

3.1 APPLIED MECHANICS

	L	T	P
Periods/week	4	-	2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

DETAILED CONTENTS

1. **Introduction** **(08 period)**
 - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
 - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
 - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities

2. **Laws of forces** **(12 period)**
 - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
 - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
 - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
 - 2.4 Free body diagram
 - 2.5 Equilibrant force and its determination
 - 2.6 Lami's theorem (concept only)
[Simple problems on above topics]

3. **Moment** **(10 period)**
 - 3.1 Concept of moment
 - 3.2 Moment of a force and units of moment
 - 3.3 Varignon's theorem (definition only)
 - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
 - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
 - 3.6 Concept of couple, its properties and effects

3.7 General conditions of equilibrium of bodies under coplanar forces and beams, fixed support, roller, support, over hanging, Uniformly distributed load, point load, varying load

3.8 Position of resultant force by moment

[Simple problems on the above topics]

4. **Friction** **(10 period)**

4.1 Definition and concept of friction, types of friction, force of friction

4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction

4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane, friction in simple screw jack

4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:

a) Acting along the inclined plane Horizontally

b) At some angle with the inclined plane

[Simple problems on the above topics]

5. **Centre of Gravity** **(08 period)**

5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies

5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion

5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

[Simple problems on the above topics]

6. **Moment of Inertia** **(06 Period)**

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (*without derivations*). Second moment of area for L, T and I sections, section modulus.

7. **Simple Machines** **(10 period)**

7.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines

7.2 Simple and compound machine (Examples)

7.3 Definition of ideal machine, reversible and self locking machine

7.4 Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency

7.5 System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency

- 7.6 Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application

[Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the Mechanical Advantage, Velocity Ratio and efficiency in case of an inclined plane.
5. To find the Mechanical Advantage, Velocity Ratio and efficiency of a screw jack.
6. To find the Mechanical Advantage, Velocity Ratio and efficiency of worm and worm wheel.
7. To find Mechanical Advantage, Velocity Ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi.
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	08
2	12	16
3	10	18
4	10	18
5	08	10
6	06	08
7	10	16
Total	64	100

3.2 MATERIAL SCIENCE AND METALLURGY

L T P

4 – 3

RATIONALE

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Engineering Materials has been designed to cover the above aspects.

DETAILED CONTENTS

1. Importance of Materials

08 Period

- 1.1 Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys.
- 1.2 Crystalline and non-crystalline structures; unit cells, Bravais space lattices, cubic closed pack structures, coordination number, miller indices, crystallographic planes and directions.
- 1.3 Structural imperfections- point, line, planar and volume defects, structure property relationship.
- 1.4 Names of common metals, their alloys and non-metals used in Industry
- 1.5 Properties of metals and alloys
- 1.6 Physical properties - Appearance, luster, colour, density and melting point
- 1.7 Thermal and electrical conductivity
- 1.8 Corrosion, causes, effects and prevention.
- 1.9 Study of creep and fatigue.

2. Ferrous Metals and Alloys

12 Period

- 2.1 Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram.
- 2.2 Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades
- 2.3 Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous on steels.
- 2.4 Composition, properties, and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.
- 2.5 Heat Treatment: Iron-carbon diagram, objectives of heat treatment. Brief description and uses with examples of principal heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications, case hardening

3. Iron Carbon Equilibrium Diagram

(02 Period)

- 3.1 Phase transformation
- 3.2 Nucleation and growth

4. T-T-T Diagram

02 Period

- 4.1 Importance of critical cooling rate.
- 4.2 Martensite transformation
- 4.3 Nucleation and growth

5. Non-ferrous Metals and Alloys

12 Period

5.1 Copper: Properties and uses

5.2 Composition, properties and uses of copper alloys.

5.3 Brasses: Cartridge brass, Nickel silver

5.4 Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.

