Curriculum for

Diploma Programme in

MECHANICAL ENGINEERING

Campus:
Puran Murti Campus
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THIRD SEMESTER

THIRD SEMESTER: (MECHANICAL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Hours/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
3.1	*Strength of Materials	3	2	4	25	25	50	100	3	50	3	150	200
3.2	*Thermodynamics-I	3	2	4	25	25	50	100	3	50	3	150	200
3.3	*Basics of Electrical and Electronics Engineering	3	2	4	25	25	50	100	3	50	3	150	200
3.4	*Mechanical Engineering Drawing	-	6	3	-	50+	50	100	3	25 (Viva)	2	125	175
3.5	*Workshop Technology-I	3	-	3	25	-	25	100	3	-	-	100	125
3.6	*Workshop Practice –I	-	9	4	-	100	100	-	-	100	3	100	200
*Soft Skills- I		-	2	-	-	25	25	-	-	-	-	-	25
Total		12	23	22	100	250	350	500	-	275	-	775	1125

Common with other Diploma programmes
Includes 25 marks for viva-voce

3.1 STRENGTH OF MATERIALS

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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, columns and springs. 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 thin cylindrical shells.
- Calculate energy stored by materials subjected to axial loads.
- Calculate moment of inertia of different sections.
- Draw and calculate bending moment and shear force diagrams of beam under given loading
- Interpret the concept of bending and torsion and calculate stresses on different section of materials.
- Determine the diameter of a shaft under combined bending and torsion.
- Calculate critical axial loads on column under different end constraints.
- Determine the various parameters in closed coil helical and laminated springs
- Determine conformance of given materials sample to the prescribed Indian standards.

DETAILED CONTENTS

1. Stresses and Strains (08 Hours)

1.1. Basic concept of load, stress and strain
1.2. Tensile, compressive and shear stresses
1.3. Linear strain, Lateral strain, Shear strain, Volumetric strain.
1.4 Concept of Elasticity, Elastic limit and limit of proportionality
1.5 Hook's Law and Elastic Constants
1.6. Stress-strain curve for ductile and brittle materials
1.7 Nominal stress
1.8 Yield point, plastic stage
1.9 Ultimate stress and breaking stress
1.10 Percentage elongation
1.11 Proof stress and working stress
1.12. Factor of safety
1.13 Poisson's Ratio
1.14 Thermal stress and strain
1.15 Longitudinal and circumferential stresses in seamless thin walled cylindrical shells.
1.6 Introduction to Principal stresses

2. Resilience (03 Hours)

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

3. Moment of Inertia (08 Hours)

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 (with 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 Moment and Shearing Force (08 Hours)

4.1 Concept of various types of beams and form of loading
4.2 Concept of end supports-Roller, hinged and fixed
4.3 Concept of bending moment and shearing force
4.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrate and U.D.L.

5. Bending stresses (06 Hours)

5.1 Concept of Bending stresses
5.2. Theory of simple bending, Derivation of Bending Equation
5.3. Use of the equation
5.4. Concept of moment of resistance
5.5. Bending stress diagram
5.6 Section modulus for rectangular, circular and symmetrical I section.
5.7. Calculation of maximum bending stress in beams of rectangular, circular, and T section.

6 Columns (05 Hours)

6.1. Concept of column, modes of failure
6.2. Types of columns, modes of failure of columns
6.3. Buckling load, crushing load
6.4. Slenderness ratio
6.5. Effective length
6.6 End restraints

6.7 Factors effecting strength of a column
6.8 Strength of column by Euler Formula without derivation
6.9. Rankine Gourdan formula (without derivation)

7. Torsion (06 Hours)

7.1. Concept of torsion, difference between torque and torsion.

7.2. Derivation of Torsion Equation, use of torsion equation for circular shaft, (solid and hollow)

7.3. Comparison between solid and hollow shaft with regard to their strength and weight.

7.4. Power transmitted by shaft

7.5 Concept of mean and maximum torque

8. Springs (04 Hours)

8.1. Closed coil helical springs subjected to axial load and calculation of:
- Stress deformation

- Stiffness and angle of twist and strain energy

- Strain energy and proof resilience.

