THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	*Applied Mathematics-III	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
3.2	Engineering Materials	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
3.3	Mechanics of Solids	4	1	2	5	20	10	30	50	2 ½	20	3	70	100
3.4	Thermal Engineering	5	1	3	6	20	10	30	50	2 ½	20	3	70	100
3.5	Computer Aided Drafting and 3D Modelling	-	-	8	2	-	20	20	-	-	50	3	50	70
3.6	Workshop Technology	4	-	6	5	20	10	30	50	2 ½	20	4	70	100
#Student Centred Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30
Total		22	2	24	27	100	90	190	250	-	130	-	380	570

* Common with other diploma programmes

\# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

3.1 APPLIED MATHEMATICS –III

L	T	P
5	-	-

RATIONALE

Contents of this course provide understanding of some elementary and advanced mathematics algorithms and their applications of solving engineering problems. Content of this course will enable students to use some advanced techniques like Beta-Gamma function, Fourier series, Laplace transform and probability distributions in solving complex engineering problems.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- understand matrix operations and uses of matrix in different problems.
- apply elementary row and column operations in finding inverse of a matrix.
- find Eigen values, Eigen vectors of a matrix and their different properties.
- understand degree/order of differential equations and their solution techniques.
- use differential equations in engineering problems of different areas.
- find Fourier series expansion of a function
- apply Laplace transform and their applications in solving engineering problems.
- understand concept of probability distribution and their applications.

DETAILED CONTENTS

1. Matrices (16 Periods)

1.1 Algebra of Matrices
Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.
Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation
Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence
Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.

1.4 Eigen Pairs

Definition and evaluation of eign values and eign vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

2. Differential Calculus (15 Periods)

2.1 Function of two variables, identification of surfaces in space, conicoids

2.2 Partial Differentiation :
Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians.

2.3 Vector Calculus :
Vector function, Introduction todouble and triple integral,differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives.

3. Differential Equation (15 Periods)

3.1 Formation, Order, Degree, Types, Solution :
Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of a differential equation, Linear, nonlinear equation.

3.2 First Order Equations :
Variable seperable, equations reducible to seperable forms, Homogeneous eqution, equations reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.

3.3 Higher Order Linear Equation :
Property of solution, Linear differential equation with constant coefficients (PI for $X= e^{ax}$, Sinax, Cosax, X^n, $e^{ax}V$, XV

3.4 Simple Applications
LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

4. Integral Calculus (12 Periods)

4.1 Beta and Gamma Functions :
Definition, Use, Relation between the two, their use in evaluating integrals.

4.2 Fourier Series :
Fourier series of f(x),-n<x<n, Odd and even function,Half range series.

4.3 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, inverse laplace transform, Solution of ordinary differential equations

5. Probability and Statistics (12 Periods)

5.1 Probability :

Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution :

Discrete and continuous distribution, Binomial Distribution, Poisson Distribution, Normal Distribution..

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. The basic elements of Laplace transform, differential equations and applications of differential equations can be taught with engineering applications of relevant branch.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3 Applied Mathematics-III by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-II by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	16	24
2.	15	20
3.	15	20
4	12	18
5	12	18
Total	**70**	**100**

3.2 ENGINEERING MATERIALS

L	T	P
4	-	2

RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- distinguish between metals and non metals and ferrous and non ferrous materials.
- explain the arrangement of atoms in various crystals.
- carry out various heat treatment processes.
- analyze microstructure and changes in microstructure due to heat treatment.
- classify various types of plastics and rubber.
- explain properties and applications of composites, ceramics and smart materials.
- select suitable material to be used for various engineering applications.
- perform destructive and non-destructive testing of materials.

DETAILED CONTENTS

1. Introduction (06 Periods)

Material, History of Material Origin, Scope of Material Science, Overview of different engineering materials and applications, Classification of materials, Thermal, Chemical, Electrical, Mechanical properties of various materials, Present and future needs of materials, Overview of Biomaterials and semi-conducting materials, Various issues of Material Usage-Economical, Environment and Social.

2. Crystallography (08 Periods)

Fundamentals: Crystal, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor.

Deformation: Overview of deformation behavior and its mechanism, behavior of material under load control and strain control.

Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep.

3. Metals And Alloys (12 Periods)

Ferrous Materials: Different iron ores, Raw materials in production of iron and steel, Basic process of iron-making and steel-making, Classification of iron and steel.

