position, concentricity, symmetry,

Composite tolerances : radial run-out, axial run-out

Symbols for geometrical tolerances, indication of geometrical tolerances on components.

Exercises on representation of geometrical tolerances on the drawings

4.0 Surface finish.

Standard symbol of surface finish and indications added to it.

Identification of surfaces to be finished based on functioning of component.

Representation of quality of surface finish on the drawing as BIS roughness grade numbers.

Exercises on specifying the surface roughness(average values) for functional surfaces of the following machine tool parts

-Shaft rotating in bush bearing,

-Tailstock sleeve in tailstock body,

-Keys and keyways

-Mounting surfaces for antifriction bearings

-Shaft or bush press fitted into bodies

-Beds of machine tools, guide-ways

-Contact surfaces ,example :flanges of pipe fittings

-Peripheral surfaces of pulleys and grooves for v-belts

-Surfaces of control elements example: levers ,hand wheels

-Bases of machines

-Machine tool tables

5.0 Specification of Mechanical standard parts.

Standard components (parts) are to be designated as per BIS

-Bolts, Nuts, Locknuts ,Washers, Screws and, Studs

-Circlips

-Cylindrical and taper pins

-Keys

-Rivets

Splines

-Oil seals-rings

-Antifriction bearings:

6.0 Standard conventional representation and reprographic methods

Conventional representation of metals, mechanical components and methods of reprographic methods.

7.0 Process sheets

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.

8.0 Production drawing exercises.

Prepare the relevant views of the part(s) of a given assembly drawing needed for the purpose of production.

Dimension the views obtained 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.

Indicate the geometrical tolerances on the component drawing

Mark the surface finish symbols with indications added.

Prepare the process sheet indicating sequence of processes and equipment, tools, measuring instruments required.

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

Exercises

- Knuckle Joint

- Universal Coupling

- Eccentric

- Lathe tail stock

- Revolving Centre

- Lathe Tool post

- Drill jig

- Non Return valve

- Clapper Block

- Stuffing box

- Footstep bearing with radial and thrust ball bearing

- Spindle supported by taper roller bearing

- Wall bracket with a pedestal bearing

- Hydraulic cylinder and piston

- Crane hook

- Belt drive

REFERENCE BOOKS

IS 696 – 1972-Code of Practice for General Engg. Drawing & B.I.S Code – SP . 46. IS 696 – 1988
Machine Design date hand book – Vol I & II – Dr. K. Lingaiah, (Suma Publishers, Bangalore).
IS Code on fits and tolerances.
Blur print reading for Mechanical Trades by B.R.Sachdeva.
Machine drawing by R.B. Gupta.
Machine Drawing by Siddeswar.
Production Drawing by K.Venkat Reddy
Machine Drawing by Nagpal
Production Drawing - for CCC candidates by SBTET

HYDRAULICS & PNEUMATIC LABORATORY PRACTICE

Subject Title : Hydraulics & Pneumatics Laboratory practice

Subject Code : M-407
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE - Hydraulics Lab (M –407)

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 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 Pipe friction

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 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 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 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 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 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; Plot performance curves	A. 1 B. 1 C. 2 D. 3 E. 3 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. 4	
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. 4	

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 practice (M – 407)

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 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 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 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 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 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.

FUELS LABORATORY PRACTICE

Subject Title : Fuels Laboratory practice
Subject Code : M – 408
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	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	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	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	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	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	• 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

	4. Draw the graph between the temperature and viscosities	

Title of the experiment (No.of periods)	Competencies	Key competency
3. Calorific value tests		
a) Bomb calorimeter	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	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	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

Title of the experiment (No.of periods)	Competencies	Key competency
5. Calibration of pressure gauge	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

MANUFACTURING&FABRICATION ENGINEERING LAB-II PRACTICE

Subject Title : Manufacturing and Fabrication Engg. Lab Practice II
Subject Code : M-409
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

1 Machine Shop (Turning)

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

2. 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

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

PROGRAMMING IN C LAB

Subject Title : Programming in C lab
Subject Code : Common - 410
Periods per Week : 3
Periods per Year : 45

LIST OF EXPERIMENTS

1. Exercise on structure of C program
2. Exercise on Keywords and identifiers
3. Exercise on constants and variables
4. Execution of simple C program
5. Exercise on operators and expressions
6. Exercise on special operators
7. Exercise on input and output of characters
8. Exercise on formatted input and output
9. Exercise on simple if statement
10. Exercise on if..else statement
11. Exercise on else..if ladder statement
12. Exercise on switch statement
13. Exercise on conditional operator
14. Exercise on while statement
15. Exercise on for statement
16. Exercise on do..while statement
17. Exercise on one dimensional arrays
18. Exercise on two dimensional arrays
19. Exercise on structure
20. Exercise on array of structures

The competencies and key competencies to be achieved by the student

S.No.	Name of the experiment	Objectives	Key Competencies
1	Exercise on structure of C program	For a given C program, identify the different building blocks	❖ Identify different building block in a C program
2	Exercise on Keywords and identifiers	For a given C program identify the keywords and identifiers	❖ Identify different keywords ❖ Check whether the keywords are in lowercase ❖ Differentiate identifiers and keywords
3	Exercise on constants and variables	For a given C program identify the constants and variables	❖ Identify the constants ❖ Identify the variables ❖ Declare variables with proper names ❖ Know the assignment of values to variables
4	Execution of simple C program	Execute a simple C program	❖ Acquaint with C program editing ❖ Compile the program ❖ Rectify the syntactical errors ❖ Execute the program
5	Exercise on operators and expressions	Write a C program that uses different arithmetic operators	❖ Identify different arithmetic operators ❖ Build arithmetic expressions ❖ Identify the priorities of operators ❖ Evaluate arithmetic expression ❖ Compile the program ❖ Rectify the syntactical errors ❖ Execute the program ❖ Check the output for its correctness
6	Exercise on special operators	Write a C program that uses special operators	❖ Identify different special operators ❖ Build expressions using special operators ❖ Compile the program ❖ Rectify the syntactical errors ❖ Execute the program ❖ Check the output for its correctness
7	Exercise on input and output of characters	Write a C program for reading and writing characters	❖ Know the use of getchar() function ❖ Know the use of putchar() function ❖ Compile the program ❖ Rectify the syntactical errors ❖ Execute the program ❖ Check whether the correct output is printed for the given input
8	Exercise on formatted input and output	Write a C program using formatted input and formatted output	❖ Know the use of format string for different types of data in scanf() function ❖ Know the use of format string for different types of data in printf() function ❖ Check whether the data is read in correct format