8.2. Determination of number of plates of laminated spring (semi elliptical type only)

LIST OF PRACTICALS

1. Tensile test on bars of Mild steel and Aluminium.
2. Bending tests on a steel bar or a wooden beam.
3. Impact test on metals
a) Izod test
b) Charpy test
4. Torsion test of solid specimen of circular section of different metals for determining modulus of rigidity.
5. To plot a graph between load and extension and to determine the stiffness of a helical spring.
6. Hardness test on different metals.

Note: All the tests need to be done as per prescribed Indian Standards.

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.

. MEANS OF ASSESSMENT

 Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

 Actual laboratory and practical work, model/prototype making, and viva-voce

RECOMMENDED BOOKS

1. SOM by RS Khurmi; S.Chand & Co; New Delhi

2. Mechanics of Materials by Dr. Kirpal Singh; Standard Publishers Distribution, New Delhi.

3. SOM by Birinder Singh,; Katson Publishing House, New Delhi.

4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.

5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	08	20
2	03	06
3	08	16
4	08	16
5	06	10
6	05	10
7	06	12
8	04	10
Total	48	100

3.2 THERMODYNAMICS - I

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3 - 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, and compressors and about IC engines.

LEARNING OUTCOMES

After undergoing this subject, 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.
- Determine various properties of Steam
- Explain the working, construction and applications of steam boilers and steam generators
- Explain the working, construction and application of air compressor.

DETAILED CONTENTS

1. Fundamental Concepts (04 Hours)

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 and internal energy.

2. Laws of Perfect Gases (04 Hours)

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 and its derivation.
Specific heat at constant pressure, specific heat at constant volume of a gas, derivation of an expression for specific heats with characteristics, simple numerical problems on gas equation.

3. Thermodynamic Processes (06 Hours)

Types of thermodynamic processes – isochoric, isobaric, isothermal, adiabatic, 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 (10 Hours)

Laws of conservation of energy, first law of thermodynamics (Joule's experiment) and its limitations, 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 for turbines, pump, boilers, compressors, nozzles, and evaporators.
Heat source and sink, statements of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalency of statements, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility and concept of entropy.

5. Ideal and Real Gases (04 Hours)

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 (04 Hours)

Formation of steam and related terms, thermodynamic properties of steam, steam tables, sensible heat, 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, determination of quality of steam (dryness fraction),

7. Steam Generators (06 Hours)

Uses of steam, classification of boilers, function of various boiler mounting and accessories, comparison of fire tube and water tube boilers. Construction and working of Lancashire boiler, Nestler boiler, Babcock & Wilcox Boiler. Introduction to modern boilers.

8. Air Standard Cycles (05 Hours)

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 for different cycles.
Comparison of Otto, Diesel cycles for same compression ratio, same peak pressure developed and same heat input.
Reasons for highest efficiency of Carnot cycle and all other cycles working between same temperature limits

9. Air Compressors (05 Hours)

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, working and construction of centrifugal compressor, axial flow compressor, vane type compressor

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 the working of Lancashire boiler and Nestler boiler.
4. Study of working of high pressure boiler.
5. Study of boilers (Through industrial visit)
6. Determination of Dryness fraction of steam using calorimeter.
7. Demonstrate the working of air compressor.

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

 Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

 Actual laboratory and practical work, model/prototype making, and 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. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	04	10
2	04	08
3	06	12
4	10	20
5	04	10
6	04	08
7	06	12
8	05	10
9	05	10
Total	48	100

3.3 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

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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.

LEARNING OUTCOMES

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

- Measure basic electrical quantities.
- Measure and improve power factor in a given circuit.
- Explain the construction, working principle, performance and applications of transformers.
- Identify different wires of distribution system.
- Select and operate single phase and three phase motors.
- Follow electrical safety measures.
- Describe the characteristics and applications of diodes, transistors and thyristor.