5.5 Properties and uses of Aluminium.

5.6 Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium

5.7 Properties and uses of alloys of lead, tin and magnesium.

5.8 Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and trimetallic bushes

6. Identification and Examination of Metals and Alloys

02 Period

Microscope principle and methods, Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

7. Other Important Materials

10 Period

7.1 Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses and grades.

7.2 Composite materials.

7.3 Heat insulating materials: Properties and uses of asbestos, glass wool, thermo Cole, cork, mica.

7.4 Electrical insulating materials. Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber, felt.

7.5 Sound insulating materials: Cork, fibre boards.

7.6 Fabrication materials: Wood, plywood, rubber – natural and synthetic, Glass – plate glass, toughened glass, safety glass.

7.7 Refractory materials: General characteristics and uses of dolomite, ceramics.

7.8 Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, Teflon coating.

7.9 Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.

7.10 Smart materials.

8. Diffusion

02 Period

Ficks Laws of Diffusion and practical examples

9. Powder Metallurgy and Mechanical Working of Metals

08 Period

9.1 Introduction of powder metallurgy

9.2 Advantage and limitations of powder metallurgy

9.3 Powder metallurgy processes

9.4 Principles of hot and cold working

9.5 Effect on properties and limitations

10. Selection, specifications and commercial availability of materials

06 Period

10.1 Practical considerations for selection of material for different purposes

10.2 ISO/Bureau of Indian standard specifications for metals, non-metals, various components and materials.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts into
 - Metals and Non Metals
 - Metals and Alloys
 - Ferrous and non ferrous metals
 - Ferrous and non ferrous alloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminum, cast iron, HSS, Gun metal), identify and indicate the various properties possessed by them
3. Study of heat treatment furnace
4. Study of metallurgical microscope and a specimen polishing machine.
5. To prepare specification of following materials for microscopic examination and to examine the micro structure of specimens of following materials
(i) Brass (ii) Copper (iii) Grey CI (iv) Malleable CI (v) Low carbon Steel (vi) High carbon steel (vii) HSS
6. To anneal a given specimen and find out difference in hardness as a result of annealing
7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing
8. To temper a given specimen to find out the difference in hardness as a result of tempering
9. Study of Ball Mills used in preparation of powder.
10. Study of Pallet Press.

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 in the industry.

RECOMMENDED BOOKS

1. Material Science by R.K.Rajput; Laxmi Publications, Darya Ganj, New Delhi.
2. Advances in material Science by R.K.Dogra and Dr.A.K.Sharma;S.K.kataria & sons; New Delhi.
3. Material Science by GBS Narang; Khanna Publishers New Delhi
4. Material Science and Metallurgy by D.S. Nutt. SK Kataria and Sons, Delhi.
5. Material Science and Engineering by Dr. P.L Shah

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1.	08	10
2.	12	20
3.	02	05
4.	02	05
5.	12	20
6.	02	05
7.	10	10
8.	02	05
9.	08	10
10.	06	10
Total	64	100

3.3 WORKSHOP TECHNOLOGY

L T P

4 - 6

RATIONALE

This subject provides knowledge about various welding processes and foundry work and machine work. Welding is very useful for fabrication work and foundry for production of castings used for manufacturing of machines and machine work is also use for manufacturing which is included in this subject and it is very essential for diploma holders.

DETAILED CONTENTS

UNIT-1

13 Period

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

Gas Welding , Principle of gas welding, Types of gas welding flames and their applications, Gas welding equipments, Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes.

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, Flux for arc welding.

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

Modern Welding Methods, Principle of operation, advantages, disadvantages and applications of: Tungsten inert gas (TIG) welding, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding.

UNIT-2

13 Period

Pattern Making, 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.

Moulding Sand , Properties of moulding sand, permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility etc. Various types of moulding sand and testing of moulding sand.

Mould Making, Types of moulds, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floormolding, pit molding and machine molding.

Special Casting Processes Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, Centrifugal casting, Continuous casting process

Gating and Riser system , Elements of gating system, Pouring basin, sprue, runner, gates Types of risers, location of risers.

