

CURRICULUM

FOR

SECOND SEMESTER

DIPLOMA IN

MECHANICAL ENGINEERING

SUBJECT STUDY SCHEME (2nd Sem: Mechanical Engineering)

Course Code	Subjects	Time in Hours				CREDITS		
		Theory	Tutorial	Practical	Total	Theory	Practical	Total
BS201	Applied Mathematics-II	3	1	-----	4	4	-----	4
ES202	Introduction to Computers and Information Technology	---	---	4	4	---	2	2
ES207	Applied Mechanics	4	1	-----	5	5		5
ES208	Applied Mechanics Lab	---	-----	2	2	---	1	1
MEPC205	Mechanical Engineering Drawing	-----	-----	4	4	-----	2	2
MEPC206	Material Science and Metallurgy	3	---	---	3	3		3
MEPC207	Material Science and Metallurgy Lab	---	-----	2	2	---	1	1
MEPC208	Manufacturing Technology-I	3	---	---	3	3		3
MEPC209	Manufacturing Technology-I Lab	---	-----	2	2	---	1	1
	Total	13	2	14	29*	15	7	22

* * Note: The remaining 1 hour in a week shall be utilized for sports and other activities like debates, seminar etc.

PROGRAM: THREE YEAR DIPLOMA IN ENGINEERING AND TECHNOLOGY *	
Course Code: BS201	Course Title: Applied Mathematics-II
Semester: 2nd	Credit: 4
Periods Per Week: 4 (L: 03, T: 01, P: 0)	

(* Common to Architecture Assistantship, Automobile, Civil, Civil(PHE), QSCM, Computer, Electrical, E&C, Medical Electronics, Food Technology, I&C, Leather Technology, Mechanical, Textile Technology, Wood Technology and IT)

COURSE OBJECTIVE:

This course is designed to develop an understanding of basic mathematical and statistical tools which include matrices, determinants, integral calculus and coordinate geometry and the applications of such tools in the field of engineering and technology

COURSE CONTENT

1. Integral Calculus

- 1.1 Integration as inverse operation of differentiation
- 1.2 Simple integration by substitution, by parts and by partial fractions (for Linear factors only)
- 1.3 Evaluation of definite integrals (simple problems)-

$$\text{Evaluation of } \int_0^{\pi/2} \sin^n x \, dx, \int_0^{\pi/2} \cos^n x \, dx, \int_0^{\pi/2} \sin^m x \cos^n x \, dx$$

Using formulae without proof (m and n being positive integers only)

2. Coordinate Geometry

- 2.1 Equation of straight line in various standard forms (without proof), intersection of two straight lines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula.
- 2.2 General equation of a circle and its characteristics. To find the equation of a circle, given: Centre and radius, three points lying on it and coordinates of end points of a diameter.
- 2.3 Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations without proof. Basic problems on conics when their foci, directrices or vertices are given.

3 Matrices and Determinants

- 3.1 Definition of matrix and its types.
- 3.2 Addition, subtraction and multiplication of matrices.
- 3.3 Expansion of Determinants.

4 Statistics

- 4.1 Measures of Central Tendency: Mean, Median, Mode
- 4.2 Measures of Dispersion: Mean deviation, Standard deviation
- 4.3 Basic Concepts of Probability.

COURSE OUTCOME

After the completion of the course the student will be able to:

- evaluate both indefinite and definite integrals by various methods
- identify various points in a 2-D space along with formulation of equations and graphs for different types of lines, circles, ellipses, parabolas etc.
- find the sum, difference and product of two or more matrices,
- evaluate determinants and their relations to matrices
- find the mean, median, mode and other measures of central tendency.
- solve basic problems on probability.

RECOMMENDED BOOKS:

1. R.D Sharma, Applied Mathematics-II.
2. H.K Das, Applied Mathematics.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
4. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.
5. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
6. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi
7. Applied Mathematics-II, Eagle Publications.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	16	35
2	10	20
3	12	25
4	10	20
Total	48	100

PROGRAM THREE YEAR DIPLOMA IN ENGINEERING AND TECHNOLOGY	
Course Code: ES202	Course Title: Introduction to Computers and Information Technology
Semester: 2nd	Credit: 2
Periods Per Week: 4 (L: 0 T: 0 P: 4)	

(* Common to Architecture Assistantship, Automobile, Civil, Civil(PHE), QSCM, Computer, Electrical, E&C, Medical Electronics, Food Technology, Garment Technology, I&C, Leather Technology, Mechanical, Textile Design, Textile Technology, Travel and Tourism, MLT, Wood Technology and IT)

COURSE OBJECTIVE

Information technology has great influence on all aspects of our life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools of MS Office/Open Office using internet etc. form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

COURSE CONTENT

1. Basics of Information Technology

- 1.1. Its concept and scope, applications of IT, ethics and future with information technology.
- 1.2. Impact of computer and IT in society.
- 1.3. Computer application in office, book publishing, data analysis, accounting, investment, inventory control, graphics, air and railway ticket reservation, robotics, military, banks, Insurance financial transactions and many more.