Cast Iron: Different types of Cast Iron, manufacture and their use. Classification of Grey cast iron and S.G. iron

Steels: Steels and alloy steel, Classification of plain carbon steels, Properties and usage of different types of Plain Carbon Steels, Effect of various alloys on properties of steel, Uses of alloy steels (high speed steel, stainless steel, spring steel, silicon steel)

Non Ferrous Materials: Properties and uses of Aluminum, Copper and Zinc and their alloys

4. Heat Treatment (06 Periods)

Purpose of heat treatment, Solid solutions and its types, Formation and decomposition of Austenite, Martensitic Transformation – Simplified Transformation Cooling Curves. Various heat treatment processes- hardening, tempering, annealing, normalizing, Case hardening and surface hardening, Hardenability of steels, Selection of case carburizing and induction hardening steels. Types of heat treatment furnaces (only basic idea)

5. Plastics (06 Periods)

Important sources of plastics, Classification-thermoplastic and thermoset and their uses, Various trade names of plastics, Plastic coatings, food grade plastics. Applications of plastics in automobile and domestic use.
Rubber classification - Natural and synthetic. Selection of rubber

6. Advanced Materials (06 Periods)

Composites-Classification, properties, applications
Ceramics-Classification, properties, applications
Adhesives – Classification, properties and applications
Smart materials - properties and applications.

7. Miscellaneous Materials (06 Periods)

Overview of -Tool and Die materials, Materials for bearing metals, Materials for Nuclear Energy, Refractory materials.

8. Identification and Testing of Materials (Destructive and NDT) (06 Periods)

Identification of metal by giving mini projects.
Destructive testing: Stress testing, Harness testing
Non-destructive testing: Eddy-current, Magnetic-particle, Liquid penetration, radiographic, Ultrasounic and visual testing

LIST OF PRACTICALS

1. Use of diamond polishing apparatus.
2. To perform following heat treatment process on materials of known carbon percentage and checking the change in the properties

   a) Annealing
   b) Normalising
   c) Care hardening
3. Preparation of specimens and study of micro structure of given metals and alloys on metallurgical microscope

   a) Brass
   b) Bronze
   c) Grey Cast Iron
   d) Low Carbon Steel
   e) High Carbon Steel
   f) High Speed Steel

4. To prepare specimen for microscope examination for polishing
5. To determine composition of alloy steel by steeloscope

MEANS OF ASSEESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Small projects
- Viva-voce

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

RECOMMENDED BOOKS

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
2. Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science by Hazra, Chaudhary
5. Material Science and Engineering Raghuan by Raghvaan PHI
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh

Website for Reference

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	06	10
2.	08	16
3.	12	22
4.	06	12
5.	06	10
6.	06	10
7.	06	10
8.	06	10
Total	**56**	**100**

3.3 MECHANICS OF SOLIDS

L T P

4 1 2

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- interpret various concepts and terms related to strength of materials
- calculate stresses in bars of various cross-section.
- calculate energy stored by materials subjected to axial loads.
- calculate moment of inertia of different sections.
- interpret the concept of bending and torsion and calculate stresses on different section of materials.
- draw and calculate shear force and bending moment diagrams of beam under given loading
- calculate stresses in thin cylindrical shells.
- determine the diameter of a shaft under combined bending and torsion.
- calculate critical axial loads on column under different end constraints.

DETAILED CONTENTS

1. Stresses and Strains (08 Periods)
   - 1.1. Basic assumptions; Concept of load, stress and strain
   - 1.2. Tensile compressive and shear stresses and strains
   - 1.3. Concept of Elasticity, Elastic limit and limit of proportionality.
     - 1.3.1. Nominal and true stress-strain diagrams.
     - 1.3.2 Hook's Law
     - 1.3.3. Young Modulus of elasticity
     - 1.3.4. Nominal stress
     - 1.3.5. Yield point, plastic stage
     - 1.3.6 Ultimate strength and breaking stress

1.3.7. Percentage elongation
1.3.8. Proof stress and working stress
1.3.9. Factor of safety
1.3.10 Poisson's Ratio
1.3.11 Shear modulus
1.3.12 Deflection and stiffness

1.4. Concepts of fatigue, creep and stress concentration

1.5. Thermal stresses

2. Resilience (04 Periods)

2.1 Resilience, proof resilience and modulus of resilience
2.2 Strain energy due to direct stresses
2.3 Stresses due to gradual, sudden and falling load.

