3.1   THERMODYNAMICS - I

L T P
4 - 2

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.

DETAILED CONTENTS

1.   Fundamental Concepts   (06 hrs)

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   (05 hrs)

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, derivation of an expression for specific heats with characteristics, simple problems on gas equation

3.   Thermodynamic Processes on Gases   (08 hrs)

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, change in entropy, rate of heat transfer for the above processes

4.   Laws of Thermodynamics   (12 hrs)

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, compressors, nozzles, evaporators, limitations.

Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy.

5.   Ideal and Real Gases   (06 hrs)

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

6.   Properties of Steam   (05 hrs)

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of stream, 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), finding dryness fraction using separating and throttling calorimeter, Rankine cycle

7.   Steam Generators   (05 hrs)

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.

8.   Air Standard Cycles   (06 hrs)

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

Comparison of Otto, Diesel cycles for same compression ratio or same peak pressure developed

Reasons for highest efficiency of Carnot cycle and all other cycles working between same temperature limits

9.   Air Compressors   (08 hrs)

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.

Multistage compressors – advantages over single stage compressors, use of air cooler – condition of minimum work in two stage compressor (without proof), simple problems

Rotary compressors – types, descriptive treatment of centrifugal compressor, axial flow compressor, vane type compressor

10.   Introduction to Heat Transfer   (03 hrs)

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

LIST OF PRACTICALS

1.   Determination of temperature by
        1.1   Thermocouple
        1.2   Pyrometer
        1.3   Infrared thermometer
2.   Demonstration of mountings and accessories on a boiler.
3.   Study of boilers (through industrial visit)
4.   Study of air compressors.
5.   Demonstration of heat transfer through conduction, convection and Radiation

INSTRUCTIONAL STRATEGY

1.   Expose the students to real life problems.
2.   Plan assignment so as to promote problem solving abilities.

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.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	05	08
3	08	12
4	12	20
5	06	10
6	05	08
7	05	08
8	06	10
9	08	10
10	03	04
Total	**64**	**100**

3.2   APPLIED MECHANICS

L   T   P
3   -   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   (04hrs)

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 for density, force, pressure, work, power, velocity, acceleration

1.4   Concept of rigid body, scalar and vector quantities

2.   Laws of forces   (09 hrs)

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 (09 hrs)

    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

    3.8   Position of resultant force by moment

    [Simple problems on the above topics]

4. Friction (06 hrs)

    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.

5. Centre of Gravity (08 hrs)

    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. Simple Machines (06 hrs)

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

6.2   Simple and compound machine (Examples)

6.3   Definition of ideal machine, reversible and self locking machine

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

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

6.6   Working principle and application of wheel and axle, Weston's Differential Pulley Block , 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]

7.   Torsion   (06 hrs)

7.1   Torsion in shafts/bars

7.2   Modulus of rigidity

7.3   Torsional Equation (simple numerical problems)

7.4   Power Transmission in shafts (simple numerical problems)

LIST OF PRACTICALS

1. Verification of the polygon law of forces using greavesand apparatus.
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. Applied Mechanics By, Col. Harbhajan Singh, TL Singha and Parmod Kumar Singla, Published By Abhishek Publication, 57-59, Sector-17, Chandigarh

3. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.

4. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..

5. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	08
2	09	20
3	09	20
4	06	12
5	08	16
6	06	12
7	06	12
Total	**48**	**100**

3.3   ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L   T   P
4   -   2

RATIONALE

The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, electromagnetic induction, batteries, transformers, motors   distribution system, domestic installation, electrical safety etc. The students will also learn basic electronics including diodes and transistors and their applications.

DETAILED CONTENTS

1.   Application and Advantage of Electricity   (06 hrs)

Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy

2.   Basic Electrical Quantities   (06 hrs)

Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit

3.   Electromagnetic Induction   (06 hrs)

Production of e.m.f., idea of a transformer and its working principle

4.   Transmission and Distribution System   (10 hrs)

Key diagram of 3 phase transmission and distribution system, Brief functions of accessories of transmission line. Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply. Arrangement of supply system from pole to the distribution board, function of service line, energy meter, main switch, distribution board

5.   Domestic Installation   (10 hrs)

Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems.