2. Basic Components of Computer System

- 2.1. Block diagram of a computer System and Processing of Data.
- 2.2. Demonstration of computer system viz., Hardware, Software
- 2.3. Concept of Memory and its various types, Primary and secondary memories (RAM, ROM, Storage Devices etc).

3. Internet and its Applications

- 3.1. Introduction to Internet, its basic working.
- 3.2. Concept of Email, Social Media, Cloud Computing.
- 3.3. Basic ideas about IP Address, DNS, URL, Server, Web Browser, LAN etc.

4. Use of Various Basic Data Processing Softwares

4.1. Word Processing (Microsoft Word & Google Docs.)

4.1.1. File Management:

- 4.1.1.1. Opening, creating and saving a document, locating files, copying contents in some different file(s).

4.1.2. Editing a document:

- 4.1.2.1. Entering text, Cut, copy, paste using tool- bars

4.1.3. Formatting a document:

- 4.1.3.1. Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
- 4.1.3.2. Aligning of text in a document, justification of document, Inserting bullets and numbering
- 4.1.3.3. Formatting paragraph, inserting page breaks and column breaks, line spacing
- 4.1.3.4. Use of headers, footers: Inserting footnote, end note, use of comments
- 4.1.3.5. Inserting date, time, special symbols, importing graphic images, drawing tools

4.1.4. Tables and Borders:

- 4.1.4.1. Creating a table,
- 4.1.4.2. Formatting cells,
- 4.1.4.3. Use of different border styles, shading in tables,
- 4.1.4.4. Merging of cells, partition of cells, inserting and deleting a row in a table

4.1.5. Print preview, zoom, page set up, printing options

4.1.6. Using Find, Replace options

4.2. Microsoft-Excel and Google Sheets

4.2.1. Introduction to Spreadsheet Application-Workbook and Worksheets

4.2.2. Working with data and formulas:

- 4.2.2.1. Addition, subtraction, division, multiplication, percentage and autosum.
- 4.2.2.2. Format data, create chart, printing chart, save worksheet, creating and formatting of charts and graphs

4.3. Presentation (Microsoft-PowerPoint and Google Slides)

4.3.1. Introduction to PowerPoint - How to start PowerPoint - Working environment: concept of toolbars, slide layout, templates etc. - Opening a new/existing presentation - Different views for viewing slides in a presentation: normal, slide sorter etc.

4.3.2. Addition, deletion and saving of slides.

4.3.3. Insertion of multimedia elements - Adding text boxes, importing pictures, movies and sound, tables and charts etc.

4.3.4. Formatting slides - Text formatting, changing slide layout, changing slide color scheme - Changing background, Applying design template.

4.3.5. Viewing the presentation using slide navigator

COURSE OUTCOME

After the completion of the course the student will be able to:

- Identify the different hardware components and functional units of a Computer system.
- Explain basic concepts and working of internet.
- Create and format word documents by using different word processing software.
- Prepare the spread sheets and the presentation of data in different ways.
- Prepare power point presentations.

RECOMMENDED BOOKS:

1. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd- Jungpura, New Delhi
2. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
3. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
4. Basics of Information Technology, by Ishan Publications, Ambala
5. Information Technology for Management by Henery Lucas, 7th edition, Tata McGraw Hill Education Pvt Ltd, New Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	13	20
3	13	20
4	32	50
Total	64	100

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: ES207	Course Title: APPLIED MECHANICS*
Semester: 2 nd	Credits: 05
Periods Per Week :5 (L: 4, T: 1, P:0)	

(* Common to Automobile, Civil, Civil (PHE), QSCM, Mechanical, Wood Technology,)

COURSE OBJECTIVE:

The objectives of the course are to determine the resultant of various forces and to compute support reactions using equilibrium conditions for various structures and to understand the significance of friction in equilibrium problems, basic machine rules and their applications in different engineering problems

COURSE CONTENT

1. Basics of mechanics and force system

- 1.1. Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics
- 1.2. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.
- 1.3. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification.
- 1.4. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem
- 1.5. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces

2. Equilibrium

- 2.1. Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analysing equilibrium
- 2.2. Lami's Theorem – statement and explanation, Application for various engineering problems.
- 2.3. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple)
- 2.4. Beam reaction for cantilever, simply supported beam with or without overhang subjected to combination of Point load and uniformly distributed load.
- 2.5. Beam reaction graphically for a simply supported beam subjected to vertical point loads only.