3. Moment of Inertia (05 Periods)

3.1. Concept of moment of inertia and second moment of area
3.2 Radius of gyration
3.3 Theorem of perpendicular axis and parallel axis (without derivation)
3.4 Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
3.5 Section modulus

4. Bending Stresses (06 Periods)

4.1 Concept of Bending stresses
4.2. Theory of simple bending
4.3. Use of the equation $\sigma/y = M/I = E/R$
4.4. Concept of moment of resistance
4.5. Bending stress diagram
4.6. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
4.7 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

5. Torsion (06 Periods)

5.1. Concept of torsion- difference between torque and torsion.
5.2. Use of torque equation for circular shaft
5.3. Comparison between solid and hollow shaft with regard to their strength and weight.
5.4. Power transmitted by shaft
5.5 Concept of mean and maximum torque
5.6 Concept of Principal stresses, principal planes and max. shear stress.
5.7 Determination of shaft diameter under combined bending and torsion.

6. Shear Force and Bending Moment (10 Periods)

6.1 Concept of beam and form of loading
6.2 Concept of end supports-Roller, hinged and fixed
6.3 Concept of bending moment and shearing force
6.4 S.F. and B.M. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated load and U.D.L.

7. Columns (05 Periods)

7.1. Concept of column, modes of failure
7.2. Types of columns
7.3. Buckling load, crushing load
7.4. Slenderness ratio
7.5. Factors effecting strength of a column
7.6 End restraints
7.7 Effective length
7.8 Strength of column by Euler Formula without derivation
7.9. Rankine Gourdan formula (without derivation)

8. Thin Cylinder and Spherical Shells (04 Periods)

8.1 Introduction to longitudinal stresses, circumferential or hoop stresses and radial stresses
8.2 Longitudinal and circumferential stresses in thin cylinder
8.3 Longitudinal and circumferential stresses in thin Spherical shells

9. Slope and Deflections of Beams: (08 Periods)

9.1 Definition of slope and deflection, sign convention. Circular bending. Calculation of maximum slope and deflection for the following standard cases by double integration or moment area method.

a) Cantilever having point load at the free end
b) Cantilever having point load at any point of the span
c) Cantilever with uniformly distributed load over the entire span
d) Cantilever having U.D.L. over part of the span from free end
e) Cantilever having U.D.L. over a part of span from fixed end
f) Simply supported beam with point load at centre of the span.
g) Simply supported beam with U.D. L. over entire span.

Note: All examples will be for constant moment of inertia without derivation of formula.

LIST OF PRACTICALS

1. To find the sheer force at a given section of simply supported beam for different loading.

2. To find the value of 'E' for a steel beam by method of deflection for different loads.
3. To determine the Max-Fiber stress in X-section of simply supported beam with concentrated loads and to find the neutral axis of the section.
4. To determine the ultimate tensile strength, its modulus of Elasticity, stress at yield point, Elongation and contraction in X-sectional area of the specimen by U.T.M. through necking phenomenon.
5. To determine the ultimate crushing strength of materials like steel and copper and compare their strength.
6. To determine Rockwell Hardness No. and Brinell Hardness No. of a sample.
7. To estimate the Shock Resistance of different qualities of materials by Izod's test and Charpy test.
8. To determine the bending moment at a given section of a simply supported beam for different loading.
9. Top determine the various parameters of helical coil spring.
10. To determine the angle of twist for a given torque by torsion apparatus and to plot a graph between torque and angle of twist.

MEANS OF ASSEESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Small projects
- Viva-voce

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

RECOMMENDED BOOKS

1. SOM by Birinder Singh; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Mechanics of Materials by Dr. Kirpal Singh; Standard Publishers Distribution, New Delhi.
4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.
5. Mechanics of Solids by Karmveer Saini, Krishna Publication House, Meerut.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Website for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	12
2	04	08
3	05	08
4	06	12
5	06	10
6	10	16
7	05	10
8	04	08
9	08	16
Total	**56**	**100**

3.4 THERMAL ENGINEERING

L	T	P
5	1	3

RATIOANLE

A diploma holder in this course is supposed to maintain steam generators, turbines, compressors and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, compressors and about IC engines.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- apply thermodynamic laws.
- solve basic problems of gas equation using perfect gas laws.
- determine enthalpy, specific heat capacity and P-V-T surface of an ideal and real gas.
- explain the working, construction and applications of steam boilers and steam generators
- explain the functions and uses of air compressors.
- interpret different modes of heat transfer.
- explain the working of IC engine.
- assist in testing an IC engine.
- explain the functioning of steam turbine, gas turbine and jet propulsion.