			❖ Check whether the data is printed in correct format
9	Exercise on simple if statement	Write a C program using simple if statement	❖ Build a relational expression ❖ Use the if statement for decision making ❖ Rectify the syntax errors ❖ Check the output for correctness
10	Exercise on if..else statement	Write a C program using if..else statement	❖ Build a relational expression ❖ Use the if..else statement for decision making ❖ Rectify the syntax errors ❖ Check the output for correctness
11	Exercise on else..if ladder statement	Write a C program using else..if ladder statement	❖ Use else..if ladder statements with correct syntax ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check the output for correctness
12	Exercise on switch statement	Write a C program using switch statement	❖ Use switch statement with correct syntax ❖ Identify the differences between switch and else..if ladder ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check the output for correctness
13	Exercise on conditional operator	Write a C program using (**?** **:**) conditional operator	❖ Build the three expressions for conditional operator ❖ Use conditional operator with correct syntax ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Differentiate conditional operator and if..else statement
14	Exercise on while statement	Write a C program using while statement	❖ Build the termination condition for looping ❖ Use while statement with correct syntax ❖ Check whether correct number of iterations are performed by the while loop ❖ Rectify the syntax errors ❖ Debug logical errors
15	Exercise on **for** statement	Write a C program using for statement	❖ Build the initial, increment and termination conditions for looping ❖ Use for statement with correct syntax ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check whether correct number of iterations are performed by the **for** loop ❖ Differentiate **for** and **while** statements
16	Exercise on **do..while** statement	Write a C program using do statement	❖ Build the termination condition for looping ❖ Use do statement with correct syntax ❖ Rectify the syntax errors ❖ Debug logical errors

			❖ Check whether correct number of iterations are performed by the while loop ❖ Differentiate **do..while,while** and **for** statements
17	Exercise on one dimensional arrays	Write a C program to create and access one dimensional array	❖ Create a one dimensional array with correct syntax ❖ Store elements into array ❖ Read elements from array ❖ Validate boundary conditions while accessing elements of array ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check for the correctness of output for the given input
18	Exercise on two dimensional arrays	Write a C program to create and access two dimensional array	❖ Create a two dimensional array with correct syntax ❖ Store elements into array ❖ Read elements from array ❖ Validate boundary conditions while accessing elements of array ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check for the correctness of output for the given input
19	Exercise on structure	Write a C program using structure	❖ Define a structure with correct syntax ❖ Identify different members of a structure ❖ Declare a structure variable ❖ Access different members of structure ❖ Observe the size of the structure ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check for the correctness of output for the given input
20	Exercise on array of structures	Write a C program to create an array of structures and store and retrieve data from that array	❖ Define a structure with correct syntax ❖ Identify different members of a structure ❖ Declare a structure variable ❖ Create an array of structure ❖ Access individual element of the array of structure ❖ Access different members of structure ❖ Rectify the syntax errors ❖ Debug logical errors ❖ Check for the correctness of output for the given input

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:								
M-501	Industrial Management &Entrepreneurship	5	-	75	3			100
M-502	Industrial Engg. & Estimating & Costing	5	-	75	3			100
M-503	Heat Power Engineering	5	-	75	3			100
M-504	Design of Machine Elements -II	4	-	60	3			100
M-505	CAD/CAM	4	-	60	3			100
M-506	**Elective** (A) Refrigeration & Air conditioning (B) Automobile Engg. (C) Energy Sources & Power plant Engg.	4	-	60	3			100
PRACTICAL:								
M-507	CAD 3D / CAM Lab Practice	-	6	90	3			100
M-508	TE and R&AC lab practice	-	3	45	3			100
M-509	Manufacturing&Servicing and Maintenance Lab practice	-	3	45	3			100
M-510	Project work	-	3	45	3			100
	TOTAL	27	15	630				1000

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Subject Tit *:Industrial Management And Entrepreneurship*

Subject Code **:M–501**

Periods/Week **:05**

Periods per Semester **:75**

TIME SCHEDULE

S. No.	Major Topics	Periods	Weightage Of Marks	Short Answer Questions	Essay Type Questions
1.	Principles and functions of Management	5	08	01	½
2.	Organisation structure & organisational behaviour	14	21	02	1 ½
3	Production Management	10	13	01	01
4.	Materials Management	10	16	02	01
5.	Marketing ,Sales & Feasibility study	10	13	01	01
6.	Industrial legislation & safety	08	13	01	01
7.	Introduction to ISO 9000 & T.Q.M.	08	13	01	01
8	Role of Enterprenuer and Enterprenuerial Development	10	13	01	01
	Total	75	110	10	08

OBJECTIVES

On completion of the course the student will be able to

1.0 Understand the principles of management as applied to industry.

1.1 Define industry, commerce (Trade) and business.

1.2 Know the need for management.

1.3 Understand the evolution of management

1.4 Explain the principles of scientific management.

1.5 Understand functions of Management.

1.6 Differentiate between management and administration.

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

2.1 Understand types of ownerships

2.2 Differentiate types of ownerships.

2.3 Understand salient features of joint stock companies.

2.4 Understand the philosophy and need of organisation structure of an industry.

2.5 Understand the line, staff and Functional organisations.

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 Understand organisational behaviour.

2.10 Conduct for analysis.

2.11 Assess the incurring applicants.

2.12 Outline the selection process.

2.13 Understand the sources of manpower.

2.14 State motivation theories.

2.15 State Maslow's Hierarchy of needs.

2.16 List out different leadership models.

2.17 Explain the trait theory of leadership.

2.18 Explain behavioural theory of Leadership.

2.19 Explain the process of decision Making.

2.20 Outline the communication process.

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 Derive an expression for economic ordering quantity.