6.   Electric Motor s and Pumps   (12 hrs)

Definition and various applications of single-phase and three-phase motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Conversion of horse power in watts or kilowatts, Type of pumps and their applications, Use of direct online starter and star delta starter

7.   Electrical Safety   (06hrs)

Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs

8.   Basic Electronics   (08hrs)

Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, symbols, identification of terminals of transistor, of current flowing in a transistor their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of servo motors.

LIST OF PRACTICALS

1.   Connection of a three-phase motor and starter with fuses and reversing of direction of rotation
2.   Connection of a single-phase induction motor with supply and reversing of its direction of rotation
3.   To test a battery for its charged and discharged condition.
4.   Identify the different faults in a domestic wiring system
5.   Connection and reading of an electric energy meter with supply and load using ammeter, voltmeter, wattmeter
6.   Study of a distribution board for domestic installation
7.   Ohm's law verification
8.   Verification of law of resistance in series
9.   Verification of law of resistance in parallel
10.   Draw V-I characteristics of P-N junction diode
11.   Draw input and output characters of a transistor
12.   Draw reverse break down characteristics of a zener diode

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhogal; Tata McGraw Hill Publishers, New Delhi
2. A Text Book of Electrical Technology, Vol. I and II by BL Thareja; S Chand and Co., New Delhi
3. Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
4. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi
6. Basic Electronics by VK Mehta; S Chand and Co., New Delhi
7. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	6	10
3	6	10
4	10	15
5	10	15
6	12	18
7	6	10
8	8	12
Total	**64**	**100**

3.4   WORKSHOP TECHNOLOGY-1

L T P
3 - 6

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.

DETAILED CONTENTS

1.   Welding   (16 hrs)

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.

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

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.

1.5   Modern Welding Methods

Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, Metal inert gas (MIG)

welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding

2.   Pattern Making   (03 hrs)

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   (16 hrs)

   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.

   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 Forming Processes   (08 hrs)

    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 forging, 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   (05 hrs)

    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 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

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 first hand 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.

LIST OF 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.   Manufacturing Technology by M Adithan and A.B. Gupta; Wiley Eastern India Ltd. New Delhi.
4.   Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
5.   A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
6.   Foundry Technology by KP Sinha and DB Goel; Roorkee Publishng House, Roorkee.
7.   A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	16	32
2	03	08
3	16	32
4	08	18
5	05	10
Total	**48**	**100**

3.5 MECHANICAL ENGINEERING DRAWING-I

L T P
- - 6

RATIONALE

Diploma holders in Mechanical Engineering are required to interpret drawings and therefore it is essential that they have skills of preparing drawings and sketches of mechanical components. This subject aims at development of drawing skills in the students.

DETAILED CONTENTS

1. Limits and fits   (03 sheets)

    Maximum limit of size, minimum limit of size, tolerance, allowance, deviation, upper deviation, lower deviation, fundamental deviation, clearance, maximum clearance, minimum clearance. Fits – clearance fit, interference fit, transition fit. Hole basis system, shaft basis system, tolerance grades, calculating values of clearance, interference, hole tolerance, shaft tolerance with given basic size for common assemblies like $H_7/g6$, $H_7/m6$, $H_8/p6$

2. Introduction to drawing office equipment through a visit to modern drawing office of an industry.

3. Drawing of the following with complete dimensions, tolerances, materials and surface finish marks.
    3.1 Universal coupling (Assembly) and Oldham coupling   (02Sheets)
    3.2 Bearings   (05 sheets)

        3.2.1 Bushed Bearing (Assembled Drawing)
        3.2.2 Ball Bearing and Roller Bearing (Assembled Drawing)
        3.2.3 Plummer Block (Detailed Drawing)
        3.2.4 Plummer Block (Assembled Drawing)
        3.2.5 Foot step Bearing (Assembled Drawing)
    3.3 Bracket   (01 sheets)

        3.3.1 Wall bracket (orthographic views)

    3.4 Pulleys   (03 sheets)

        3.4.1 Stepped Pulley
        3.4.2 V. Belt Pulley
        3.4.3 Fast and loose pulley (Assembled Drawing)

| 3.5 | Pipe Joints | (03 sheets) |

3.5.1 Expansion pipe joint (Assembly drawing)
3.5.2 Flanged pipe and right angled bend joint (Assembly Drawing)
3.5.3 Spigot and Socket joint