DETAILED CONTENTS

1. Fundamental Concepts (06 Periods)

   Thermodynamic state and system, boundary, surrounding, universe, thermodynamic systems – closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic, properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy.

2. Laws of Perfect Gases (03 Periods)

   Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants, derivation Specific heat at constant pressure, specific heat at constant volume of gas, simple problems on gas equation

3. Thermodynamic Processes on Gases (05 Periods)

Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes
Derivation of work done, change in internal energy, rate of heat transfer for the above processes

4. Laws of Thermodynamics (06 Periods)

Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Application of first law of thermodynamics to non-flow systems – Constant volume, constant pressure, Adiabatic and polytropic processes.
Steady flow energy equation, Application of steady flow energy to equation, turbines, pump, boilers, nozzles.
Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Clasius statement, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy, ideal and real gases.

5. Properties of Steam (05 Periods)

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, Mollier diagram (H – S Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes
Quality of steam (dryness fraction),

6. Steam Generators (04 Periods)

Uses of steam, classification of boilers, comparison of fire tube and water tube boilers. Construction features of Lancashire boiler, Nestler boiler, Babcock & Wilcox Boiler. Introduction to modern boilers.

7. Air Standard Cycles (04 Periods)

Meaning of air standard cycle – its use, condition of reversibility of a cycle
Description of Carnot cycle, Otto cycle, Diesel cycle, simple problems on efficiency, calculation for different cycles
Reasons for highest efficiency of Carnot cycle over all other cycles working between same temperature limits

8. Air Compressors (05 Periods)

Functions of air compressor – uses of compressed air, type of air compressors

Single stage reciprocating air compressor, its construction and working, representation of processes involved on P – V diagram, calculation of work done.
Rotary compressors – types, descriptive treatment of centrifugal compressor, axial flow compressor, vane type compressor

9. Introduction to Heat Transfer (04 Periods)

Modes of heat transfer, Fourier's law, steady state conduction, composite structures, Natural and forced convection, thermal radiation

10. IC Engines (12 Periods)

Introduction, Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle, Location and functions of various parts of IC engines and materials used for them. Testing of IC Engines: Engine power - indicated and brake power, Efficiency - mechanical, thermal. relative and volumetric, Methods of finding indicated and brake power, Morse test for petro1 engine, Heat balance sheet, simple numerical problems, Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO – 2.

11. Steam Turbines and Steam Condensers (08 Periods)
Function and use of steam turbine, Steam nozzles - types and applications
Steam turbines - impulse, reaction, construction and working principle
Governing of steam turbines, Function of a steam condenser, elements of condensing plant, Classification - jet condenser, surface condenser, Cooling pond and cooling towers

12. Gas Turbines and Jet Propulsion (08 Periods)

Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine. Open cycle constant pressure gas turbines - general layout, PV and TS diagram and working of gas turbine.
Closed cycle gas turbines, PV and TS diagram and working.
Principle of operation of ram-jet engine and turbo jet engine - application of jet engines

LIST OF PRACTICALS

1. Demonstration of mountings and accessories on a boiler.
2. Demonstrate the working of air compressor.
3. Demonstration of heat transfer through conduction, convection and Radiation
4. Study of working of high pressure boiler
5. Study the working of Lancashire boiler and Nestler boiler

6. Dismantle an IC engine and note down the condition of various parts, removal and fitting of piston, rings, measuring of bore size, crank shaft ovality and assemble it.
7. Servicing of petrol injection system
8. Valve servicing, grinding, lapping and fitting mechanism and tappet adjustment.
9. Inspection of ignition system of a multi-cylinder engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment, spark plug cleaning.
10. Service of cooling & lubrication system of IC engine and note down the functioning/testing of various components.
11. Determination of BHP by dynamometer.
12. Morse test on multi-cylinder petrol engine.