4.7 Explain stock layout.

4.8 List out stores records.

4.9 Explain the Bin card.

4.10 Describe Cardex method.

4.11 Explain purchasing procedures.

4.12 List out purchase records.

4.13 Describe the stores equipment

4.14 **Understand marketing, sales and feasibility study.**

4.15 Explain marketing functions.

4.16 Explain Sales function.

4.17 List out market conditions.

4.18 Differentiate Sellers and Buyers' market.

4.19 Differentiate monopoly, oligarchy, and perfect competition.

4.20 Conduct market and demand surveys.

4.21 Differentiate product and production analysis.

4.22 Identify the input materials, i.e. Bill of materials

4.23 Explain the concept of cost.

4.24 List out the elements of cost.

4.25 Explain the concept of contribution.

4.26 Explain break-even analysis.

4.27 Define the main policy requirements.

4.28 Decide the location.

4.29 Evaluate Economic and Technical factors.

4.30 Preparation of feasibility study.

4.31 List out different products currently in demand with market or industry.

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

5.1 Describe employer and employee relations.

5.2 Describe the mechanics of Trade Unions.

5.3 Describe mechanics of settlement of in outs.

5.4 Explain the significance of collective bargain.

5.5 List out Welfare activities.

5.6 List out subsidy schemes.

5.7 Explain the total welfare concept.

5.8 List out the rights and responsibilities of employees and employers.

5.9 List out the salient features of Indian Factories Act.

5.10 Explain the importance of safety at Work place.

5.11 List out the important provisions related to safety.

5.12 Explain the significance and mechanics of safety education.

5.13 Explain hazard and accident.

5.14 List out different hazards in the Industry.

5.15 Explain the causes of accidents.

5.16 Explain the direct and indirect cost of accidents.

5.17 List out provisions of Indian Electricity Rules laid in the electricity act1923.

6.0 Understand ISO 9000 & TQM.

6.1 Understand the concept of quality.

6.2 Know the quality systems and elements of quality systems.

6.3 Know the principles of quality Assurance.

6.4 Know the Indian Standards on quality systems.

6.5 Know the evolution of ISO standards.

6.6 Discuss ISO standards and ISO 9000 series of quality systems.

6.7 State the constituents of ISO 9000 series of standards for quality systems.

6.8 State the outstanding features and drawbacks of ISO 9000 series of standards.

6.9 List the beneficiaries of ISO 9000.

6.10 Understand 5-S principles and ZERO DEFECT.

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

7.1 Outline the concepts of Entrepreneurship.
7.2 Define the word entrepreneur.
7.3 Determine the role of Entrepreneurship.
7.4 Describe the profile of an entrepreneur.
7.5 Explain the requirements of an entrepreneur.
7.6 Outline the expectations of Entrepreneurship.
7.7 Determine the role of entrepreneurs in promoting Small Scale Industries.
7.8 Describe the details of self-employment schemes.
7.9 Explain the importance of TS-IPASS.
7.10 List salient features of TS-IPASS.
7.11 Explain the method of product selection.
7.12 Explain the method of site selection.
7.13 Outline the method of plant layout.
7.14 List the financial assistance programmes.
7.15 List out the organisations that help an entrepreneur.

COURSE CONTENTS

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, Leadership in organisation, decision making, communication,

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, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex.

5. Marketing, Sales & Feasibility Study

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligarchy, perfect competition, Pricing Policies. Cost Elements of Cost, Contribution, Break even analysis, 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.

6. Industrial Legislation & 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 Indian Factories Act, Important of Safety at work places, factories Act- Provisions, Safety Education, Hazards, causes of accidents, Cost of accidents, Indian Electricity rules.

7. Introduction to ISO 9000 and TQM.

Concept of quality discussed by B. Crosby W. Edward, Deming, 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.

Know 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 (Whom does ISO 9000 help).

8. Role of Entrepreneur & Entrepreneurial Development.

Concept, definition, role, expectation, entrepreneurship Vs Management, promotion of S.S.I. Self – employment schemes. The importance and salient features of TS-IPASS.

Product selection, site selection, plant layout, profile and requirement, Institutional support needed, financial assistance programmes.

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.

INDUSTRIAL ENGINEERING & ESTIMATING AND COSTING

Subject Title : Industrial Engineering & Estimating and Costing

Subject Code : M-502

Periods/Week : 05

Periods per Semester : 75

TIME SCHEDULE

Sno.	Major Topics	No. of	Weightage of	Short Answer	Essay Type

		Periods	Marks	Questions	Questions
1.	**Work Study**				
	a) Method Study	15	13	1	1
	b)Work Measurement	10	13	1	1
2.	Inspection & S.Q.C.	20	16	2	1
3.	Fundamentals of estimation	04	13	1	1
4.	Elements of costing	06	13	1	1
5	Estimation of Weights	06	13	1	1
6	Estimation of Machining times	05	13	1	1
7	Estimation of Fabrication costs	06	13	1	1
8	Estimation of Forging & Foundry costs	03	03	1	-
Total		**75**	**110**	**10**	**08**

OBJECTIVES

On completion of the subject the student should be able to

1. 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 purpose of work Measurement.

1.6.Describe the time – study Equipment.

1.7.Describe the sequence of making Time – study.

1.8. State the procedure of recording the Time.

1.9. Explain the need for rating factor.

1.10. Compute normal time.

1.11. Explain the importance of Allowances.

1.12. Compute the standard time for an operation using observed time.

1.13. State the purpose of work – sampling.

1.14. State the advantages of work – sampling.

2. Understand inspection procedures & the quality control functions.

2.1. Distinguish between the terms quality of design and quality of Manufacturing.

2.2. Discuss quality – cost relationship.

2.3. Discuss quality variation parameters.

2.4. Explain inspection procedures.

2.5. State the different inspection methods.

2.6. State the characteristics of normal distribution.

2.7. Construct control charts for variables and attributes.

2.8. Interpret control chart for “process in control” or “process out of control”.

2.9. Identify the situation where Random Sampling is useful.

3. Understand the fundamentals of estimation.

3.1. Estimation of design time.

3.2. Estimation of drafting time.

3.3. Estimation of planning and production.

3.4. Estimate procurement or manufacturing time for special tools or equivalent.

3.5. Estimating labour, material and overhead costs.

3.6. Estimate selling expenses.

3.7. Estimate the selling price.

4. Understand the elements of costing.

4.1. List the elements of costing such as Direct material, direct labour and overhead expenses.

4.2. Appraise the terms prime cost, factory cost, total cost overheads and depreciation.

4.3. Determine the items that go into Prime cost.

4.4. Determine the items that constitute on costs.

4.5.Calculate the cost of a product taking into consideration all the items.

4.6.Calculate the selling price of a Product.

5. Estimate the weight of material required for a product.

5.1.Divide the component drawing into simple and smaller geometrical configurations.

5.2.Calculate the volumes and the weight of the material required.

5.3.Estimate the cost of material.

5.4.Solve simple problems on the above.

6. Estimation of machining times.

6.1.Estimate time required for machining like turning, drilling, screw cutting

6.2.Solve problems on the above.

7. Estimate the fabrication cost.

7.1.Use table for obtaining consumption of gas, filler rods, and rate of welding for different types of welding.

7.2.Estimate the cost of fabrication

8. Estimate forging and foundry costs

8.1.Estimate the loss in forging.

8.2.Define the terms net and gross weight.

8.3.Know the components that go into foundry costs

COURSE CONTENTS

Contribution of work study to productivity

1. Work Study.

1.1.Meaning and purpose.