3.6	Lathe Tool Holder (Assembly Drawing)	(01 sheets)
3.7	Reading of mechanical components drawings	(01 sheets)
3.8	Sketching practice of bearing, bracket and pulley.	(02 sheets)

| 4. | Drilling Jig (Detail and Assembly) | (2 sheets) |

| 5. | Machine Vice (Detail and Assembly) | (3 sheets) |

Note:- (1) First angle projection should be followed, 20% of drawings may be prepared in third angle projection.
(2) SP-46-1988 should be followed
(3) The drawing should include discussion with tolerances, whenever necessary and material list as per BIS / ISO specifications.

INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the components/part whose drawing is to be made
2. Emphasis should be given to 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

LIST OF RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons; Ludhiana
2. A Text Book of Machine Drawing by R.K.Dhawan; S. Chand and Co. Ltd New Delhi.
3. Machine Drawing by N.D. Bhatt; Charotar Book Depot. Anand.

3.6. MATERIAL SCIENCE

L T P
3 - 2

RATIONALE

Lot of developments have 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.

DETAILED CONTENTS

1.   Introduction   (07 hrs)

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   (07 hrs)

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 behaviour and its mechanisms, behaviour of material under load and stress-strain.

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

3.   Metals And Alloys   (14 hrs)
Introduction: History and development of iron and steel, 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 usage.

Steels: Steels and alloy steel, Classification of plain carbon steels, Availability, 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 Light Metals and their alloys, properties and uses of White Metals and their alloys.

4. Theory of Heat Treatment   (08 hrs)

Purpose of heat treatment, Solid solutions and its types, Iron Carbon diagram, Formation and decomposition of Austenite, Martensitic Transformation – Simplified Transformation Cooling Curves various heat treatment processes- hardening, tempering, annealing, normalizing, Case hardening and surface hardening, Types of heat treatment furnaces required for above operations (only basic idea)

5. Engineering Plastics   (03 hrs)

Important sources of plastics, Classification-thermoplastic and thermo set and their uses, Various Trade names of engg. Plastics, Plastic Coatings.

6. Advanced Materials   (03 hrs)

Composites-Classification, properties, applications
Ceramics-Classification, properties, applications
Heat insulating materials

7. Miscellaneous Materials   (06 hrs)
Properties and uses of Asbestos, Glass wool, thermocole, cork, mica. Overview of tool and die materials, Materials for bearing metals, Spring materials, Materials for Nuclear Energy, Refractory materials.

LIST OF PRACTICALS

1. Classification of about 25 specimens of materials/machine parts into
    (i)   Metals and non metals
    (ii)   Metals and alloys
    (iii) Ferrous and non ferrous metals
    (iv)   Ferrous and non ferrous alloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate the various properties possessed by them.
3. a)   Study of heat treatment furnace.
    b)   Study of a thermocouple/pyrometer.
4. Study of a metallurgical microscope and a specimen polishing machine.
5. To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials:
    i) Brass ii)Copper iii)Grey iv)Malleable 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 harden and temper a specimen and to find out the difference in hardness due to tempering.

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 Varinder Kumar, Eagle Publisher, Jalandhar
3.   Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
4.   Engg. Metallurgy by R.A. Higgens, Standard Publishers, New Delhi
5.   Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	07	15
2.	07	15
3.	14	30
4.	08	16
5.	03	06
6.	03	06
7.	06	12
Total	**48**	**100**

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1.   Basics of ecology, eco system and sustainable development

2.   Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table

3.   Sources of pollution - natural and man made, their effects on living and non-living organisms

4.   Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms

5.   Pollution of air-causes and effects of man, animal, vegetation and non-living organisms

6.   Sources of noise pollution and its effects

7.   Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods

8.   Mining, blasting, deforestation and their effects

9.   Legislation to control environment

10.   Environmental Impact Assessment (EIA), Elements for preparing EIA statements

11.   Current issues in environmental pollution and its control

12.   Role of non-conventional sources of energy in environmental protection