Melting Furnaces Construction and working of: Pit furnace, Cupola furnace, Crucible furnace –tilting type.

Casting Defects, Different types of casting defects and their reasons, testing of defects: radiography, magnetic particle inspection, and ultrasonic inspection.

UNIT-3

13 Period

Elementary theory of metal cutting, chip formation, continuous chip, continuous chip with BUE, discontinuous chips. Mechanism of chip formation, Geometry of chip formation, forces of chip, Merchant circle diagram. Tool life, Economics of tool life.

Cutting Tools and Materials, Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect, Properties of cutting tool material, Study of various cutting tool materials viz. High speed steel, tungsten carbide, cobalt steel, cemented carbides, stellite, ceramics and diamond.

UNIT-4

13 Period

Lathe, Principle, Description and function of various parts of a lathe, Classification and specification of various types of lathe, Drives and transmission, Work holding devices, Lathe tools: Parameters/Nomenclature and applications, Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling. Cutting parameters –Speed, feed and depth of cut for various materials and for various operations, machining time. Speed ratio, preferred numbers of speed selection. Lathe accessories:- Centers, dogs, chucks, collets, face plate, angle plate, mandrel, steady rest, taper turning attachment, tool post grinder.

UNIT-5

12 Period

Drilling, Principle of drilling. Classification of drilling machines and their description. Various operations performed on drilling machine –drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feed during drilling, machining time. Types of drills and their features, Types of reamers.

Boring Principle of boring, Classification of boring machines and their brief description. Specification of boring machines.

Shaping, Planing and Slotting, Working principle of shaper, planer and slotter. Quick return mechanism applied to shaper, slotter and planer machine. Types of tools used and their geometry. Specification of shaper, planer and slotting machine. Speeds and feeds in above processes.

Cutting fluids and Lubricants, Function of cutting fluid, Types of cutting fluids, Difference between cutting fluid and lubricant, Selection of cutting fluids for different materials and operations, Common methods of lubrication of machine tools.

PRACTICAL EXERCISES

1. Single point cutting tool grinding.
2. A composite job involving turning, taper turning, thread cutting and knurling.
3. Marking and drilling practice using column and knee type drilling machine and radial drilling machine.
4. A job on drilling, reaming, counter boring and counter sinking.
5. Prepare a V- block on shaper machine.
6. Exercise on key way cutting..
7. Planning of C.I. block

8. Preliminary joining practice by gas welding.
9. Exercises of gas welding on the following Aluminum, Brass, Copper, C.I.
10. Gas cutting of the following types
 - (a) Preliminary gas cutting practice
 - (b) Stock cutting by oxy acetylene
11. Making following types of joints by arc welding:
 - (a) Preliminary joining practice by arc welding
 - (b) Butt and lap joint (invertical position, travel up and down)
 - (c) Welding of outside corner joint
12. Exercise on spot welding
13. Exercise on brazing
14. Exercise on TIG/MIG welding
15. Testing & Inspection of welding defects visually
16. Pattern making: Preparation of solid pattern (single piece), Preparation of split pattern
17. Preparation of the following types of moulds. Floor molding.
18. Testing moisture content of moulding sand
19. Moulding and casting of (a) a solid pattern b) a split pattern
20. Testing and inspection of casting defects visually

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 audiovisual aids/video films should be made to show specialized operations.

RECOMMENDED BOOKS

1. Welding Technology by R.L. Agarwal and Tahil Maghanani; Khanna Publishers, Delhi.
2. Principles of Foundry Technology by Jain; Tata Mc Graw Hill Publishers, New Delhi.
3. Workshop Technology by B S Raghuvanshi; Dhanpat Rai and Sons, Delhi.
4. Manufactuiring Technolgoy by M Adithan and AB Gupta, New Age International (P) Ltd., Delhi.
5. Elements of Workshop Technology by SK Chaudhry and Hajra; Asia Publishing House, Delhi.
6. Workshop Technology Vol. I, II, III by Chapman; Standard P ublishers Distributors, New Delhi.
7. Practical Handbook for Mechanical Engineers by Dr. A B Gupta; Galgotia Publications, New Delhi.