1.2.Components of Work study – Method study & Time study

1.3.Method study- purpose

1.4.Method study -procedure

1.5.Process chart symbols-types

1.6.Outline process chart -illustration

1.7. Flow process chart - illustration
1.8. Flow diagrams-illustration
1.9. String diagram -illustration
1.10. Two handed process chart-illustration
1.11. Micro motion study- concept
1.12. Principles of Motion economy
1.13. Therbligs
1.14. SIMO Chart
1.15. Cycle graph -Chronocyclegraph
1.16. Time study -purpose.
1.17. Stop watch study - procedure
1.18. Performance rating –concept
1.19. Rating scales
1.20. Time allowances
1.21. Determination of Normal Time & standard time.
1.22. simple problems on Normal and standard times
1.23. Work sampling-concept – advantages

2. Inspection and Statistical quality control

2.1. Quality-quality of design-quality conformance-quality assurance
2.2. Quality -cost relationship,
2.3. Inspection – objectives of inspection
2.4. Methods of inspection
2.5. Quality control-necessity
2.6. variation in manufacture-assignable causes - chance causes
2.7. Quality characteristics-variables-attributes.
2.8. Normal curve-properties of normal curve.
2.9. Simple problems on Normal curve applications
2.10. Control charts – necessity - types
2.11. X and R charts – concept
2.12. Method of constructing X-R chart-simple problems
2.13. Control chart for attributes – advantages
2.14. Method of constructing – fraction defective and no. of defectives charts-simple problems

2.15.Terminology of sampling inspection

2.16.OC curve – illustration-importance

2.17.Single sampling plan – illustration

2.18.Double sampling plan – illustration

3. Fundamentals of estimating

3.1.Meaning of Estimation – necessity

3.2.Meaning of costing - necessity

3.3.Difference between estimation and costing

3.4.Principle constituents of estimating the cost of a component

3.5.Meaning of design time, drafting time, planning time, production time, labour, materials, overheads

4. Elements of costing.

4.1.Elements of cost - material, labour and expenses

4.2.Classification of cost - direct material, direct labour and overhead s

4.3.Definition of Prime cost, factory cost, production cost ,total cost and selling price

4.4.Calculation of the selling price of a product – simple problems

4.5.Depreciation-sinking fund method- simple problems.

5. Estimation of weights of materials

5.1.Review of mensuration formulae for regular 2D figures including fillets, segments of circles

5.2.Review of mensuration formulae for regular 3D solids including solids of revolutions and segments

5.3.Principles of dividing the component drawing into simple and smaller geometrical configurations.

5.4.Table showing the specific weights of important engineering materials

5.5.Simple problems on estimation of weights of machine components

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6. Estimation of Machining times

6.1. Meaning of cutting speed – feed – depth of cut- machining time-purpose of calculating machining time

6.2. Formulae for all basic turning times

6.3. Simple problems on estimation of turning times

6.4. Formulae for Drilling – screw cutting times

6.5. Simple problems on estimation of drilling time

7. Estimation of fabrication cost.

7.1. Oxy-acetylene gas welding – principle – rightward and leftward techniques

7.2. Estimation of gas welding time using tables

7.3. Simple problems on estimation of gas welding times

7.4. Estimation of arc welding costs-components that go into cost

7.5. Simple problems on estimation of arc welding costs

8. Estimation of forging and foundry costs.

8.1. Components that go into forging costs

8.2. Forging loses – net weight – gross weight

8.3. Patten allowances used in Foundry – net weight – gross weight

8.4. Components that go into foundry costs

REFERENCE BOOKS

Work study – by Ralph Banes.

Work study – by I.L.O.

S.Q.C – by Grant & Levenworth

S.Q.C -by Juran

Industrial Engineering & Management Science. - by T.R.Banga

Estimating & Costing - by Agarwal.

Estimating & costing -by Narang & Acharya

Estimating & Costing -by T.R. Banga – Sharma.

HEAT POWER ENGINEERING

Subject Title : Heat Power Engineering

Subject Code : M-503

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 Compressors	08	13	01	01
2	Gas Turbines & Jet Propulsion	11	16	02	01
3	Properties of Steam	10	13	01	01
4	Steam Boilers	14	21	02	01½
5	Steam Nozzles	10	13	01	01
6	Steam Turbines	14	21	02	01½
7	Steam Condensers	08	13	01	01
	Total	**75**	**110**	**10**	**08**

OBJECTIVES

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

1.0 Comprehend the construction and working of air compressor.

1.1 State the functions of air compressors.

1.2 Enumerate the uses of compressed air.

1.3 Name the different types of compressors.

1.4 Explain with line diagram the working of a single reciprocating air compressor.

1.5 Write the formula for work done and power required by a single stage compressor.

1.6 Solve simple problems on single acting reciprocating air compressors.

1.7 State the advantages of multi- stage compressors over single stage compressor.

1.8 Explain the use of inter cooler.

1.9 State the conditions for minimum work done in two stage compression.

1.10 Write the formula for work done and power required in two stage compressor.

1.11 Solve simple problems in two stage air compressor.

1.12 Name the types of rotary compressors.

1.13 Explain with line diagram the working of a centrifugal compressor.

1.14 Explain with line diagram the working of an axial flow type compressor.

1.15 Explain with line sketch the working of a vane type compressor.

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

2.1 Classify gas turbines.

2.2 Compare Gas turbines with Steam turbines.

2.3 Compare gas turbines with reciprocating I.C. engines.

2.4 Mention the applications with limitations of gas turbine.

2.5 Explain with line diagrams the working of an open cycle constant pressure type gas turbine.

2.6 Explain with line diagram the working of a closed cycle type gas turbine.

2.7 Represent cycle of operation for the above type on P-V and T-s diagrams.

2.8 Explain with line diagram the principles of operation of Ramjet engine and turbo- jet engines.

2.9 State the application of jet engine.

2.10 Explain with line sketches the working of rocket engine.

2.11 Identify the fuels used in jet propulsion.

3.0 Understand the Properties of Steam

3.1 Define the various properties of steam

3.2 Compute the enthalpy, internal energy and entropy at given pressure.

3.3 Practice the use of steam tables

3.4 Interpret the data in steam tables to calculate enthalpy and entropy.

3.5 Compute the above values using Mollier chart.

3.6 Solve simple problems on the above.

3.7 Identify the various thermodynamic processes (Expansion & Compression of vapours)

3.8 Compute the work done, internal energy, enthalpy and entropy in each of the above processes.

3.9 Represent the above process on T-S and H-S diagrams

3.10 Calculate dryness fraction by using Steam calorimeters

4.0 Understand the Working of Steam Boilers.

4.1 State the function of boiler

4.2 List all the uses of boilers.

4.3 Explain the working of Cochran Boiler with a legible sketch

4.4 Explain the working of Babcock Wilcox Boiler with a legible sketch

4.5 Distinguish between water tube and fire-tube boilers

4.6 Recognise the need of high-pressure modern boilers

4.7 Explain the working principle of Lamont and Benson Boilers with a legible sketch

4.8 List all the boiler mountings

4.9 Explain the function all the mountings with a legible sketch such as pressure gauge, water level indicator, safety valve and fusible plug.

4.10 List all the boiler accessories.

4.11 Illustrate the function of all the accessories with a legible sketch such as economiser, Super Heater, Steam traps & Separators.

4.12 Explain the terms actual/equivalent evaporation and factor of evaporation.

4.13 Define the boiler Power

4.14 Define the boiler efficiency

4.15 Write the formula for the above.

4.16 Compute the equivalent and actual evaporation from given data.

4.17 Solve problems on Boiler Power & efficiency

4.18 Draw heat balance for boiler performance

4.19 Explain draught systems (Natural, forced & induced) in detail with a legible sketch

5.0 Understand the Working of Steam Nozzles

5.1 Explain the Flow of steam through nozzle

5.2 Derive the expression for Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.

5.3 Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.