MEANS OF ASSEESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Small projects
- Viva-voce

RECOMMENDED BOOKS

1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
3. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi.
4. A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.
5. Internal Commercial Engine by V. Ganeshan; Tata McGraw Hill, Education
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Website for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (periods)	Marks Allotted (%)
1	06	08
2	03	04
3	05	08
4	06	08
5	05	08
6	04	06
7	04	06
8	05	08
9	04	06
10	12	16
11	08	12
12	08	10
Total	**70**	**100**

3.5 COMPUTER AIDED DRAFTING AND 3D MODELLING

L	T	P
-	-	8

RATIONALE

Computer Aided Design plays a very important role in designing products with exact determines for manufacturing industries. Modellings helps to achieve the designed shape and size of products for the manufacturing sector. After studying this subject the students will be able to know Drafting, Designing and Modelling techniques which helps a manufacturer machines sound for better product development.

LEARNING OUTCOMES

After completion of this course, the students will be able to :

- know the advantages of using CAD in comparison with conventional method.
- draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
- create easy and complex solids and assemblies using various tools in Solid works software.
- can understand exploded views and assembled views

DETAILED CONTENTS

1. Introduction to AutoCAD commands (6 drawing sheets)

    1.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snaps, Grid, and ortho mode (Absolute, Relative and Polar)
    1.2 Drawing commands – point, line, arc, circle, ellipse, parabola.
    1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
    1.4 Dimensioning and placing text in drawing area
    1.5 Sectioning and hatching
    1.6 Inquiry for different parameters of drawing entity
    1.7 Create layers within a drawing
    1.8 Specifying Geometrical Dimensioning & Tolerancing (GD&T) parameters in drawing

2. Detail and assembly drawing of the following using AUTOCAD (4 sheets)

    2.1 Plummer Block
    2.2 Wall Bracket
    2.3 Stepped pulley, V-belt pulley
    2.4 Flanged coupling
    2.5 Machine tool Holder (Three views)
    2.6 Screw jack or knuckle joint
    2.7 Foot step bearing

3. Isometric Drawing by CAD using Auto CAD (one sheet)

ISO Commands, User Co-ordinate System, View points, Viewports Elevation, World Co-ordinate System X/Y/Z Filter
Drawings of following on computer:

- Cone
- Cylinder
- Isometric view of objects

4. Introduction to Solid works

Introduction to Sketcher: Sketch Entities, Sketch Tools, Blocks, Dimensioning

4.1 Part modeling (4 models)

Part Modeling Tools:-

4.1.1 Creating reference planes
4.1.2 Creating Extrude features, Creating Revolve, Creating Swept features-
4.1.3 Creating Loft features
4.1.4 Creating Reference - points, axis, coordinates
4.1.5 Creating curves
4.1.6 Creating Fillet features
4.1.7 Inserting Hole types
4.1.8 Creating Chamfer
4.1.9 Creating Shell
4.1.10 Creating Rib
4.1.11 Creating Pattern Advanced Modeling Tools
4.1.12 Inserting Fastening features,
4.1.13 Environment& Utilities - Working with views and manipulating views,

4.2 Assembly (4 models)

Assembly Modeling Tools:-

Introduction to Assembly Modeling & Approaches – Top down and Bottom up approach, Applying Standard Mates- Coincident, Parallel, Perpendicular, Tangent, Concentric, Lock, Distance, Angle. Applying Advanced Mates – Symmetric, Width, Path Mate, Linear/Linear Coupler, Limit Mate. Applying Mechanical Mates – Cam, Hinge, Gear, Rack Pinion, Screw, and Universal Joint. Manipulating Components - Replacing Components, Rotating Components, Move Components, Collision Detection, Physical Dynamics, Dynamic Clearance, Detecting Interference Creating Pattern - Assembly Pattern, Mirror, Creating Explode Views

1. Lathe tool past assembly
2. Shaper tool assembly
3. Valve assembly
4. Screw Jack

INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the component/part whose drawing is to be made.

2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.
3. Teachers should ensure use of IS codes related to drawing.

