DRAFT SYLLABUS OF DIPLOMA ENGINEERING
(3rd Semester)

BRANCH: MECHANICAL ENGINEERING

Under

MANAV BHARTI UNIVERSITY
SOLAN (HIMACHAL PRADESH)

DIPLOMA MECHANICAL ENGINEERING
SEMESTER III

S.No.	Subject Code	Subject	Credit	L-T-P	Marks Weightage	
					Theory	**Sessional**
1	DM-201E	Strength of Materials	4	3-1-0	75	25
2	DM-203E	Thermodynamics	4	3-1-0	75	25
3	DM-205E	Basics of Electrical and Electronics Engineering	4	3-1-0	75	25
4	DM-207E	Workshop Technology-I	3	3-0-0	75	25
5	DM-209E	Machine Drawing	6	2-0-4	75	25
					Ext.	Internal
6	DM-211E	Workshop Practice-I	6	0-0-6	25	25
7	DM-213E	Strength of Materials Lab	2	0-0-2	25	25
8	DM-215E	Thermodynamics Lab	2	0-0-2	25	25
9	DM-217E	BEE Lab	2	0-0-2	25	25
		TOTAL	**33**	**14-3-16**	**475**	**225**

STRENGTH OF MATERIALS
DM-201E

L-T- P
3- 1- 0

Section A
Stresses and Strains: Concept of load, stresses and strain, Tensile, compressive and shear stresses and strains, Concept of elasticity, elastic limit and limit of proportionality, Hooke's Law, Young's Modulus of elasticity, Yield point, plastic stage, Strain hardening, Stress strain diagram, Ultimate strength and breaking stress, Percentage elongation, Principle of superposition, Free body diagram, Proof stress and working stress, Factor of safety, Bars of varying cross-section, Temperature stresses and strains, Composite sections under compression and tension, Lateral strain, Poisson's ratio, Numerical Problems.

Resilience and Instantaneous Stress: Concept of resilience, proof resilience and co-efficient of resilience, Modes of loading: gradual loading, sudden loading and falling load, Calculation of instantaneous stress induced due to gradual loading, sudden load and falling loads - Numerical problems on the above.

Section B
Beams and Bending Stress: Concept of beams, Types of beams, Types of loading, Concept of end supports: Roller, hinged and fixed, Concept of bending moment and shearing force, Bending moment and shearing force diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and UDL. Point of contraflexure, Numerical problems

Moment of Inertia: Concept, Second moment of area, Radius of gyration, Theorem of parallel axes, Theorem of perpendicular axes, Section modulus, Moment of inertia of plane figures such as rectangle, square, triangle, circle, trapezium (without proof), Numerical problems on: Angle section, T section, I section, circular section, channel section, Z section, hollow section and removed section

Section C
Bending Stress: Concept of bending stresses, Theory of simple bending, assumptions made in bending theory, Use of equation $\sigma/y=M/I=E/R$, Concept of moment of resistance, Bending stress diagram, Calculation of maximum bending stress in beams of rectangular, I and T sections, Permissible bending stress, section modulus for rectangular, circular and symmetrical I sections

Springs: Determination of number of plates, Maximum bending stress and deflection, Closed coil helical spring subjected to axial load, Stress deformation, Stiffness and angle of twist and strain energy, Falling loads on springs, Numerical problems.

Section D
Columns: Concept of column, modes of failure, Types of columns, Buckling load, crushing load, Slenderness ratio, Factors effecting strength of a column, End restraints, Effective length, Strength of column by Euler Formula without derivation, Rankine Gourdan formula (without derivation), Numerical problems

Torsion: Concept of torsion, difference between torque and torsion, Derivation and use of torque equation, Shear stress diagram for solid and hollow circular shaft, Comparison between solid and hollow shaft with regard to their strength and weight, Power transmitted by shaft, Concept of mean and maximum torque, Numerical problems

RECOMMENDED BOOKS
1. Strength of Materials by R.S. Khurmi; S. Chand and Company, Delhi.
2. Strength of Materials by DR Malhotra, Satya Prakashan, Delhi.
3. Strength of Materials by RK Rajput, SK Kataria and Sons, Delhi
4. Strength of Materials by Birender Singh.
5. Strength of Materials by Dr. Sadhu Singh.

THERMODYNAMICS
DM-203E

Section A
Fundamental Concepts: 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.

Laws of Perfect Gases: 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.

Thermodynamic Processes of Gases: 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.

Section B
Laws of Thermodynamics: 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 to second laws of thermodynamics; Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion Machine of first kind, second kind, (PMM1, PMM2), Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy.

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

Properties of Steam: 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), measurement of dryness fraction, throttling calorimeter, separating and throttling calorimeter.

Section C
Steam Boiler: Water and fire tube boilers, construction and working of lancashire, babcock and Wilcox boilers. Various mountings and accessories of boilers.