5.4 Write the expression for Discharge of steam through nozzles

5.5 Write the formula for Critical pressure ratio

5.6 Calculate cross-sectional areas at throat and exit for maximum discharge

5.7 Explain the Effect of friction in nozzles and Super saturated flow in nozzles.

5.8 Explain the Working of steam jet injector with a legible sketch.

5.9 Solve simple problems of nozzles.

6.0 Understand the Working of Steam Turbines

6.1 Explain the principle of working of a turbine

6.2 Classify the Turbines with examples.

6.3 Differentiate the impulse turbines from reaction turbine

6.4 Explain the Principle of working of simple De-Laval turbine with a line diagram.

6.5 Draw velocity triangles

6.6 List various blade angles

6.7 Derive formula for work done, axial thrust, energy lost, power and efficiencies.

6.8 State the necessity of compounding a turbine.

6.9 Describe the methods of reducing rotor speeds with the help of legible sketch (3 compounding methods)

6.10 Explain the working principle of Parson's Reaction Turbine with a line diagram.

6.11 Velocity triangle for Parson's reaction turbine.

6.12 Simple problems on Single stage Impulse turbines (without blade friction) and reaction turbines (including data on blade height)

6.13 Define the terms bleeding & reheating.

6.14 State the necessity of governing a turbine

6.15 Explain the methods of turbine governing

7.0 Understand the Working of Steam Condensers

7.1 Define the Steam condenser

7.2 State the functions of steam condenser

7.3 Classify the condensers

7.4 Explain the working principle of Low level counter – Flow and Parallel –

Flow jet condensers with legible sketch

7.5 Explain the working principle of High level Jet condenser with legible

Sketch

7.6 List the Advantages and Disadvantages of High- Level Jet condenser

7.7 Explain the working principle of Ejector condenser with legible

Sketch

7.8 Explain the working principle of Shell and Tube Surface condenser with Legible sketch

7.9 Distinguish between down flow and central flow surface condenser

7.10 Explain the working principle of Evaporative condenser with legible Sketch

7.11 List Advantages and Disadvantages of Surface condenser

7.12 Distinguish between Jet Condenser and Surface Condenser

7.13 Write the Formulae for cooling water required, Condenser efficiency, Corrected vacuum, absolute pressure and Vacuum efficiency

7.14 Solve Simple problems on Steam condensers to Estimate the Cooling water required, Condenser efficiency and Vacuum efficiency

7.15 Define Air Extraction

7.16 List the types of Air Extraction systems

7.17 Distinguish between Dry-air Extraction and Wet-air Extraction systems

7.18 Explain the working principle of Air pump and Steam –Jet Air Ejector with legible sketch

COURSE CONTENT

1.0 Air Compressors.

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

1.2 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.

1.3 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.

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

2.0 Gas Turbines & Jet Propulsion

2.1 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.

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

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

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

2.5 Rocket engine – its principle of working & application.

2.6 Fuels used in jet – propulsion.

3.0 Properties of steam.

3.1 Formation of steam under constant pressure, dryness, fraction and degree of superheat, specific volume.

3.2 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.

3.3 Simple direct problems on the above using tables and charts.

3.4 Vapour processes – simple problems using tables and charts.

3.5 Steam calorimeters – Separating, throttling, Combined Separating and throttling calorimeters – problems.

4.0 Steam Boilers.

4.1 Function and use of steam boilers.

4.2 Classification of steam boiler with examples.

4.3 Brief explanation with line sketches of Cochran and Babcock Wilcox Boilers.

4.4 Comparison of water tube and fire tube boilers.

4.5 Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers.

4.6 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).

4.7 Brief explanation with line sketches of boiler accessories such as feed pump, economiser, super heater and air pre-heater only.

4.8 Study of steam traps & separators.

4.9 Explanation of the terms : Actual evaporation, equivalent evaporation, factor of evaporation, boiler horse power and boiler efficiency.

4.10 Formula for the above terms without proof.

4.11 Simple direct problems on the above.

4.12 Draught systems (Natural, forced & induced).

5.0 Steam Nozzles

5.1 Flow of steam through nozzle.

5.2 Velocity of steam at the exit of nozzle in terms of heat drop by analytical and mollier diagram.

5.3 Discharge of steam through nozzles.

5.4 Critical pressure ratio.

5.5 Methods of calculation of cross – sectional areas at throat and exit for maximum discharge.

5.6 Effect of friction in nozzles and Super saturated flow in nozzles.

5.7 Working steam jet injector.

5.8 Simple problems of nozzles.

6.0 Steam Turbines

6.1 Classification of steam turbines with examples.

6.2 Difference between impulse & reaction turbines.

6.3 Principle of working of a simple De-lavel turbine with line diagrams.

6.4 Velocity diagrams.

6.5 Expression for work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, nozzle efficiency.

6.6 Methods of reducing rotor speed compounding for velocity, for pressure or both pressure and velocity.

6.7 Working principle with line diagram of a Parson’s Reaction turbine – velocity diagram.

6.8 Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height.

6.9 Bleeding, re-heating and re-heating factors (Problems omitted).

6.10 Governing of steam turbines : Throttle, By-pass & Nozzle control governing.

7.0 Steam Condensers

7.1 Steam condenser ,its functions, Classifications

7.2 Low level counter – Flow and Parallel –

Flow jet condensers, High level Jet condenser and Ejector condenser,

Advantages and Disadvantages of High- Level Jet condenser

7.3 Shell and Tube Surface condenser, Down flow, Central flow Surface

Condenser and Evaporative condenser, Advantages and Disadvantages of Surface condenser

7.4 The Formulae for cooling water required, Condenser efficiency,

Corrected vacuum, Absolute pressure and Vacuum efficiency

7.5 Simple problems on Steam condensers to Estimate the Cooling water

Required, Condenser efficiency and Vacuum efficiency

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

REFERENCE BOOKS

1. Thermodynamics by Ballaney

2. Thermal Engineering by Arora & S. Domkundwar

3. Thermal Engineering by Roy & Sarao

4. Thermal Engineering by Vasandani & Kumar

5. Thermal Engineering by R.S.Khurmi.

DESIGN OF MACHINE ELEMENTS-II

Subject Title : Design of Machine Elements-II
Subject Code : M–504
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	12	21	02	1 ½
4.	Brakes and Clutches	14	26	02	02
5.	Cams	10	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 Write the expression for maximum fluctuation of energy stored in 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, iso-chronism, 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 clutch

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 - three 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]

