POLYTECHNIC ENGINEERING

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-301
Course Title	BASIC MECHANICAL ENGINEERING
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives:

1 To understand General Principles of Mechanical Engineering.
2 To understand laws of thermodynamics, thermal and thermodynamic Processes.
3 To understand working principles of power developing and power absorbing devices.
4 To understand basic materials and manufacturing processes..

Course outcomes:

At the end of the course, the student will be able to:
1 Understand basics of thermodynamics and components of a thermal power plant
2 Understand basics of heat transfer, refrigeration and internal combustion engines
3 Understand mechanism of thermal power plant and boiler operation
4 Identify engineering materials, their properties, manufacturing methods encountered in engineering practice
5 Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines

UNIT-I: Introduction to Thermodynamics - Role of Thermodynamics in Engineering and Science, Types of Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Heat and Work Interactions for various non-flow and flow processes; Concept of Heat Engine, Heat Pump & Refrigerator, Efficiency/ COP; Kelvin-Planck and Clausius Statements, Carnot Cycle, Carnot Efficiency, T-S and P-V Diagrams, Concept of Entropy (Definition only).

Unit-II: Heat transfer & Thermal Power Plant: Modes of Heat Transfer; Conduction: Composite Walls and Cylinders, Combined Conduction and Convection: Overall Heat Transfer Co-efficient, Simple Numerical Problems: Thermal Power Plant Layout; Rankine Cycle; Fire Tube and Water Tube boilers, Babcock & Wilcox, Cochran Boilers.

Unit-III: Steam Turbines: Impulse and Reaction Turbines; Condensers: Jet & Surface Condensers, Cooling Towers; **Internal Combustion Engines and Refrigeration:** Otto, Diesel and Dual cycles; P-V and T-S Diagrams; IC Engines: 2 - Stroke and 4 - Stroke I.C. Engines, S.I. and C.I. Engines.

Unit-IV: Materials and Manufacturing Processes: Engineering Materials, Classification and their Properties; Metal Casting, Moulding, Patterns, Metal Working: Hot Working and Cold Working, Metal Forming: Extrusion, Forging, Rolling, Drawing, Gas Welding, Arc Welding, Soldering, and Brazing.

Unit-V: Machine Tools and Machining Processes: Machine Tools: Lathe Machine and types, Lathe Operations, Milling Machine and types, Milling Operations, Shaper and Planer Machines: Differences, Quick-Return Motion Mechanism, Drilling Machine: Operations, Grinding Machine: Operations.

Reference Books:

1. Basic Mechanical Engineering – M.P. Poonia & S.C. Sharma, Khanna Publishing House, Delhi
2. Elements of Mechanical Engineering – M. L. Mathur, F. S. Mehta and R. P. Tiwari, Jain Brothers, New Delhi
3. Engineering Heat Transfer – Gupta & Prakash, Nem Chand & Brothers, New Delhi
4. Workshop Technology (Vol. 1 and 2) – B. S. Raghuvanshi, Dhanpath Rai and Sons, New Delhi.
5. Basic Mechanical Engineering – J Benjamin 225 Mechanical Engineering Curriculum Structure
6. Elements of Mechanical Engineering – Roy and Choudhary
7. Engineering Thermodynamics – Spalding and Cole

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-302
Course Title	MATERIAL SCIENCE & ENGINEERING
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives:

1 To understand crystal structures and atomic bonds.
2 To understand the properties of different types of ferrous metals and alloys.
3 To understand the properties of different types of non-ferrous metals and alloys.
4 To understand various metallic failures and acquire the knowledge of testing of materials.
5 To understand the concept of corrosion and its prevention. Python.

Course outcomes:

At the end of the course, the student will be able to:
1 Explain about crystal structures and atomic bonds.
2 Describe about classification of ferrous metals and their properties.
3 Explain about non-ferrous metals, cutting tool materials and composites along with their properties.
4 Describe about the various metallic failures and knowledge in testing of materials.
5 Explain the principle of corrosion, their types and its prevention methods along with the various surface engineering processes.

UNIT-I: Crystal structures and Bonds: 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.
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.

Unit-II: Phase diagrams, Ferrous metals and its Alloys: Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; 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; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses

Unit-III: Non-ferrous metals and its Alloys: Properties and uses of aluminium, copper, tin, lead, zinc, magnesium and nickel; Copper alloys: Brasses, bronzes – composition, properties and uses; Aluminium alloys: Duralumin, hindalium, magnelium – composition, properties and uses; Nickel alloys: Inconel, monel, nicPerome – composition, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.