8. Production Technology by HMT; Tata McGraw Publishers, New Delhi.
9. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
10. Workshop Practice by R.K. Singal, S K Kataria and Sons, New Delhi.
- 11.A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1.	13	25
2.	13	25
3.	13	15
4.	13	25
5.	12	10
Total	64	100

3.4 MACHINE DRAWING

L T P

2 - 6

RATIONALE

Diploma holders are required to read and interpret drawings .Therefore, it is essential that they have competency in preparing drawings and in sketching various machine parts and this will also improve their imagination skill.

NOTE:

1. Third angle projection is to be followed.
2. SP46- 1988 should be followed.
3. Instruction relevant to various drawing may be given along with appropriate demonstration, before assigning drawing practice to the students.
4. The drawing should include dimensions with tolerance, wherever necessary, and material list as per BIS/ ISO specifications.

DETAILED CONTENTS

L P
2 -

1. Introduction to Machine Drawing

- 1.1 Graphic language, classification of machine drawing, conventional representation.
- 1.2 System of orthographic projections. Third angle projection, first angle Projection No. of views required. One view, Two views, Three views drawing
- 1.3 Sectioning- Material convention, important types of section- full section, half Section ,revolved section and aligned section
- 1.4 Temporary and permanent fasteners

2. Bearings (3 sheets)

L P
3 10

- 2.1 Bush bearing
- 2.2 Foot Step bearing
- 2.3 Simple wall bracket

3. Pulleys (2 sheets)

L P
4 8

- 3.1 Flat belt pulley
- 3.2 V belt pulley
- 3.3 Cone or stepped pulley
- 3.4 Fast and loose pulley

4. Pipe Joints (4 sheets)

L P
4 13

- 4.1 Flange joint
- 4.2 Spigot and socket joint
- 4.3 Threaded pipe joint
- 4.4 Expansion joint
- 4.5 piping joint

5. Assembling drawing from detail drawing (13 sheets)

L P
12 40

- 5.1 Stuffing box
- 5.2 Eccentric
- 5.3 Blow off cock
- 5.4 Cross head
- 5.5 Connecting rod
- 5.6 Ram's bottom safety valve
- 5.7 Stop valve
- 5.8 Plummer block
- 5.9 Tail stock
- 5.10 Shaper tool head
- 5.11 Machine vice
- 5.12 Screw jack
- 5.13 Swivel Bearing

6. Gears and Gearing (2 sheets)

L P
3 8

- 6.1 Spur gear- Nomenclature, gear formula, method to draw base circle, involute curve, tooth profile of internal and external gears.
- 6.2 Bevel gear- Nomenclature, gear formula, method to draw Bevel gear

7. Free hand sketches (2 sheets)

L P
2 8

- 7.1 Cutting tool of lathe, shaper, milling cutter, drilling tools, broaching tools.
- 7.2 Gear puller, C clamp
- 7.3 Square and hexagonal nut bolt assembly
- 7.4 Cotter joint
- 7.5 Knuckle joint
- 7.6 Pipe joints

8. Jig, fixture and Gauges (2 sheets)

L P
2 9

- 8.1 Concept of jig and fixture, types of jig and fixture and applications
- 8.2 Simple plate drill jig, drill jig for batch production
- 8.3 Indexing fixture
- 8.4 Introduction to gauges, use of Go-No Go gauge and ring gauge

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.
4. Focus should be on the proper selection of drawing instrument and its proper use.

RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; Kataria and Sons, Ludhiana.
2. A Text book of Machine Drawing by R.K. Dhawan , S.Chand and Company Ltd.,New Delhi.
3. Machine Drawing by GR Nagpal; Khanna Publishers, New Delhi.
4. Machine Drawing by ND Bhatt, Charotar Book Depot, Anand.
5. Fundamentals of Machine Drawing by Sadhu Singh and P.L. Shah
6. Machine Drawing by Laxmi Narayan
7. A Textbook of Machine Drawing by Er. R. K. Dhawan

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1.	02	05
2.	03	10
3.	04	15
4.	04	15
5.	12	35
6.	03	10
7.	02	05
8.	02	05
Total	32	100

3.5 THERMODYNAMICS

L T P

4 - 2

RATIONALE

Looking at the needs of various industries and departments, the following topics lay a firm foundation for the advanced knowledge of topics like thermal power plants, internal combustion engines etc.

DETAILED CONTENTS

1. Fundamental Concepts

06 Period

Introduction, thermodynamic system, surrounding, boundary, state, 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, concept of work and heat, equality of temperature, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy, Simple numerical problems.

2. Laws of Perfect Gases

06 Period

Definition of gases, concept of perfect gas, explanation of perfect gas laws – Boyle's law, Charles's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas equations, derivation, (Simple numerical problems) Specific heat at constant pressure, specific heat at constant volume of gas, derivation of an expression for specific heats with characteristics, simple problems on gas equation

3. Thermodynamic Processes on Gases

06 Period

Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes Derivation of work done in various processes change in internal energy.

4. Laws of Thermodynamics

12 Period

Law 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 equation to turbines, pump, boilers, compressors, nozzles, evaporators. Limitations. Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Clausius statement, equivalence of statements, Perpetual motion Machine of first and second kind, Carnot engine, concept of irreversibility, entropy, Introduction to third law of thermodynamics (Simple numerical problems)

5. Ideal and Real Gases

06 Period

Concept of ideal gas, enthalpy and specific heat capacities of an ideal gas, P – V – T surface of an ideal gas, triple point, real gases, Vander-Wall's equation, Amagat's experiment, equation of states Mass fraction, mole fraction, partial pressure, introduction to compressibility of gases

6. Properties of Steam

06 Period

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, entropy of water, entropy of steam, T- s diagrams, Mollier diagram (H – s Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes Quality of steam (dryness fraction), measurement of dryness fraction, throttling calorimeter, separating and throttling calorimeter

7. Steam Boiler

05 Period

Type of steam Generators, Working principle of boilers, need of high pressure modern boilers, characteristics of modern boilers. Working principle of Sterling, La-mont, Loeffler, Benson, Velox, Ramsin and Schmidt- Hartmann boiler

8. Steam turbines

06 Period

- Function and use of steam turbine
- Steam nozzles- types and applications
- Steam turbines, impulse, reaction, simple and compound, construction and working principle
- Governing of steam turbines

9. Steam condensers

05 Period

- Function of a steam condenser, elements of condensing plant
- Classification-Jet condenser, surface condenser
- Cooling pond and cooling towers

10. Air compressors

06 Period

Function of air compressor, type of air compressor - single stage, multi stage reciprocating compressors, inter-cooling of compressors, rotary compressor, Construction and working

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning.
2. Expose the students to real life problems.
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

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. Thermal Engineering by R.K.Rajput
6. Thermal Engineering by R.S.Khurmi

LIST OF PRACTICES

- 1 Demonstration of steam turbines through models and visit
- 2 Demonstration of steam condensers through models and visits
3. Study of modern high pressure steam boilers (at least one)
- 4 Demonstration of boiler Accessories and mountings
- 5 Demonstration/ study of an impulse turbines
- 6 Demonstration/ study of a reaction turbine
- 7 Demonstration of air compressor

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1.	06	10
2.	06	10
3.	06	10
4.	12	20
5.	06	10
6.	06	10
7.	05	05
8.	06	10
9.	05	05
10.	06	10
Total	64	100

3.6 BASIC ELECTRICAL AND ELECTRONICS TECHNOLOGY

L T P

5 - 3

RATIONALE

The objective of the course is to impart basic knowledge and skills regarding electrical and electronics engineering, which diploma holders will come across in their professional life

DETAILED CONTENTS

1. Overview of Electricity: (04 Period)

General use and applications of electricity; Use and applications of electricity to agriculture, Mechanical & Automobile sector; Advantages of electrical energy over other forms of energy.

