SINGHANIA UNIVERSITY

Department

Of

Mechanical Engineering

(Syllabus for Diploma Mechanical Engg.)

Diploma 1 Year (Common for all Branches of Engineering)

Sr. No.	Code	Subjects
1	101	English & Communication Skills
2	102	Applied Physics
3	103	Applied Chemistry
4	104	Applied Mathematics
5	105	Computer & Information Technology Fundamental
6	106	Applied Mechanics
7	107	Engineering Drawing
8	108	Workshop Practice
9	109	Electrical & Electronics

(Diploma Detailed Syllabus for 1st Year)

Code 101 English and Communication Skills

1. Transformation of sentences, Determiners, Preposition.
2. Tense, Common errors (Noun, Pronoun, Articles, Adverb, Punctuation, etc.)
3. Modals, in conversational usage, prefix suffix idioms & phrasal Verbs.
4. Composition- 1. Unseen Passage, prefix suffix idioms & phrasal Verbs.
5. Letter Writing, Paragraph Writing, Report Writing.
6. Essay Writing

Code 102 Applied Physics

Units and dimensions, elasticity, Properties of Liquids, Gravitation and Satellites Sound Waves, Transfer of Heat, Electrostatics, D.C. Circuits, A.C. Circuits Semi conductor Physics, /modern Physics, Modern Physics, Nuclear Physics, Pollution and its control.

Code 103 Applied Chemistry

Atomic Structure, Development of periodic Table, Electro Chemistry, Kinetic theory of Gases, Carbon Chemistry, Metals and Alloys, Pollution, Water, Fuels, Corrosion, Polymers. Cement and Glass, Lubricants, Miscellaneous materials, New Engineering Materials.

Code 104 Applied Mathematics

Introduction of different type of expansion, complex Number, Trigonometry Matrices and determinants, Numerical integration, Two Dimensional Coordinate geometry Conic, Function, Different Calculus, Application of different calculus, Integral Calculus.
Differential Equations, Vector algebra.

Code 105 Computer and Information Technology Fundamentals

Introduction to computer, Operating System, Introduction to windows xp Information concept and processing, Computer and Communication Internet , Information Processing, Power Point.

Code 106 Engineering Mechanics

Force, Coplanar Forces, Moment, Application of principal of Force % Movements
Center of Gravity, Friction, Simple Machines, Rectilinear Motion, Motion Under Gravity Projectiles, Newton's laws of Motion, Impact and Collision, Circular Motion, Work power and Energy.

Code 107 Engineering Drawing

Introduction of Drawing Instruments, Lines Lettering and Dimensioning, Geometrical Construction and Engineering Curves, Scales, Theory of Orthographic Projection of solids, Conversion of Practical View into orthographic views, Section of solids and Development of Surfaces, Isometric Projection, Section and Conventions, Rivets and Riveted Joints Screw Threads and Fasteners, Foundation Bolt and locking Devices, Keys and Pulleys Shaft Coupling, Veering Building Drawing.

Code 108 Workshop Practices

Carpentry Shop, Welding and Sheet Metal Shop, Sheet Metal Shop, Fitting and Plumbing Shop.

Code 109 Electrical & Electronics Workshop

1. Identification of following resistors and finding their value
2. Identification of following capacitor and finding their value
3. Identification of following Switches and study of their working Mechanism
4. Identification and testing of connectors
5. Study of different relays and their contacts
6. Measuring of voltage, current and resistance using analog & Digital Millimeter
7. Testing of electronic component such as capacitor, inductor diode and transistor.
8. Measurement of amplitude e& frequency of a signal using CRO.
9. Verification of Ohm's Law using resistive circuit and analog meter.
10. Soldering of different passive component combination on general purpose PCB.
11. Sketching of different electronic components symbol on drawing sheet..