CAD/CAM

Subject Title : CAD / CAM

Subject Code : M–505

Periods per week : 04

Period per semester : 60

TIME SCHEDULE

Sl No.	Major Topics	No. of periods	WEIGHTAGE	SHORT	ESSAY
1.	Computer Aided Design and Manufacturing	16	29	3	2
2.	CNC Machines and their components	18	32	4	2
3.	CNC Part Programming	14	26	2	2
4.	CIMS & Flexible Manufacturing Systems	07	13	1	1
5.	Robotics	05	10	0	1
	TOTAL	**60**	**110**	**10**	**08**

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

1. Computer Aided Design and Manufacturing

1.1. Define CAD

1.2. Identify advantages of CAD

1.3. Identify CAD software and hardware

1.4. Appreciate the importance of Solid Modelling software like Creo-E (PRO-E) / UNIGRAPHICS / CATIA

1.5. Appreciate importance of Auto CAD as a CAD software

1.6. Familiarize with Graphic Work Station.

1.7. Define CAM

1.8. Identify the functions of CAM

1.9. Appreciate the advantages of CAM

1.10. Familiarize with the terms material requirement planning (MRP I) and manufacturing resources planning (MRP II)

2. CNC Machines and their Components

2.1. Define numerical control

2.2. Identify the components of NC & CNC systems

2.3. State the classification of NC

2.4. Differentiate between NC, CNC & DNC systems

2.5. Explain Manufacturing Methodology on NC system

2.6. Illustrate the working principle of CNC system

2.7. Familiarize with the term Machining Centre

2.8. Identify the maintenance aspects of CNC machines

2.9. Appreciate the role of CNC in computer integrated manufacturing environment

2.10. Identify the various spindle drives

2.11. Illustrate slide ways

2.12. Familiarize with linear motion bearings, recirculatory ball screws

2.13. Appreciate the importance of automatic tool change

2.14. Illustrate tool magazine

2.15. Identify the various feed back devices

3. CNC PART PROGRAMMING

3.1. Familiarize with structure of NC part program

3.2. Differentiate between manual and computer aided programming methods

3.3.Familiarize with G & M codes

3.4.Explain the method of programming tool information, feed, speed data

3.5.Identify the various programming cycles like plain turning cycle, peck drilling, grooving and 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 canned cycles, sub routines and macros.

3.8.Appreciate the necessity of tool nose radius compensation in programming

3.9.Familiarize with APT programming

4. 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 Advantages of CNC-CMM

5. 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 advantages and applications of robots

5.7.Appreciate the role of robots in CIMS

COURSE CONTENTS

1. COMPUTER AIDED DESIGN AND MANUFACTURING

1.1.Introduction to CAD

1.2.Benefits of CAD
1.3.Stages of CAD
1.4.CAD input devices
1.5.CAD Output devices
1.6.CAD display devices
1.7.Types of CAD systems
1.8.Types of CAD soft ware
1.9.Features of different CAD software
1.10.Computer communications
1.11.Types of computer communications networks
1.12.Introduction to CAM
1.13.Functions of CAM
1.14.Benefits of CAM
1.15.Integrated CAD / CAM Organization – concept
1.16.Necessity of CAD/CAM integration
1.17.Importance of MRP I and MRP II and Explain
1.18.Advantages of MRP I and MRP-II

2. CNC MACHINES AND THEIR COMPONENTS

2.1.Introduction to numerical control
2.2.Classification of NC machines
2.3.Features of NC system
2.4.Advantages of NC system
2.5.Limitations of NC system in comparison to conventional systems
2.6.Layout of NC system
2.7.Functions of each component of NC system
2.8.Manufacturing methodology on NC system
2.9.Development of CNC and DNC systems
2.10.comparative treatment of features for NC, CNC, DNC
2.11.Block diagram of CNC system
2.12.Functions of each component of a CNC system
2.13.Working principle of CNC system – advantages over NC system
2.14.Machining centres -Types

2.15.Specifications of CNC machines.
2.16.Care and maintenance of CNC machines
2.17.Drives of CNC-Spindle drives – Feed drives.
2.18.Slide ways – types with illustrations
2.19.Bearings – linear motion bearings – recirculatory ball screws
2.20.Automatic tool change – working of tool magazine
2.21.Feedback devices – encoders – linear transducers'

3. CNC PART PROGRAMMING

3.1.Steps involved in CNC part programming
3.2.CNC coordinate system
3.3.zero points-types
3.4.Interpolation and types
3.5.Co-ordinates referencing methods
3.6.Preparatory functions (G codes)
3.7.Miscellaneous functions (M codes)
3.8.Manual part programming -format
3.9.APT statements and programming
3.10.Tool nose radius compensation
3.11.linear interpolation-coding
3.12.Circular interpolation methods-coding
3.13.Macros
3.14.subroutines
3.15.Thread cutting cycles
3.16.Plain turning cycles
3.17.Peck drilling cycles
3.18.Programming Practice problems on Plain turning
3.19.Programming Practice problems on Step turning
3.20.Programming Practice problems on Taper turning

4. CIMS & FLEXIBLE MANUFACTURING SYSTEMS

4.1.Computer integrated manufacturing system – features
4.2.Necessity of CIMS

4.3.Flexible manufacturing system – features

4.4.Necessity of FMS

4.5.Components of FMS –illustration

4.6.Functions of each component

4.7.Advantages and limitations of FMS

4.8.Introduction to CMM

4.9.CNC CMM – features

4.10.Advantages of CNC-CMM

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

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. Computer Aided Manufacturing, TMH – T. K. Kundra, P.N. Rao
5. CNC Machines, New Age – B.S. Pabla and M. Adithan
6. CAD, CAM, CIM ------- BY Radha Krishnan.

M-506 Elective

REFRIGERATION AND AIR CONDITIONING

Subject Title : **Refrigeration & Air conditioning**

Subject Code : **M-506(A)**

Periods/Week : **04**

Periods per Semester : **60**

TIME SCHEDULE

Sl. No.	Major Topics	No. of Periods	Weightage	Short	Essay
1.	Fundamentals of Refrigeration & Air Refrigeration	08	13	01	01
2.	Vapour compression & Vapour absorption Refrigeration Systems	15	26	02	02
3.	Refrigerants, Refrigeration equipment & Applications	13	26	02	02
4.	Fundamentals of A/c & A/c Equipment	06	13	01	01
5.	Psychrometry, Cooling & Heating loads	10	19	03	01
6.	Applications of A/c, Servicing and maintenance of Refrigeration and A/c equipment	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 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 State the desirable properties of refrigerants absorbers.

2.9 Describe the construction and working of vapour absorption refrigeration system with the help of a legible sketch.

2.10 Differentiate VCR & VAR, two fluid system and three absorption refrigeration system

2.11 Explain the construction and working of Electrolux refrigeration with the help of a legible sketch.

2.12 Explain the construction and 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 List the desirable properties of refrigerants.

3.3 List the commonly used refrigerants.

3.4 Explain different types of compressors such as reciprocating and rotary

3.5 State the function of condenser and classify the condensers

3.6 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..

3.7 State the function of evaporator and classify the evaporators

3.8 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.

3.8 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.