DETAILED CONTENTS

1. Application and Advantage of Electricity (03 Hours)
Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy

2. Basic Electrical Quantities (04 Hours)
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. AC Fundamentals (08 Hours)
Electromagnetic induction-Faraday's Laws, Lenz's Law; Fleming's rules, Principles of a.c. Circuits; Alternating emf, Definition of cycle, frequency, amplitude and time period. Instantaneous, average, r.m.s and maximum value of sinusoidal wave; form factor and Peak Factor. Concept of phase and phase difference. Concept of resistance, inductance and capacitance in simple a.c. circuit. Power factor and improvement of power factor by use of capacitors. Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)

4. Transformers (06 Hours)
Working principle and construction of single phase transformer, transformer ratio, emf equation, losses and efficiency, cooling of transformers, isolation transformer, CVT, auto transformer (brief idea), applications.

5. Distribution System (06 Hours)
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

6. Electric Motor (08 Hours)
Description and 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. Motors used for driving pumps, compressors, centrifuge, dyers etc. Totally enclosed submersible and flame proof motors

7. Domestic Installation (04 Hours)
Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems. Common safety measures and earthing

8. Electrical Safety (04 Hours)
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

9. Basic Electronics (05 Hours)
Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.

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. Troubleshooting in domestic wiring system, including distribution board
4. Connection and reading of an electric energy meter
5. Use of ammeter, voltmeter, wattmeter, and multi-meter
6. Measurement of power and power factor in a given single phase ac circuit
7. Study of different types of fuses, MCBs and ELCBs
8. Study of zener diode as a constant voltage source and to draw its V-I characteristics
9. Study of earthing practices
10. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
11. Study of construction and working of a (i) stepper motor and (ii) servo motor

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

 Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

 Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

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
8. Basic electronics and Linear circuits by NN Bhargava and Kulshreshta, Tata Mc Graw Hill New Delhi.
9. Electronic principles by SK Sahdev, Dhanpat Rai and Sons, New Delhi.
10. Electronic Devices and circuits by Rama Raddy Narora Publishing House Pvt. Ltd. New Delhi.
11. Principles of electrical and electronics Engineering by VK Mehta; S Chand and Co. New Delhi
12. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	03	06
2	04	08
3	08	16
4	06	12
5	06	12

6	**08**	**16**
7	**04**	**10**
8	**04**	**10**
9	**05**	**10**
Total	**48**	**100**

3.4 MECHANICAL ENGINEERING DRAWING

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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.

LEARNING OUTCOMES

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

- Interpret different limits and fits of components
- Draw different kind of machine components like bearings, brackets, pulleys, pipe joints and lathe tool holder.
- Read and interpret drawings of mechanical components
- Interpret and draw the drawings of mechanical machine parts like jig, vices and screw jack
- Interpret and prepare the drawings of boiler and J.C. engine parts.
- Interpret gear terminology and draw spur gear teeth profile.

DETAILED CONTENTS

1. Limit, fits and tolerance (01 sheets)

Need of limit, fits and tolerance, 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 and 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 H7/g6, H7/m6, H8/p6. Basic terminology and symbols of geometrical dimensioning and tolerances.

2. Drawing of the following with complete dimensions, tolerances, bill of material and surface finish representation.

2.1 Universal coupling and Oldham coupling (Assembly) (01 Sheets)

2.2 Bearings (04 sheets)

2.2.1 Bushed Bearing (Assembly Drawing)
2.2.2 Ball Bearing and Roller Bearing (Assembled Drawing)
2.2.3 Plummer Block (Detail and Assembly Drawing)
2.2.4 Foot step Bearing (Assembled Drawing)

2.3 Pulleys (02 sheets)

2.3.1 Pulleys, Function of pulley, Types and materials of Pulley.
2.3.2 Free hand Sketch of Various types of pulleys.
2.3.3 Fast and loose pulley (Assembly Drawing)