3. Friction

- 3.1. Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of

repose, relation between co-efficient of friction and angle of friction.

3.2. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane.

3.3. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

4. Centroid and centre of gravity

4.1. Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle)

4.2. Centroid of composite figures composed of not more than three geometrical figures

4.3. Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere)

4.4. Centre of Gravity of composite solids composed of not more than two simple solids

5. Simple lifting machine

5.1. Simple lifting machine, load, effort, mechanical advantage, applications and advantages.

5.2. Velocity ratio, efficiency of machines, law of machines.

5.3. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility

5.4. Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

COURSE OUTCOME

After completing this course, the student will be able to:

- Identify the force systems for given conditions by applying the basics of mechanics.
- Determine unknown force(s) of different engineering systems.
- Apply the principles of friction in various conditions for useful purposes.
- Find the centroid and centre of gravity of various components in engineering systems.
- Calculate mechanical advantage, velocity ratio and efficiency of simple lifting machine

RECOMMENDED BOOKS

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi.
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi
8. Applied Mechanics by Er. Arun Bangotra, Eagle Prakashan

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	17	25
2	15	22
3	10	17
4	11	18
5	11	18
Total	64	100

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: ES208*	Course Title: APPLIED MECHANICS LAB*
Semester: 2 ND	Credits: 01
Periods Per Week : 2 (L: 0, T: 0, P:2)	

(* Common to Automobile, Civil, Civil (PHE), QSCM, Mechanical and Wood Technology)

COURSE OBJECTIVES:

The objectives of the course are to determine the resultant of various forces and to compute support reactions using equilibrium conditions for various structures and to understand the significance of friction in equilibrium problems, basic machine rules and their application in different engineering problems

LIST OF PRACTICAL TO BE PERFORMED:

1. To study various equipment related to Engineering Mechanics.
2. To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
3. To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
4. Derive Law of machine using Worm and worm wheel.
5. Derive Law of machine using Single purchase crab.
6. Derive Law of machine using double purchase crab.
7. Derive Law of machine using Weston's differential or wormed geared pulley block.
8. Verification of Polygon Law of Forces using gravesand apparatus
9. Determine resultant of concurrent force system graphically.
10. Determine resultant of parallel force system graphically.
11. Verify Lami's theorem.
12. Study forces in various members of Jib crane.
13. Determine support reactions for simply supported beam.
14. To obtain support reactions of beam using graphical method.
15. Determine coefficient of friction for motion on horizontal and inclined plane.
16. Determine centroid of geometrical plane figures.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC205	Course Title: Mechanical Engineering Drawing
Semester: 2ND	Credits: 2
Periods Per Week : 4 (L: 0, T: 0, P: 4)	

COURSE OBJECTIVE:

The objectives of the course are to make the students understand and interpret drawings of machine Components so as to prepare assembly drawings and to familiarize the students with Indian Standards on drawing practices and standard components

COURSE CONTENT**1. Symbols and Conventions**

- 1.1. Mechanical Engineering Symbols/ Conventions
- 1.2. Electrical Engineering Symbols/Conventions.

2. Screw Threads

- 2.1. Types of Threads- Internal and External Threads, Right hand and Left hand threads (actual and conventional representation)
- 2.2. Different forms of Screw Threads- V-Threads (B.S.W Threads, American National and Metric thread)
- 2.3. Square Thread (Square, Acme, Buttress and Knuckle Thread)

3. Nuts and Bolts

- 3.1. Detailed Drawing of Hexagonal Nut and Hexagonal Bolt.
- 3.2. Assembly Drawing of Hexagonal Nut and Bolt with washer.
- 3.3. Detailed Drawing of Square Nut and Square Bolt.
- 3.4. Assembly Drawing of Square Nut and Bolt with washer.