Fuels and Combustion: Definition of fuel, types – solid, liquid and gaseous fuels, examples, uses of different types of fuels Calorific values of fuels, Dulong's formula for calorific value, calculation of calorific values, chemical composition of a fuel, Bomb calorimeter unit – description, procedure for determination of C.V. of solid or liquid fuel using bomb calorimeters, calculation of CV with test data Junker's gas calorimeter unit – description, determination of gas using Junker's calorimeter, Problems on CV determination with Junker's calorimeter test data Balance chemical equations for the combination of C, H, S, CH_4, and ethane Calculation of minimum air requirement for the complete combustion of unit mass/unit volume of fuel having a given composition, Conversion of volumetric analysis to gravimetric analysis and vice versa, calculation of percentage composition (by weight and volume) of fuel gas. Calculation of weight of fuel gases obtained by combustion of fuel with and without excess air, simple problems, Description of Orsat apparatus and use, procedure for determination of flue gas analysis, chemicals used for absorption of different gases in flue gases Description and working of a mechanical type of CO_2 recorder.

Section D
Air Standard Cycles: 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, calculations 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

Air Compressors: 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. 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

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

RECOMMENDED BOOKS
1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi
3. Basic Thermodynamics by PB Joshi and US Tumne; Pune Vidyarthi Grah Prakashan
4. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi
5. A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.

BASICS OF ELECTRONICS AND ELECTRONICS ENGINEERING
DM-205E

Section A
Application and Advantage of Electricity: Difference between AC and DC, various pplications of electricity, advantages of electrical enginergy over other types of energy

Basic Quantities of Electricity: Definition of voltages, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit

Section B
Electromagnetic Induction: Production of e.m.f., idea of a transformer and its working principle

Electric Motor: 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.

Section C
Distribution System: Difference between high and low voltage distribution system, identification of three-phase wire, neutral wires 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.

Domestic Installation: Distinction between light and fan circuits and single phase power circuit, subcircuits, various accessories and parts of electrical installation. Identification of wiring systems. Common safety measures and earthing.

Section D
Electrical Safety: 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.

Basic Electronics: Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses, characteristics and application of a thyristor, characteristics and applications of servo motors.

RECOMMENDED BOOKS
1. Basic Electrical Engineering by PS Dhongal; 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

<u>WORKSHOP TECHNOLOGY – I</u>
DM-207E

Section A
Welding Process: Principle of welding, Welding positions and techniques, symbols.

Gas Welding: Types of gas welding flames and their applications, Gas welding equipments- Gas welding torch, Oxy – acetylene cutting torch, Blowpipe, Pressure regulators, Filler rods and fluxes.

Arc Welding: 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.

Other Welding Processes: Principle of resistance welding, working and applications of spot welding, seam welding, projection welding and percussion welding. Welding defects and inspection of welded joints.

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

Section B
Pattern Making: Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores.

Moulding Sand: Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility. Various types of moulding sand.

Mould Making: Introduction to moulding tools, Types of moulds, Step involved in making a mould, Moulding boxes, hand tools used for mould making, Moulding processes: Bench moulding, floor moulding, pit moulding and machine moulding.

Special Casting Processes: Principles, working and applications of Dies casting: hot chamber and cold chamber, Centrifugal casting,

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

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

Section C

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

Drilling: Classification of drilling machines and their description. Various operations performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feed during drilling, impacts of these parameters on drilling, machining time. Types of drills and their features, nomenclature of a drill, Drill holding devices. Types of reamers.

Section D
Boring: Principle of boring, Classification of boring machines and their brief description.
- Specification of boring machines. Boring tools, boring bars and boring heads. Description of jig boring machine.

Cutting Tools and Cutting Materials: Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature. Properties of cutting tool material. Study of various cutting tool materials viz. High speed steel, tungsten carbide, cobalt steel, cemented carbides, satellite, ceramics and diamond. Cutting fluid – their types, importance, properties & advantages and applications.

REFERENCE BOOKS
1. A Text Book of Welding Technology by O.P. Khanna.
2. Welding Technology by R.L. Agarwal and Tahil Maghanani; Khanna Publishers, Delhi.
3. A Text Book on Foundry Technology by M.Lal and O.P.Khanna.
4. Foundry Engineering by Tahil Maghnani.
5. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons, Delhi.
6. Manufacturing Technology by M.Adithan and AB Gupta; New Age International (P) Ltd, Delhi.
7. Workshop Technology by RC Jindal; Ishan Publication Ambala city.
8. Elements of Workshop Technology by S.K.Choudhary and Hazara; Asia Publishing House.