2.4 Pipe Joints (03 sheets)

2.4.1 Types of pipe Joints, Symbol and line layout of pipe lines
2.4.2 Expansion pipe joint (Assembly drawing)
2.4.3 Flanged pipe and right angled bend joint (Assembly Drawing)

2.5 Lathe Tool Holder (Assembly Drawing) 01 sheets)
2.6 Reading and interpretation of mechanical components and assembly drawings
2.7 Sketching practice of bearings and bracket. (01 sheet)

3. Drilling Jig (Assembly Drawing) 01 sheets)

4. Machine vices (Assembly Drawing) (02sheets)

5. I.C. Engine Parts (03 sheets)
Piston Connecting rod (Assembly Drawing) Crankshaft and flywheel (Assembly Drawing)

6. Boiler Parts (02 sheets)
Steam Stop Valve (Assembly Drawing)
Blow off cock. (Assembly Drawing)

7. Mechanical Screw Jack (Assembled Drawing) (01 sheet)

8. Gears (02 sheets)

Gear, Types of gears, Nomenclature of gears and conventional representation
Draw the actual profile of involute teeth of spur gear by different methods.
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.
(4) At least 18 sheets may be prepared covering all the topics.

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

MEANS OF ASSESSMENT

- Sketching
- Drawing

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.
4. Machine Drawing by Bhattacharya, Oxford Press, New Delhi.
5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:
http://swayam.gov.in

3.5 WORKSHOP TECHNOLOGY-1

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RATIONALE

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 techniques .
- Select suitable (most appropriate) process, electrodes, various parameters of process for a given job.
- Explain respective principle of operations of modern welding processes.
- Inspect various welding joints, castings, forgings.
- 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).
- Explain the principle of forging, rolling, extrusion and drawing process.

DETAILED CONTENTS

1. Welding (16 Hours)

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, Oxygen cylinder, acetylene cylinder, cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes and personal safety equipment for welding.

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.

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. Foundry Techniques (16 Hours)

2.1. 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

2.2.. Moulding and Casting

2.2.1. 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.

2.2.2. 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.

2.2.3 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, Centrifugal casting

2.2.4. Gating and Risering System
Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification

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

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

3 Metal Forming Processes **(10 Hours)**

3.1 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

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

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

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

4. Plastic Processing **(06 Hours)**

4.1 Industrial use of plastics, and applications- Advantages and limitations of use of plastics.

4.2 Injection moulding-principle, working of injection moulding machine.

4.3 Compression moulding-principle, and working of compression moudling machine.

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. Use of audio-visual aids/video films should be made to show specialized operations.

MEANS OF ASSESSMENT

 Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

LIST OF RECOMMENDED 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.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	16	35
2	16	35
3	10	20
4	06	10
Total	**48**	**100**

3.6 WORKSHOP PRACTICE -1

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RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in operating various machines need to be developed. Hence the subject of workshop practice.

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 (200 mm x 6 mm Flats)
Job 5. Exercise on spot welding/seam welding (any utility item)
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 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. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine.
Job 3. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
Job 4. Preparation of utility item such as Dustbin or Paper tray out of G.I. sheet.
Job 5. Preparation of drilling Jig.

INSTRUCTIONAL STRATEGY

1. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
2 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.

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva-voce

SOFT SKILLS – I

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RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

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

- Identify components of effective verbal communication
- Prepare a report
- Learn the techniques of enhancing memory
- Set goals for overall personality development
- Understand the concept of quality and its implementation in an organisation.

DETAILED CONTENTS

- Soft Skills - Concept and Importance
- Communication Skills- Improving verbal communication
- Report Writing
- Method to enhance memory and concentration
- Component of overall personality- Dressing sense/etiquettes/body language etc.

In addition, the students must participate in the following activities to be organized in the institute.

- Sports
- NCC/NSS
- Camp – Blood donation
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.