4. Rivets and Riveted Joints

- 4.1. Various types of Rivet Heads.
- 4.2. Types of Riveted joints
 - a) Lap joint- Single Riveted, Double Riveted (Chain and Zig Zag)
 - b) Butt joint- Single Riveted, Single cover Butt joint and Double riveted double cover butt joint (Chain and Zig Zag)

5. Keys, Cotters and Coupling. (Free Hand Sketch)

- 5.1. Various types of keys and cotters.
- 5.2. Various types of Joints :-
 - a) Spigot and Socket Joint
 - b) Gib and Cotter Joint

c) Knuckle Joint

5.3. Pipe Joints:- Expansion Pipe Joint. (Assembly Drawing)

Flanged Pipe and Right-angled bend joint. (Assembly Drawing)

Spigot and Socket Joint

5.4. Coupling:- Flange Coupling (protected and non-protected)

Universal coupling and Oldham Coupling

6. Auto CAD

6.1. Various types of Modify Commands.

6.2. Dimensioning and placing text in drawing area.

6.3. Drawing of objects which were drawn by free hand Sketching in Unit 5.

6.4. Sectioning and hatching .

6.5. Concept of Layers and Work on Multiple Layers.

COURSE OUTCOME

After completing this course, the student will be able to:

- Draw the assembly drawings of nut, bolt, rivets, keys and cotter and couplings.
- Identify various CAD commands and use them to draw various machine components.

RECOMMENDED BOOKS

1. Elementary Engineering Drawing (in first angle projection) by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh Published by Dhanpat Rai and Co. Delhi
3. Engineering Drawing by PS Gill; published by SK kataria and Sons, New Delhi
4. Machine Drawing by RB Gupta published by Satya Prakashan, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	03	05
2	05	10
3	12	15
4	12	15
5	14	25
6	18	30
Total	64	100

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC206	Course Title: MATERIAL SCIENCE AND METTALURGY
Semester: 2ND	Credits: 3
Periods Per Week : 3 (L: 3, T: 0, P: 0)	

COURSE OBJECTIVES:

The objective of the course is enable the candidate to comprehend atomic bonding and crystal formations, to learn the characteristics of various kinds of ferrous metals and alloys, and to better understand the characteristics of various non-ferrous metal and alloy types; moreover, to comprehend various metallic failures, learn about material testing.

COURSE CONTENT**1. Crystal structures and Bonds:**

- 1.1. Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell.
- 1.2. Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.

2. Phase diagrams, Ferrous metals and its Alloys:

- 2.1. Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel;
- 2.2. Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses;
- 2.3. Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI;
- 2.4. Alloy Steels – purpose of alloying; effects of alloying elements –
- 2.5. Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS,
- 2.6. Applications of SS – magnet steel – composition, properties and

3. Non-ferrous metals and its Alloys:

- 3.1. Properties and uses of aluminium, copper, tin, lead, zinc, magnesium and nickel;
- 3.2. Copper alloys: Brasses, bronzes – composition, properties and uses;
- 3.3. Aluminium alloys: Duralumin, hindalium, magnelium – composition, properties and uses;

- 3.4. Nickel alloys: Inconel, Monel, nicPerome – composition, properties and uses.
 3.5. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

4. Failure analysis & Testing of Materials:

- 4.1. Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture;
 4.2. Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test.
 4.3. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.

5. Theory of Heat Treatment:

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

COURSE OUTCOME

After the completion of the course the student will be able to :

- Explain about crystal structures and atomic bonds.
- Describe about classification of ferrous metals and their properties.
- Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
- Understand various metallic failures and can conduct destructive and nondestructive testing of materials.

RECOMMENDED BOOKS

1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi.
2. Material Science & Engineering – R.K. Rajput, S.K. Kataria & Sons, New Delhi.
3. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	12	26
2	12	24
3	12	18
4	08	16
5	08	16
Total	48	100

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC207	Course Title: MATERIAL SCIENCE AND METTALURGY LAB
Semester: 2ND	Credits: 1
Periods Per Week : 2 (L: 0, T: 0, P: 2)	

COURSE OBJECTIVE:

The objective of the course is enable the candidate the practical aspects of atomic bonding and crystal formations, to learn the characteristics of various kinds of ferrous metals and alloys, and to better understand the characteristics of various non-ferrous metal and alloy types; moreover, to comprehend various metallic failures, learn about material testing.

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.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC208	Course Title: MANUFACTURING TECHNOLOGY-I
Semester: 2ND	Credits: 3
Periods Per Week: 3 (L: 3, T: 0, P: 0)	

COURSE OBJECTIVE:

The objective of this course is to familiarize the students with various fabrication and manufacturing techniques like welding, casting and molding, forging and forming, besides enable them to understand production techniques for metal powder.