Unit-IV: Failure analysis & Testing of Materials: 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; Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test. Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.

Unit-V: Corrosion & Surface Engineering: Nature of corrosion and its causes; Electrochemical reactions; Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control: Material selection, environment control and design; Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-fetching ;– Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

Reference Books:

1. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpath Rai and Sons, New Delhi. 2003.
2. Material Science & Engineering – R.K. Rajput, S.K. Kataria & Sons, New Delhi, 2004.
3. Material Science – R.S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-303
Course Title	FLUID MECHANICS & HYDRAULIC MACHINERY
Number of Credits	3 (L:3; T:0; P:0)

Course Objectives:

1 To understand fluid flow & related machinery for power generation, water supply and irrigation.
2 To Select and use appropriate flow measuring device.
3 To Select and use appropriate pressure measuring device.
4 To understand and analyze the performance of pumps and turbines. problems.

Course outcomes:

At the end of the course, the student will be able to:
1 Measure various properties such as pressure, velocity, flow rate using various instruments.
2 Calculate different parameters such as co-efficient of friction, power, efficiency etc of various Systems.
3 Describe the construction and working of turbines and pumps.
4 Test the performance of turbines and pumps.
5 Plot characteristics curves of turbines and pumps..

UNIT-I: Properties of fluid: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility.
Fluid Pressure & Pressure Measurement: Fluid pressure, Pressure head, Pressure intensity, Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdan pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers.

Unit-II: Fluid Flow: Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for discharge, coefficient of discharge and numerical problems.
Flow Through Pipes: Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes, Hydraulic gradient and total gradient line, Numerical problems to estimate major and minor losses

Unit-III: Impact of jets: Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on curved vanes with special reference to turbines & pumps, Simple Numericals on work done and efficiency.

Unit-IV: Hydraulic Turbines: Layout of hydroelectric power plant, Features of Hydroelectric power plant, Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available, Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Draft tubes – types and construction, Concept of cavitation in turbines, Calculation of Work done, Power, efficiency of turbines, Unit quantities and simple numericals.

Unit-V: Centrifugal Pumps: Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitation, Manometric head, Work done, Manometric efficiency, Overall efficiency. Numericals on calculations of overall efficiency and power required to drive pumps.
Reciprocating Pumps: Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitation and separation.

Reference Books:

1. Fluid Mechanics & Hydraulic Machines, S.S. Rattan, Khanna Publishing House, New Delhi
2. Hydraulic, fluid mechanics & fluid machines – Ramamrutham S, Dhanpath Rai and Sons, New Delhi.
3. Hydraulics and fluid mechanics including Hydraulic machines – Modi P.N. and Seth S.M., Standard Book House. New Delhi
4. One Thousand Solved Problems in Fluid Mechanics – K. Subramanya, Tata McGraw Hill.
5. Hydraulic, fluid mechanics & fluid machines – S. Ramamrutham, Dhanpat Rai and Sons, New Delhi
6. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications, New Delhi

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-303
Course Title	FLUID MECHANICS & HYDRAULIC MACHINERY Lab
Number of Credits	1 (L:0; T:0; P:2)

List of practical to be performed:

I Verification of Bernoulli's theorem.

II Determination of Coefficient of Discharge of Venturi meter.

III Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of Orifice meter.

IV Determination of coefficient of friction of flow through pipes.

V Demonstration of stream line and turbulent flow by Reynolds experiment.

VI Trial on centrifugal pump to determine overall efficiency.

VII Trial on reciprocating pump to determine overall efficiency.

VIII Trial on Pelton wheel to determine overall efficiency.

IX Trial on Francis/Kaplan turbine to determine overall efficiency.

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-304
Course Title	Manufacturing Engineering
Number of Credits	3 (L:3: T:0: P:0)

Course Objectives:

1 To understand the importance of cutting fluids & lubricants in machining.
2 To study various types of basic production processes. To select, operate and control the appropriate processes for specific applications.
3 To understand the concept of gear making and list various gear materials.
4 To understand the importance of press tools and understand various die operations.
5 To understand Grinding and finishing processes.

Course outcomes:

At the end of the course, the student will be able to:
1 Know and identify basic manufacturing processes for manufacturing different components.
2 Operate & control different machines and equipments.
3 Produce jobs as per specified dimensions and inspect the job for specified dimensions.
4 Select the specific manufacturing process for getting the desired type of output.
5 Adopt safety practices while working on various machines.