2. DC Circuits: (10 Period)

Introduction to basic terms: charge, current, voltage, power, and energy; Ohm's law; Power dissipation in resistors; Series and parallel combination of resistors; Kirchhoff's laws; Star-delta conversions; Thevenin's theorem, Norton's theorem, and Maximum-power-transfer theorem; Ideal and practical voltage source; Current source.

3. AC Circuits: (14 Period)

Concept of alternating voltage and current; Introduction to basic terms: cycle, frequency, time period, amplitude, instantaneous value, rms value, peak value, phase difference, form factor, and peak factor; Concept of phasor; Phasor diagrams; Concepts of reactance, impedance, admittance, susceptance, and conductance; Concepts of instantaneous power, real power, reactive power, apparent power, complex power, and power factor; Analysis of simple AC circuits; Overview of three-phase AC circuits.

4. Batteries and Solar Cells: (08 Period)

Primary and secondary cells; Construction, working, and applications of Lead-Acid; Charging methods for Lead-Acid batteries; Maintenance of Lead-Acid batteries; Series and parallel connection of batteries; Maintenance free batteries; General idea of solar cells, solar panels and their applications.

5. Electrical Machines: (16 Period)

Electromagnetic induction; Introduction to magnetic circuits; Principles of electromechanical energy conversion; Construction and operation of single phase transformers; Tests of transformers; Efficiency and regulation; Operation of autotransformers & welding transformer;. Types of three-phase induction motors; principle of operation; Methods of starting and speed-control of three-phase induction motors; Overview of single-phase induction motors.; Construction and operation of synchronous machines; Construction and operation of stepper motors. Applications of single and three phase induction motors.

6. Semiconductors: (10 Period)

Classification of materials as conductors, insulators, and semiconductors; Intrinsic and extrinsic semiconductors; p-type and n-type semiconductors; pn-junction diode; Half wave and full wave rectification using diodes; Basic construction and operation of BJT, UJT, JFET, MOSFET, and thyristor.

7. Measuring Instruments: (10 Period)

Construction and working principles of PMMC and MI type voltmeters and ammeters; Dynamometer wattmeter; Induction-type energy meters; Measurement of power and energy in three-phase circuits; Use of digital meters (voltmeter, ammeter, and multimeter).

8. Electrical Installation and Safety: (08 Period)

Various accessories and parts of electrical installation; Overview of industrial and domestic wiring systems; Common electrical safety measures; Protection and precaution against electrical shock; Treatment of electrical shock; Basic protective devices like fuse, MCB, thermal overload relay, ELCB, and RCCB; Concepts and types of earthing; Protection against lightning.

LIST OF PRACTICALS

1. Verification of Ohm's Law
2. Verification of KCL and KVL
3. Test of charging and discharging of lead-acid battery using hydrometer
4. Connection of a three-phase motor and starter with fuses and reversing of direction
5. Connection of analog and digital single phase energy meter
6. Study of a distribution board for domestic and industrial installation
7. Open-circuit and short-circuit test on a single-phase transformer
8. Star-delta starting of induction motors
9. To draw V-I characteristics of pn-junction diode
10. To draw input and output characteristics of a transistor in CB and CE configurations

RECOMMENDED BOOKS

- 1 Basic Electrical Engineering by PS Dhongal; Tata McGraw Hill Publishers, New Delhi
- 2 Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
- 3 Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
- 4 Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	5
2	10	13
3	14	16
4	8	10
5	16	20
6	10	13
7	10	13
8	8	10
Total	80	100