Electrical Workshop

1. Study of symbol, specification and approximate cost of common electrical accessories, tools and worse & cables required for domestic installation.
2. Study of
    a) Basic electricity rules for a domestic consumer
    b) Safety precaution & use of Fire fighting equipments.
3. Use of series of phase tester, series test lamp tong test and megger in testing of electrical installation.
4. a) Prepare of potential divider and measure resistance of a filament lamp using voltmeter and meter.
   b) Measurement of power and energy consumption by and electric heater using wattmeter and energy meter.
5. Preparation of wiring diagram, wiring testing, fault finding& costing for

a) Control of one lamp by one switch (using batten and tumbler switch

b) Control the staircase wiring (using batten and tumbler switch)

c) Control of one bell buzzer indenter by one switch (using conduit and flush type switch)

6. Prepare one Switchboard as per institutional requirement (using flush type switches. Sockets, MCB, ELCB, etc.)
7. Study Connecting testing and fault finding of
   a) Fluorescent rube and its necessaries
   b) Ceiling fan with resistance type and electronic regulator
8. Study Connecting testing and fault finding of
   a) Automatic electric Iron.
   b) Air Cooler
   c) Electric water pump
9. Design Draw and estimate the material required for installation for A small residential Building/ Office/ hall

		Semester - II			
9	21	ENGLISH AND COMMUNICATION TECHNIQUES – II	2	1	0
10	22	ENGINEERING PHYSICS – II	3	0	2
11	23	ENGINEERING CHEMISTRY–II	2	0	2
12	24	ENGINEERING MATHEMATICS–II	3	1	0
13	25	INFORMATION TECHNOLOGY FUNDAMENTALS	1	0	2
14	26	ENGINEERING MECHANICS – II	2	1	1
15	27	ENGINEERING DRAWING – II	1	0	6
16	28	WORKSHOP PRACTICE – II	0	0	6

Mechanical Engineering					
Sr. No.	**Paper Code**	**Name of Paper**	**Weekly Teaching Load**		
			Theory	**Practical**	**Tutorial**
		Semester - III			
17	ME31	STRENGTH OF MATERIALS – I	2	1	2
18	ME32	FLUID MECHANICS – I	2	1	2
19	ME33	MANUFACTURING PROCESS – I	4	0	2
20	ME34	THERMAL ENGINEERING	3	0	2
21	ME35	MATERIALS AND MATERIALS SCIENCE	2	0	2
22	ME36	ELECTRICAL ENGINEERING	3	0	2
23	ME37	MACHINE DRAWING	0	0	6
		Semester - IV			
24	ME41	STRENGTH OF MATERIALS – II	2	1	2

25	ME42	FLUID MACHINES	2	1	2
26	ME43	FLUID POWR AND TRIBOLOGY	2	0	2
27	ME44	INTERNAL COMBUSTION ENGINE	3	0	2
28	ME45	WORKSHOP TECHNOLOGY – I	2	0	6
29	ME46	METROLOGY	2	0	2
30	ME47	THEORY OF MACHINES	3	2	0
		Semester - V			
31	ME51	INDUSTRIAL ENGINEERING	3	1	0
32	ME52	INDUSTRIAL AND COMPUTER AIDED DRAFTING	1	0	6
33	ME53	INDUSTRIAL ELECTRONICS	2	0	2
34	ME54	THERMAL ENGINEERING – II	2	1	1
35	ME55	WORKSHOP THECHNOLOGY – II	3	0	6
		ELECTIVE – I	0	0	0
36	ME561	POWER PLANT ENGINEERING	3	1	0
37	ME562	MACHINE TOOL ENGINEERING	2	0	2
38	ME563	INSTRUMENTATION AND CONTROL	2	0	2
		ELECTIVE – II	0	0	0
39	ME571	'C' PROGRAMMING	2	0	2
40	ME572	COMPUTER IN BUSINESS SYSTEM	2	0	2
		Semester - VI			
41	ME61	REFRIGERATIN AND AIR CONDITIONING	3	0	3
42	ME62	AUTOMOBILE ENGINEERING	3	0	2
43	ME63	MANUFACTURING PROCESS – II	3	0	3
44	ME64	C.N.C. MACHINES AND AUTOMATION	3	0	3
45	ME65	MACHINE DESIGN	3	2	0
		ELECTIVE – III	0	0	0
46	ME661	MECHANICAL ESTIMATING AND COSTING	2	2	0
47	ME662	RENEWABLE ENERGY SOURCES	3	1	0
48	ME663	MAINTENANCE AND SAFETY ENGINEERING	2	0	2
		ELECTIVE – IV	0	0	0
49	ME671	MANAGEMENT	2	2	0
50	ME672	ENTREPRENEURSHIP DEVELOPMENT	2	2	0
51	ME673	PRODUCTION SYSTEM MANAGEMENT	2	2	0