COURSE CONTENT**1. Foundry Technology**

- 1.1. Patterns: Definition – types of pattern – solid piece – split piece – loose piece – match plate – sweep – skeleton – segmental – shell – pattern materials – pattern allowances.
- 1.2. Moulding: Moulding sand – constituents – types – properties of moulding sand – moulding sand preparation – moulding tools – moulding boxes – types of Moulds – green sand mould – dry sand mould – loam sand mould – methods of Moulding – Moulding machines – Jolting – Squeezing – sand slinger Construction and working principle.
- 1.3. Cores: Essential qualities of core – materials – core sand preparation – core binders – core boxes – CO₂ process core making – types of core.
- 1.4. Metallurgy: Introduction – Iron-carbon diagram. Melting furnaces: Blast furnace – Cupola furnace – Crucible furnace – types – Pit furnace – Coke fired – Oil fired – Electric furnace – types – Direct arc – Indirect arc – Induction furnace –working principles

2. Casting:

- 2.1. Shell mould casting – Investment casting – Pressure die casting – Hot chamber die casting – Cold chamber die casting – Gravity die casting – Centrifugal casting – Continuous casting.
- 2.2. Defects in casting – causes and remedies.

3. Welding Technology

- 3.1. Arc Welding: Definition – arc welding equipment – electrode types – filler and flux materials – arc welding methods – Metal arc – Metal Inert gas (MIG) – Tungsten inert gas (TIG) - Submerged arc - Electro slag welding – Resistance welding – Spot welding – Butt welding – Seam welding – Plasma arc welding – Thermit welding – Electron beam welding – Laser beam welding – Friction welding – Ultrasonic welding – Induction welding – working principle – applications – Advantages and disadvantages.
- 3.2. Gas welding: Oxy-acetylene welding – advantages – limitations – gas welding equipment –three types of flames – welding techniques – filler rods. – Flame cutting – soldering – brazing – difference between soldering and brazing.
- 3.3. Types of welded joints –Selection of welding rod and type of flame for gas welding of

ferrous metals- merits and demerits of welded joints – Inspection and testing of welded joints – destructive and non-destructive types of tests – magnetic particle test – radiographic and ultrasonic test - defects in welding – causes and remedies.

4. Forming Technology

- 4.1. Forging: Hot working, cold working – advantages of hot working and cold working – hot working operations – rolling, forging, smith forging, drop forging, upset forging, press forging – roll forging.
- 4.2. Press Working: Types of presses – mechanical and hydraulic presses – press tools and accessories – press working operations – bending operations – angle bending – channel bending – curling – drawing – shearing operations – blanking, piercing, trimming – notching – lancing.

5. Powder Metallurgy:

- 5.1. Methods of manufacturing metal powders – atomization, reduction and electrolysis deposition – compacting – sintering – sizing – infiltration – mechanical properties of parts made by powder metallurgy – design rules for the powder metallurgy process.

COURSE OUTCOME

After completion of the course the student will be able to :

- Demonstrate understanding of casting process.
- Illustrate principles of forming processes.
- Demonstrate applications of various types of welding processes.
- Explain the concepts of rolling, forming and forging.
- Illustrate the concept of powder metallurgy.

RECOMMENDED BOOKS

1. Elements of Workshop Technology Volume I & II, Hajra Chowdry & Bhatt Acharaya, Media Promoters,
2. Introduction of Basic Manufacturing Processes and Workshop Technology, Rajender singh, New age International (P) Ltd. New Delhi
3. Manufacturing Process Begeman, Tata McGraw Hill, New Delhi.
4. Workshop Technology- Volume I, II, & III, WJ Chapman Viva Books Pvt. Ltd., New Delhi.
5. Workshop Technology by BS Raghuvanshi: Dhanpat Rai and Sons Delhi
6. Elements of Workshop Technology by SK Choudhry and Hajra: Asia Publishing House

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	14	30

2	05	12
3	16	30
4	08	16
5	05	12
Total	48	100

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC209	Course Title: MANUFACTURING TECHNOLOGY-I LAB
Semester: 2ND	Credits: 1
Periods Per Week : 2 (L: 0, T: 0, P: 2)	

COURSE OBJECTIVE:

The objective of this course is to familizize the candidates with the various casting, moulding, furnace, and casting process kinds, along with the design and operation of various welding techniques, besides to enable to comprehend various shaping processes and production techniques for metal powder.

LIST OF PRACTICALS

1. General introduction to hand tools used in foundry, welding and pattern making and smithy shop.
2. **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
3. **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.
4. **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.
5. **Forging Shop/Machine Shop**
 - Job 1. Preparation of single ended spanner by hand/machine forging.
 - Job 2. Preparation of simple die
 - Job 3. Turning and facing operations on Lathe Machine.
 - Job 4. External and Internal thread cutting on a lathe machine
 - Job 5. Demonstration of Knurling operation