3.10 Explain the refill type and throw away type dryers.

3.11 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 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 Compute cooling load – components involved in cooling load.

5.6 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, Refrigerants and absorbents – their properties – two fluid & three fluid systems - 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 .

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.

5.0 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

AUTOMOBILE ENGINEERING

Subject Title :**Automobile Engineering**
Subject code :**M-506(B)**
No.of 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	Introduction & Chassis Construction	10	16	2	1
2	Transmission & Clutches	12	32	4	2
3	Propeller shaft and rear axle	12	18	1	1 1/2
4	Suspension system	08	13	1	1
5	Front axle and steering	10	18	1	1 1/2
6	Brakes	08	13	1	1
	Total	**60**	**110**	**10**	**08**

OBJECTIVES

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

1.0 **Introduction & chassis construction**

1.1 List various components of an automobile.

1.2 Explain the function of basic structure, power plant, transmission system, auxiliaries, and controls of automobiles.

1.3 List 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 defects in frames.

1.8 Explain the frameless construction.

2.0 Transmission & 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 box.

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 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 Propeller Shaft and rear axle

3.1 State the functions of propeller shaft.

3.2 Explain construction of propeller shaft.

3.3 List various universal joints in automobile.

3.4 Explain 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 Suspension System

4.1 List Objectives of vehicle suspension.

4.2 List various factors considered for suspension.

4.3 List different types of suspension spring.

4.4 Explain the construction details of leaf spring and its mounting on front and rear axles with legible sketch.

4.5 List 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 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 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.

5.11 Explain under steering – over steering.

5.12 write the principle of Power steering.

6.0 Brakes

6.1 List 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 Explain 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 hydraulically operated four wheel brake system

6.8 Explain the working of hydraulically operated four wheel brake system.

6.9 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 and Chassis construction

1.1 Identification of 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 frame.

1.5 The loads on frame.

1.6 Frame construction with a neat sketch.

1.7 Identification of various materials for frames.

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 , 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 axle 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-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 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. Automotive Engineering- G.B.S Narang
2. Automobile Engineering- Kirpal singh
3. Automobile Engineering- Rajput
4. The motor vehicle- Newton steeds & Garret
5. Automotive Chassis- P.M. Heldt.

ENERGY SOURCES AND POWER PLANT ENGINEERING

Subject Title : Energy Sources and Power Plant Engineering
Subject Code : M-506 (C)
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

S.NO CONTENT

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 working principle solar air heater
State the applications of solar air heater
2.7 Identify different types of concentrating collectors
2.8 Explain the working principle of concentrating collector (focusing type, parabolic trough collector and flat plate collectors with plain reflectors).

2.9 State the different methods of storing solar energy
2.10 Explain the methods of sensible heat, latent heat and thermo chemical storage.
2.11 Explain the working principle of solar pond with a sketch
2.12 State the applications of solar pond
2.13 Explain with the help of sketch the construction details and working principle of different types of solar water heater
2.14 Explain with the help of sketch the construction details and working principle of solar space heater
2.15 Explain with the help of sketch the construction details and working principle of absorption refrigerator type solar space cooler
2.16 Explain with the help of sketch the construction details and working principle of solar still
2.17 Explain with the help of sketch the construction details and working principle of cabinet and connective type of solar drier
2.18 Explain with the help of sketch the construction details and working principle of Box type solar cooker
2.19 State the principle of photo –voltaic conversion.
2.20 State the working principle of solar cell
2.21 Explain the conversion energy and current voltage characteristics of solar cell.
2.22 State the use of photo voltaic cell for power generation
2.23 Explain the solar photovoltaic arrays
2.24 Explain the solar water pumping system with a legible sketch
2.25 State the advantages and limitations of solar energy conversion.
2.26 Explain the power available in the wind and force caused by it on the blades.
2.27 State the collection of wind data and estimate the energy
2.28 State the different considerations for sight selection for installing wind mill.
2.29 Identify the basic components of a wind mill
2.30 Explain the construction details on the working principle of the wind mill
2.31 State the differences between horizontal axis and vertical axis type wind mills
2.32 Define the terms co-efficient of performance and tip speed ratio
2.33 Plot curves for wind turbines
2.34 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 Bacon'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 with 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 legible 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 using legible sketches
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, super heater, 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 about the ash removal, water cooling.
5.6 Explain about the feed water treatment.
5.7 Explain about the coal handling
5.8 Explain about the coal storage.
5.9 Identify the fuel handling equipment.
5.10 Trace the ash disposal system.
5.11 Explain the chain reaction
5.12 Explain the process of nuclear fission and nuclear fusion.
5.13 List nuclear fuels
5.14 State the characteristics of atomic power plants
5.15 Explain the principle of working of a nuclear reactor

5.16 Classify the nuclear reactors
5.17 Explain with the help of legible sketch the constructional details and the working principle of : (i) PWR (ii) BWR power plant.
5.18 Explain with the help of legible sketch the constructional details and the working principle of: (i) GCR (ii) Liquid metal - C.R Power plant
5.19 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.

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. Energy Technology by S. Rao & Dr. D.B. Palekr
(Non conventional , Renewable and conventional) (Khanna Publishers 2009 Edition)

2 Thermal Engineering by R.K RAJPUT (Lakshmi Publications 2004 Edition)

3. Non conventional Energy source by G.D Rai. (Khanna Publishers 2010 E dition)

4. Power Plant Engineering by PK Nag (Tata McGraw-Hill Education, 2002 Edition)

CAD3D /CAM LAB PRACTICE

Subject Title	**:**	**CAD3D / CAM LAB PRACTICE**
Subject Code	**:**	**M-507**
Periods/ week	**:**	**06**
Periods per Semester	**:**	**90**

A) CAD 3D lab practice

OBJECTIVES

3.0 **Upon completion of the course the student shall be able to understand the concepts of 3D**

1.1. View entities in three dimensions

- To set a new viewing direction
- To dynamically set a view direction

4.0 **Create three-dimensional entities using different methods**

- Draw two dimensional entities in three dimensional space
- Convert two dimensional planar entities into three dimensional entities by applying elevation and thickness
- Convert two dimensional planar entities into three dimensional entities by revolving or extruding.