UNIT-I: Cutting Fluids & Lubricants: Introduction; Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of lubricants.
Lathe Operations: Types of lathes – light duty, Medium duty and heavy duty geared lathe, CNC lathe; Specifications; Basic parts and their functions; Operations and tools – Turning, parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning.

Unit-II: Broaching Machines: Introduction to broaching; Types of broaching machines – Horizontaltype (Single ram & duplex ram), Vertical type, Pull up, pull down, and push down; Elements of broachtool; broach teeth details; Nomenclature; Tool materials.
Drilling: Classification; Basic parts and their functions; Radial drilling machine; Types of operations; Specifications of drilling machine; Types of drills and reamers.

Unit-III: Welding: Classification; Gas welding techniques; Types of welding flames; Arc Welding – Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIG welding; Resistance welding - Spot welding, Seam welding, Projection welding; Welding defects; Brazing and soldering: Types, Principles, Applications.
Milling: Introduction; Types of milling machines: plain, Universal, vertical; constructional details – specifications; Milling operations: simple, compound and differential indexing; Milling cutters – types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool & work holding devices.

Unit-IV: Gear Making: Manufacture of gears – by Casting, Moulding, Stamping, Coining Extruding, Rolling, Machining; Gear generating methods: Gear Shaping with pinion cutter & rack cutter; Gear hobbing; Description of gear hob; Operation of gear hobbing machine; Gear finishing processes; Gear materials and specification; Heat treatment processes applied to gears.
Press working: Types of presses and Specifications, Press working operations - Cutting, bending, drawing, punching, blanking, notching, lancing; Die set components- punch and die shoe, guide pin, bolster plate, stripper, stock guide, feed stock, pilot; Punch and die clearances for blanking and piercing, effect of clearance.

Unit-V: Grinding and finishing processes: Principles of metal removal by Grinding; Abrasives – Natural & Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, bakelite; Factors affecting the selection of

grind wheels: size and shape of wheel, kind of abrasive, grain size, grade and strength of bond, structure of grain, spacing, kinds of bind material; Standard marking systems: Meaning of letters & numbers sequence of marking, Grades of letters; Grinding machines classification: Cylindrical, Surface, Tool & Cutter grinding machines; Construction details; Principle of centreless grinding; Advantages & limitations of centre less grinding; Finishing by grinding: Honing, Lapping, Super finishing; Electroplating: Basic principles, Plating metals, applications; Hot dipping: Galvanizing, Tin coating, Parkerising, Anodizing; Metal spraying: wire process, powder process and applications; Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubber base coating; Finishing specifications.

Reference Books:

1. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications
2. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, Media Promoters and Publishers Limited.
3. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.
4. Fundamental of metal cutting and machine tools– B. L. Juneja, New age international limited.
5. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications
6. Production Technology – R.B. Gupta, Satya Prakashan, New Delhi

Undergraduate Diploma Courses in Engineering & Technology

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Semester-III

Course Code	DMEA-304
Course Title	Manufacturing Engineering Lab
Number of Credits	1 (L:0; T:0; P:2)

List of practical to be performed:

1 Familiarization with programming environment (Editor, Compiler, etc.)
2 Programs using I/O statements and various operators
3 Programs using expression evaluation and precedence
4 Programs using decision making statements and branching statements
5 Programs using loop statements
6 Programs to demonstrate applications of n dimensional arrays
7 Programs to demonstrate use of string manipulation functions
8 Programs to demonstrate parameter passing mechanism
9 Programs to demonstrate recursion
10 Programs to demonstrate use of pointers
11 Programs to demonstrate command line arguments and dynamic memory allocation

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-305
Course Title	Thermal Engineering - I
Number of Credits	3 (L:3: T:0: P:0)

Course Objectives:

1To give a good understanding of and thorough insight into all important aspects of thermal systems, energy control and the general issue of energy.

2 To understand the principles & working of various power producing & power absorbing devices.

3 To study, analyze and evaluate the operation and the performance of I.C. engines, compressors and refrigerators, to apply pinch technology and to critically analyze and describe the global behavior of integrated thermal systems.

Course outcomes:

At the end of the course, the student will be able to:

1 Know various sources of Energy and their applications.
2 Classify I.C. engines and understand their working and constructional features.
3 Draw the energy flow diagram of an I.C. engine and evaluate its performance.
4 Describe the constructional features of air compressor and working of different air compressors.
5 Know the applications of refrigeration and Classify air-conditioning systems.