Code	Name of Paper	Lecture	Tutorial	Practical
	STRENGTH OF MATERIALS - I	2	2/2	2

RATIONALE

In Engineering every structure or machine element is designed for a particular application. Then it is tested. A Diploma holder should be capable of designing the various elements for particular requirements. For this he must be able to calculate the stresses in an elements and their nature.

CONTENTS

1. Simple Stress and Strain :1.1 Various mechanical properties 1.1.1 Elasticity1.1.2 Plasticity1.1.3 Ductility1.1.4 Brittleness1.1.5 Toughness1.1.6 Hardness1.2 Concept of stress and strain1.2.1 Type of force - Direct, shear1.2.2 Stress - Tensile, compressive, shear1.3 Hook's law1.3.1 Statement of Hook's law1.3.2 Young's modulus of

elasticity1.3.3 Tensile test diagram1.3.3.1 Gauge length1.3.3.2 Limit of proportionality1.3.3.3 Elastic limit1.3.3.4 Yield point, Yield strength1.3.3.5 Ultimate stress1.3.3.6 Rupture strength1.3.3.7 Nominal stress1.3.3.8 Proof stress1.4 Working stress and factor of safety1.5 Stress and strain calculations 1.5.1 Principle of superposition1.5.2 Bar of homogeneous section1.5.2.1 Bar of uniform cross-section1.5.2.2 Bar of steeped cross-section1.5.3 Bar of composite section1.6 Temperature stresses 1.6.1 Homogeneous section1.6.2 Composite section1.7 Shear stresses1.7.1 Modulus of rigidity1.7.2 Complementary shear stress1.7.3 Concept of single shear and double shear 1.7.4 Shear strain1.8 Poisson's ratio and volumetric strain1.8.1 Lateral strain 1.8.2 Longitudinal strain1.8.3 Volumetric strain1.8.4 Bulk modulus1.9 Relationship between elastic constants (Derivation)1.9.1 E=3K(1-2/m)1.9.2 E=2N(1+1/m)1.9.3 E=9KN/(3K+N)2. Compound Stress :2.1 Introduction
2.2 Stress components on an inclined plane2.2.1 Induced by direct stresses2.2.2 Induced by simple shear2.2.3 Induced by direct and simple shear stresses2.3 Mohr's circle :2.3.1 For like direct stresses2.3.2 For unlike direct stresses2.3.3 For two perpendiculars direct stresses with state of simple shear2.4 Principal stresses and planes 2.4.1 Major principal stress2.4.2 Minor principal stress2.4.3 Mohr's circle method for principal stresses3. Strain Energy :3.1 Introduction 3.2 Strain energy from stress - strain diagram3.3 Proof resilience 3.4 Types of loading - gradual, sudden, impact 3.4.1 Stress in gradual loading 3.4.2 Stress in sudden loading3.4.3 Stress in impact loading4. Bending Moments and Shear Force :4.1 Basic concept4.1.1 Types of support4.1.1.1 Movable hinge support (roller)4.1.1.2 Immovable hinge support4.1.1.3 Fixed support4.1.2 Types of beam 4.1.2.1 Cantilever beam4.1.2.2 Simply supported beam4.1.2.3 Fixed beam4.1.2.4 Continuous beam4.1.2.5 Overhanging beam4.1.3 Types of load4.1.3.1 Point load
4.1.3.2 Distributed load - uniformly and non uniformly4.2 Shear force and bending moment4.2.1 Concept and calculation of shear force and bending moment
4.2.2 Sign convention for shear force and bending moment4.3 Bending moment and shear force diagrams (for point loads, U.D.L. and their combinations) 4.3.1 Cantilever beam4.3.2 Simply supported beam
4.3.3 Simply supported beam with over hang5. Moment of Inertia :
5.1 Conceptof moment of Inertia5.2 Radius of gyration5.2.1 Parallel axis theorem
5.2.2 Perpendicular axis theorem5.3 Moment of Inertia of various section5.3.1 Rectangle
5.3.2 Triangle 5.3.3 Circle 5.4 Moment of inertia of unsymmetrical section like : T-section, channel section, L-section etc.6. Bending Stresses in Beams :6.1 Concept of bending stress6.2 Theory of simple bending6.2.1 Assumptions in theory of simple bending6.2.2 Use of equation (without proof)6.3 Design criterion and section modulus6.3.1 Section modulus
6.3.2 Calculation of max bending stress in beams of rectangular, circular, I and T section7. Shear Stress in Beams :7.1 Concept
7.2 Use of equation (without proof)7.3 Shear stress distribution diagram of various sections7.3.1 Rectangle7.3.2 I section7.3.3 T section7.3.4 Channel section7.3.5 H section7.3.6 + section7.3.7 Circular section