4.1 Create three-dimensional faces

4.2 Create rectangular meshes

4.3 Create ruled surface meshes

4.4 Create extruded surface meshes

4.5 Create revolved surface meshes

4.6 Create three dimensional entities such as boxes, Cylinders, Cones, Spheres, wedges, torus, Regions,

4.7 Create extruded solids

4.8 Create revolved solids

4.9 Create composite solids

4.10 Create intersect solids

5.0 Edit in three dimensions

5.1 Rotate in three dimensions

5.2 Array in three dimensions (Rectangular and polar)

5.3 Mirror in three dimensions

5.4 Align in three dimensions

6.0 Edit three dimensional solids

6.1 Practice Sectioning and Slicing solids

6.2 Practice hiding, shading and rendering

7.0 Practice the selection of material from library

7.1 Enable material library

7.2 Edit materials and material library

8.0 Appreciate the importance of Solid Modelling software like PRO-E / UNIGRAPHICS / CATIA

8.1 Use any of the solid modelling packages stated above and generate a solid model of a machine component for different 3D components

Key Competencies to achieved by the student – CAD 3D lab practice

Exercise	Key components	Periods
1.0 View entities in three dimensions	A. Set a new viewing direction B. Set dynamically view direction	**02**

1.0 Create three-dimensional entities	A. Create three-dimensional faces B. Create rectangular meshes, ruled surface meshes, extruded surface meshes, revolved surface meshes C. Create three dimensional entities such as boxes, Cylinders.	**18**
3.0 Edit in three dimensions	A. Rotate in three dimensions B. Array in three dimensions (Rectangular and polar) C. Mirror in three dimensions D. Align in three dimensions	**06**
4.0 Edit three dimensional solids	A. Practice Sectioning and Slicing solids B. Practice hiding, shading and rendering	**10**
5.0 Practice the selection of material from library	A. Enable material library B. Edit materials and material library	**03**
6.0 Appreciate the importance of Solid Modelling software like PRO-E / UNIGRAPHICS / CATIA	A. Use any of the solid modelling packages stated above and Generate a solid model of a machine component for different 3D components using Solid modelling packages	**06**
Total		**45**

COURSE CONTENT

Viewing entities in three dimensions

- setting a new viewing direction
- dynamically setting a view direction

Creation of three-dimensional entities using different methods

- Drawing of two dimensional entities in three dimensional space
- Converting two dimensional planar entities into three dimensional entities by applying elevation and thickness
- Converting two dimensional planar entities into three dimensional entities by revolving or extruding.

Creation of three-dimensional faces, rectangular meshes, ruled surface meshes, extruded surface meshes, revolved surface meshes, three dimensional entities such as boxes, Cylinders, Cones, Spheres, wedges, torus, Regions, extruded solids, revolved solids, composite solids, intersect solids.

Editing in three dimensions

Rotating in three dimensions, Array in three dimensions (Rectangular and polar)

Mirroring in three dimensions, Aligning in three dimensions

Editing of three dimensional solids

Sectioning and Slicing of solids, hiding, shading and rendering

Selection of material from library

Enable the material library, Editing materials and material library

The importance of Solid Modelling software like PRO-E /

UNIGRAPHICS / CATIA

Use any of the solid modelling packages stated above and generate a solid model of a machine component for different 3D components

B) CAM lab practice

1.0 Upon completion of the course the student shall be able to understand the concepts of CAM

1.1 Identify the parts and functions of CNC lathe

1.1 Operate CNC Lathe machine

1.2 Use incremental system and absolute system on dimensioning.

1.3 Write simple part program using G-Codes and M-Codes.

1.4 Edit and execute a part program using CNC lathe machine simulation package.

1.5 Prepare part program as per the drawing.

1.6 Produce part as per the drawing using CNC lathe machine.

Key Competencies to achieved by the student – CAM lab practice

Exercise	Key components	Periods
1. Hands on practice on CNC machine	A. Identify various parts and switches B. Identify controller software C. Identify the working axis (z&x) of lathe D. Fix the job in chuck.	03
2. Practice turning operations on CNC Lathe machine	A. Operate following movements manually by operating software buttons on screen. i. Move tool turret along X & Z directions ii. Move manually turret to home position iii. Start the spindle iv. Move the tool by number. B. Select proper speed, feed and depth of cut based on tool material combination.	
3. Use of G & M codes to write part program	A. Identify various G & M codes along with meanings B. Understand the meaning of modal codes.	03
4. Structure of a program	A. Understand the concept of blocks B. List various steps in a part program C. Understand the structure and various terms in a part program	
5. Practice with simulation software	A. Open an existing program B. Practice various buttons on screen to start, pause and stop simulation, billet size selection and new material selection C. Write simple part program for plain turning as per the drawing and simulate	03
6. Practice step turning with and without canned cycle	A. Write part program for step turning as per the drawing B. Write part program for step turning using canned cycle for same drawing, C. Simulate the programme.	06
7. Practice taper turning	A. Write simple part program for taper turning as per the drawing and simulate B. Write part program for same component using cycles.	06
8. Practice turning exercise for circular interpolation	A. Write simple part program for circular interpolation using G02 & G03 as per the drawing and B. Simulate	06
9. Practice for plain turning cycle	A. Write part program for plain, taper, step and circular interpolation using plain turning cycle	06
10. Practice peck drilling and boring cycle	A. Write part program for drilling and boring as per the drawing. B. Write part program for same component using peck drilling cycle and boring. C. Simulate	06
11. Practice for Grooving and thread cutting	A. Write part program for grooving and threading as per the drawing. B. Simulate	06
Total		**45**

COURSE CONTENT

CNC Introduction, Listing and explanation of controller software like Fanuc, Seimens etc..

Study of turning. G - codes and M- codes, Simulation software practice.

Structure of program, Turning exercise - step turning using canned cycle.

Turning exercise - circuits interpolation CW, CCW.

Turning Exercise - Taper turning and Peck drilling.

Turning exercise - Thread cutting and grooving.

Note: Practice CAD 3D for 45 periods and remaining 45 periods for programming practice on CNC turning.

THERMAL ENGINEERING & REFRIGERATION AND AIR CONDITIONING LABORATORY

Subject Title : Thermal Engineering& Refrigeration and Air Conditioning Laboratory practice
Subject Code : M – 508
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	Marcet 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 Circulate 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 Marcet 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.

Key competencies Expected from the student for Thermal Engineering Laboratory practice (M-508A)

S.No	Exercise	Key competency
1	Economic speed Test	e. Circulate cooling water through the engine jacket before starting the engine and after shutting the engine f. Maintain a constant load g. Vary the fuel supply by operating the lever h. Record the corresponding readings of fuel consumption and speed

2	Water cooling curves	c. Identify valve to allow cooling water into the engine d. Maintain constant load and speed e. Record load and speed f. Control flow rate of cooling water into the engine g. Record the readings of cooling water temperatures at inlet and outlet. h. Record the fuel consumption rate by using stop watch i. Draw graphs (s.f.c. Vs exit temperature of cooling water)
3	Morse test on multi-cylinder diesel / petrol engine	e. Vary the load f. Maintain constant speed g. Disconnect engine cylinders one by one by operating the lever h. 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	Marcet boiler	a. Record the readings of pressure and temperature b. 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 Marcet boiler.

B. REFRIGERATION & AIR CONDITIONING LABORATOTY 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 practice (M-508 B)

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	COP 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-509**
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.

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.

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 .

PROJECT WORK

Subject Title	**:**	**Project work**
Subject Code	**:**	**M-510**
Periods/Week	**:**	**03**
Periods/Semester	**:**	**45**

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