Machine Drawing
DM-209E

Introduction: Limits and Fits, Limit system – tolerance, limits, deviation, allowance, basic size, design size. Tolerances-fundamental tolerances, fundamental deviation, method of placing limit dimensions. Fits- Clearance fit, transition fit, interference fit, hole basis system, shaft basis system, tolerance grades. Calculating values of clearance/interference, hole tolerance and, shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6, H8/u7. Surface Roughness Introduction-actual profile, reference profile, datum profile, mean profile, peakto-valley height, mean roughness index, surface roughness number. Use of machining symbols in production drawings, indication of surface roughness-indication of special surface roughness characteristics, indication of machining allowance, indication of surface roughness, symbols on drawings, method of indicating surface roughness on given components. Indicating roughness on a component for i) Surface to be obtained by any production method, ii) Surface to be obtained without removal of material.

Shaft Couplings: (2 sheets)
☐ Oldham coupling
☐ Universal coupling

Bearings: (5 sheets)
☐ Bush bearing
☐ Foot step bearing
☐ Plummer block
☐ Self aligning bearing
☐ Brackets

Pipe Joints: (5 sheets)
☐ Symbols for piping and layout plan of piping
☐ Flanged joint
☐ Socket and spigot joint
☐ Union joint
☐ Expansion pipe joint

I.C. engine parts: (2 sheets)
☐ I.C. engine connecting rods
☐ I.C. engine pistons

Screw Jack

RECOMMENDED BOOKS
1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons, Delhi.

2. Machine Drawing by R.K. Dhawan; S. Chand and Company, Delhi.
3. Machine Drawing by R.B. Gupta; Satya Parkashan, New Delhi.
4. Machine Drawing by N.D. Bhatt; Charotar Publishing House.
Note: 1. The drawings should include dimensions with tolerances, wherever necessary, and material list according to B.I.S. specifications as per SP46: 1988.
2. 25% of the drawing sheets should be drawn using AutoCAD.

WORKSHOP PRACTICES
DM-211E

LIST OF PRACTICALS

WELDING
1. Making following types of joints by gas welding
- Preliminary joining practice
- Vertical welding
2. Exercises of gas welding on the following
- Aluminum
- Brass
- Copper
- C.I.
3. Gas cutting of the following types
- Preliminary gas cutting practice
- Stock cutting by oxy acetylene
- C.I. cutting
4. Making following types of joints by arc welding on M.S, C.I and aluminium
- Joining practice by arc welding
- Butt and lap joint (in vertical position, travel up and down).
- Welding of outside corner joint.
- Inspection of the welding defects occurred in the job.
5. Exercise on spot welding.
6. Exercise on projection welding (industrial visit should be arranged).
7. Exercise on brazing.
8. Exercise on TIG welding.
9. Exercise on MIG welding.

FOUNDRY
10. Preparation of the Floor molding
11. Moulding and casting of- A solid pattern and A split pattern
12. Testing and inspection of casting defects visually.
13. Study of constructional features of coupla furnace.

TURNING
14. Simple exercise on turning and step turning.
15. A composite job involving turning, taper turning, thread cutting and knurling and Eccentric turning.
16. Exercise on internal threading on lathe.

DRILLING AND FITTING
17. Marking and drilling practice using column and knee type drilling machine and radial drilling machine.
18. A job on drilling, threading, reaming, counter boring and counter sinking.
19. Exercise on boring with the help of boring bar.
20. Dovetail fitting in mild steel piece
21. Radius fitting in mild steel piece.
22. Exercise on pipe bending on MS pipe and PVC pipe using pipe bending machine.

PATTERN MAKING
23. Preparation of solid pattern (single piece)
24. Preparation of split pattern
25. Preparation of self cored pattern

SOM LAB
DM-213E

LIST OF PRACTICALS
1. Tensile test on bars of mild steel and aluminum
2. Shear test on specimen of two different metals
3. Impact test on metals (a) Izod test (b) Charpy test
4. Torsion test on specimens of different metals for determining the angle of twist for a given torque
5. To determine the stiffness of a helical spring and to plot a graph between load and extension
6. Hardness test on metal and finding the Rockwell hardness

TD LAB
DM-215E

LIST OF PRACTICALS
1. To find out the dryness fraction of steam by throttling calorimeter.
2. Determination of calorific value of fuel by bomb calorimeter.
3. To find out specific fuel consumption by gravimetric or volumetric fuel equipment.
4. To find out the viscosity index of lubricant by Orsat Apparatus.
5. To find out CO_2 value of exhaust from engine by CO_2 recorder (Smokemeter).
6. To study the construction and working of single stage air compressor.
7. To find out the flash point of fuel by flash point apparatus.

8. Study of various fire tube and water tube boiler by models or by visits.
9. Study of various mounting and accessories of boilers.

BEE LAB
DM-215E

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. Charging of a lead – acid battery
4. Troubleshooting in domestic wiring system
5. Connection and reading of an electric energy meter
6. Study of a distribution board for domestic installation
7. Use of ammeter, voltmeter, wattmeter, energy meter and multi-meter
8. Ohm's Law verification
9. Verification of law of resistance in series
10. Verification of law of resistance in parallel
11. Study of different types of fuses
12. Study of earthing practices