PRACTICALS

1. Study of extensometers
2. Study and operation of UTM
3. Tensile test on mild steel specimen and plotting stress strain curve.
4. Bending test on timber beams.
5. Compression test on common structural materials viz. timber, cast iron etc.
6. Determination of toughness of cast iron and mild steel specimen by Charpy and Izod test.
7. Hardness test by Brinell and Rockwell test.

REFERENCE BOOKS :

1. Strength of Materials & B.C.Punmia Theory of Structures (vol. I)
2. Strength of Materials Ramamurtham
3. Strength of Materials Junarkar
4. Strength of Materials R.S. Khurmi
5. Strength of Materials (Hindi) Gurcharan

Code	Name of Paper	Lecture	Tutorial	Practical
CE32 MA32 ME32	**FLUID MECHANICS - I**	2	2/2	2

RATIONALE

Technicians have to deal with pressure measurement, transportation of fluids and themachines converting hydraulic power into mechanical power and vice versa, in the field/industries for that one has to have a basic knowledge of fluid mechanics. Topicssuch as pressure measurement, laws governing the flow of liquids, measurement of discharge, production of power are included in this subject.Although the major emphasis in this subject is on the study of liquids like water an incompressible fluid yet all the principles are applicable to all the fluids such as air, gas, steam etc.

CONTENTS

1. Introduction : Introduction concepts Fluids and solids Liquid, gas and vapour Fluid mechanics Kinematics Dynamic Fluid properties Density Specific volume Specific gravity Viscosity Newton's law of viscosity Dynamic and Kinematic viscosity Compressibility Surface tension - soap bubble, drop Capillarity Vapour pressure and its importance

2. Fluid Pressure and its Measurement :

Definition and its units Pascal's law Intensity of pressure at a point in fluid at rest Pressure head Pressure Atmospheric pressure Gauge pressure Vacuum pressure Absolute pressure Differentials pressure Law of hydrostatic pressure Brahma's press Pressure measurement Manometers Piezometer - its limitation U-tube - simple, differential, inverted Micro-manometers Inclined tube micro-manometers Mechanical gauge Bourdon gauge Bellow gauge Diaphragm gauge Dead weight gauge

3. Hydrostatics :

Total pressure Centre of pressure Total pressure and center of pressure in following cases Plane surface immersed horizontally Plane surface immersed vertically Plane surface immersed at an angle Curved surface (no proof) Working of lock gates, sluice gate
3.5 Pressure on masonry dams of rectangular and trapezoidal sections and their condition of stability

4. Hydrokinematics :

Description of fluid flow Eular approach Lagrangian approach Definition of path line, stream line Types of flow Steady - Non steady Uniform - Non uniform Laminar – Turbulent One, Two, Three dimensional flow Continuity equation (no proof) : Assumption Rate of discharge For one dimensional flow

5. Hydrodynamics and Measurement of Flow :

Energy of fluid - pressure, kinetic and potential Bernoulli's theorem (no proof) Assumptions and its limitation Conversion of pressure into pressure head, velocity into kinetic head Applications of Bernoulli's theorem Pitot-tube Venturimeter Orificemeter

6. Orifices and Notches :

Definition and classification Discharge through small orifices Coefficient of contraction Coefficient of velocity Coefficient of discharge Coefficient of resistance Time of emptying a vessel of uniform cross section through an orifice at bottom.
Notches – Classification Crest, Nappe Difference between notch and weir Flow over - Triangular notch Rectangular notch

[Simple numerical problems without velocity of approach]

PRACTICALS.