RECOMMENDED BOOKS

1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
2. AutoCAD for Engineering Drawing Made Easy by P. NageswaraRao; Tata McGraw Hill, New Delhi.
3. AutoCAD 2000 for you by UmeshShettigar and Abdul Khader; Janatha Publishers, Udupi.
4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
5. Designing with Pro Engineer, Sham Tickoo by Dream Tech Publications, New Delhi.
6. Designing with CATIA, by Sham Tickoo, Dream Tech. Publications, New Delhi
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR

Website for Reference:

http://swayam.gov.in

3.6 WORKSHOP TECHNOLOGY

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RATIOANELE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of workshop technology.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Fabricate welding joints using gas welding arc welding, TIG and MIG welding of mild steel and stainless steel materials.
- Select suitable (most appropriate) process electrodes, various parameters of process for given job.
- Explain principle of operations of modern welding processes.
- Inspect various welding joints and castings.
- Prepare pattern for given job.
- Select material and type of patterns, cores.
- Prepare sand moulds manually and on machine.
- Select type of moulding sand, adhesives, compact, strength and parameters of sand for given job.
- Cast a mould.
- Identify a suitable furnace, alloying elements
- Carry out deburring of castings.
- Test the properties of moulding sand (permeability, Strength, refractoriness, adhesiveness, cohesiveness).

DETAILED CONTENTS

1. Welding (14 Periods)

1.1 Welding Process

Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols. Safety precautions in welding.

1.2 Gas Welding

Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes

1.3 Arc Welding

Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification, B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece. Welding defects and their testing methods.

1.4 Other Welding Processes

Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding, Atomic hydrogen welding, Shielded metal arc welding, submerged arc welding, Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints. Welding defects and inspection.

1.5 Modern Welding Methods

Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, other welding process, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding

2. Pattern Making (10 Periods)

Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores

3. Moulding and Casting (14 Periods)

3.1 Moulding Sand

Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand,Testing of moulding sand. Safety precautions in foundry.

3.2 Mould Making

Types of moulds, Step involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding, Molding machines squeeze machine, jolt squeeze machine and sand slinger.

3.3 Casting Processes

Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, centrifugal casting.

3.4 Gating and Risering System

Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification

3.5 Melting Furnaces

Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace

3.6 Casting Defects

Different types of casting defects, Testing of defects: radiography, magnetic particle inspection and ultrasonic inspection.

4. Metal Farming Process (10 Periods)

4.1 Press Working- Types of presses, type of dies, selection of press die, die material. Press Operations-Shearing, piercing trimming, punching, notching, shaving, gearing, embossing, stamping.

4.2 Forging- Open die forging, closed die gorging, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging.

4.3 Rolling- Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies.

4.4 Extrusion and Drawing- Type of extrusion- Hot and Cold, Direct and indirect, pipe drawing, tube drawing, wire drawing.

5. Plastic Processing (08 Periods)

5.1 Industrial use of plastics, situation where used.
5.2 Injection moulding-principle, working of injection moulding machine.
5.3 Compression moulding-principle, and working of compression moudling machine.
5.4 Potential and limitations in the use of plastics

LIST OF PRACTICALS

General introduction to hand tools used in foundry, welding and pattern making and smithy shop.

WELDING SHOP

Job 1. Preparing gas welding joint in vertical/Horizontal position joining M.S. Plates
Job 2. Exercise on gas cutting of mild steel plate with oxy-acetylene gas torch.
Job 3. Exercise on gas welding of cast iron and brass part or component.
Job 4. Exercise on preparation of T Joint by arc welding
Job 5. Exercise on spot welding/seam welding
Job 6. Exercise on MIG and TIG welding
Job 7 Exercise on arc welding pipe joint MS.

PATTERN MAKING

Job 1. Preparation of solid/single piece pattern.
Job 2. Preparation of two piece/split pattern
Job 3. Preparation of a pattern on wooden lathe
Job 4. Preparation of a self cored pattern
Job 5. Preparation of a core box.

FOUNDRY SHOP

Job 1. Preparation of mould with solid pattern on floor.
Job 2. Preparation of floor mould of solid pattern using cope.
Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.
Job 4. Moulding and casting of a solid pattern of aluminum
Job 5. Preparing a mould of step pulley and also preparing core for the same.
Job 6. A visit to cast iron foundry should be arranged to have firsthand knowledge of cast iron melting pouring and casting.
Job 7. Testing of moisture contents and strength of moulding sand.

FORGING SHOP/FITTING SHOP/SHEET METAL SHOP

Job 1. Preparation of single ended spanner by hand/machine forging.
Job 2. Preparation of simple die
Job 3. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine.
Job 4. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
Job 5. Preparation of utility item out of G.I. sheet.
Job 6. Preparation of drilling Jig.

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

RECOMMEMDED BOOKS

1. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra : Asia Publishing House
3. Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
5. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishng House, Roorkee.
6. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	14	25
2	10	20
3	14	25
4	10	20
5	08	10
Total	**100**	**100**