UNIT-I: Sources of Energy: Brief description of energy Sources: Classification of energy sources - Renewable, Non-Renewable; Fossil fuels, including CNG, LPG; Solar Energy: Flat plate and concentrating collectors & its applications (Solar Water Heater, Photovoltaic Cell, Solar Distillation); Wind Energy; Tidal Energy; Ocean Thermal Energy; Geothermal Energy; Biogas, Biomass, Bio-diesel; Hydraulic Energy, Nuclear Energy; Fuel cell.

Unit-II: Internal Combustion Engines: Assumptions made in air standard cycle analysis; Brief description of Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Internal and external combustion engines; advantages of I.C. engines over external combustion engines; classification of I.C. engines; neat sketch of I.C. engine indicating component parts; Function of each part and materials used for the component parts - Cylinder, crank case, crank pin, crank, crank shaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C.I. and S.I. engines; Valve timing and port timing diagrams for four stroke and two stroke engines.

Unit-III: I.C. Engine Systems: Fuel system of Petrol engines; Principle of operation of simple and Zenith carburettors; Fuel system of Diesel engines; Types of injectors and fuel pumps; Cooling system- air cooling, water cooling system with thermo siphon method of circulation and water cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water cooling system; Ignition systems – Battery coil ignition and magneto ignition (description and working). Comparison of two systems; Types of lubricating systems used in I.C. engines with line diagram; Types of governing of I.C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing; their applications; Objective of super charging.

Unit-IV: Performance of I.C. Engines: Brake power; Indicated power; Frictional power; Brake and Indicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical efficiency; Relative efficiency; Performance test; Morse test; Heat balance sheet; Methods of determination of B,P., I.P. and F.P.; Simple numerical problems on performance of I.C. engines.

Unit-V: Air Compressors: Functions of air compressor; Uses of compressed air; Types of air compressors; Single stage reciprocating air compressor - its construction and working (with line diagram) using P-V diagram; Multi stage compressors – Advantages over single stage compressors; Rotary compressors: Centrifugal compressor, axial flow type compressor and vane type compressors.

Refrigeration & Air-conditioning: Refrigeration; Refrigerant; COP; Air Refrigeration system: components, working & applications; Vapour Compression system: components, working & applications; Air conditioning; Classification of Air-conditioning systems; Comfort and Industrial Air-Conditioning; Window Air-Conditioner; Summer Air-Conditioning system, Winter Air-Conditioning system, Year-round Air-Conditioning system.

Reference Books:

1. Introduction to Renewable Energy – Vaughn Nelson, CRC Press
2. Thermal Engineering – P.L. Ballaney, Khanna Publishers, 2002
3. A Course in Thermal Engineering – S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai.
4. Thermal Engineering – R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, NewDelhi.
5. Thermal Engineering – R. K. Rajput,8th Edition, Laxmi publications Pvt Ltd, New Delhi.

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-305
Course Title	Thermal Engineering – I Lab
Number of Credits	1 (L:0; T:0; P:2)

List of practical to be performed:

I Flash & Fire point tests using Able's/Cleveland/Pensky Martin Apparatus

II Viscosity measurement usi/Saybolt viscometer

III Calorific value tests using Bomb Calorimeter (Solid and Liquid fuels) and Junkers Gas Calorimeter (Gaseous fuels)

IV Carbon residue test using Conradson's apparatus.

V Assembling and disassembling of I.C. Engines

VI Port timing diagram of Petrol engine

VII Port timing diagram of Diesel engine

VIII Valve timing diagram of Petrol engine

IX Valve timing diagram of Diesel engine

X Study of petrol and diesel engine components and Models

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Undergraduate Diploma Courses in Engineering & Technology

Department of Mechanical Engineering

Semester-III

Course Code	DMEA-306
Course Title	Summer Internship-1
Number of Credits	2 (L:0: T:0: P:0)

Objective of Industrial Training

The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem .

Scheme of Studies: Duration: Minimum 2 weeks in summer break after IV semester, assessment to be done in V Semester

Guidelines:

- The industrial training is also a kind of team activity. Here development and design work with a focus on learning application environment.
- Industrial training cater a system required in laboratory or real life.
- Student is expected to learn out specifications, methodology, resources required, critical issues involved in design and Production
- The student is expected to exert on testing of the proposed results as per the industry

THE END