1. Study of different types of manometers and pressure gauges
2. Verification of Bernoulli's theorem
3. Determination of Cd for Venturimeter

4. Determination of Cd for Orificemeter
5. Determination of Cc,Cv and Cd of small orifice
6. Visit of a near by dam

REFERENCE BOOKS :

1. Fluid Mechanics & Machines Dr. Jagdish Lal
2. Fluid Mechanics & Machines Dr. R.K.Bansal
3. Fluid Mechanics & Machines R.S.Khurmi.
4. Hydraulics & Pneumatics H.L. Stewart.

Code	Name of Paper	Lecture	Tutorial	Practical
MA33	**MANUFACTURING PROCESS - I**	4	-	2

RATIONALE

This subject provides an opportunity to the student to learn about various welding processes and foundry work. Welding is very useful for fabrication work and Foundry for production of castings used for manufacturing of machines. This also gives knowledge of metal cutting mechanism to the student. Theory is to be supported by visits to industries and case studies. This will help in developing proper attitude and skill to the technicians. Hence the technicians will be in a position to help and solve the problems of industry.

CONTENTS

1. Welding Process : Classification of welding process, Industrial applications of welding.

2. Gs Welding : Principle of oxy-acetylene gas welding, Construction of oxy- acetylene cutting torch and gas welding torch Blowpipes, single stage and double stage regulators. Gas cutting (oxy-acetylene), lance cutting, flames gauging, grooving

3. Electric Welding Process : Difference between A.C and D.C arc welding, Equipments and accessories of A.C and D.C welding plants Effect of polarity, length of arc, penetration, crater, arc blow Electrodes (Metal and Carbon), B.I.S specification for welding Symbols and electrodes, Flux and their functions Resistance welding Spot welding, butt welding, flash welding Seam welding, percussion welding and projection welding Atomic hydrogen welding Shielded metal arc welding, Submerged arc welding

Pressure welding Welding distortion, welding defects, method of controlling welding defects and inspection of welded joints

4. Modern Welding Methods : Tungsten inert gas welding (TIG) Principle of operation, advantage, disadvantages,application Metal inert gas welding (MIG) Principle of operation, advantage, disadvantages,application Thermit welding Electroslag welding, Electron beam welding Ultrasonic welding, Laser beam welding Robotic welding

5. Pattern Making : Introduction to materials - timber, metal, plastics and plaster of Paris etc. Allowances- shrinkage, draft, machining, distortion and shake

6. Types of Pattern : Solid, Split loose piece, match plate
Sweep, Gated, Skeleton, segmental, follow board, colour code for patterns as per B.I.S.

7. Moulding Sand Ingredients : Moulding sands-green, dry, loam, facing, baking, parting and core sands. Silica grain, binders, additive, moisture Properties of molding - sand, permeability, refractoriness, adhesiveness, cohesiveness, strength, flowability, collapsibility Tempering, sand conditioning and sand muller.

8. Core and Core Making : Core, core print and core boxes Types of cores, functions, advantage of core, shrinkage of cores Core sand and binders, core loams, oil and CO2 cores, synthetic resin Core Making procedure, core oven and core baking.

9. Testing of Moulding Sands : Need for testing chemical analysis, moisture content test, clay content test, Grain fineness test Permeability test and strength test.

10. Mould Making : Moulding boxes, hand tools used for mould making Steps involved in making a mould, gating system: definition and brief idea of basin, sprue, runner and gates Moulding machines - Squeeze machine, jolt squeeze machine and sand slinger. Moulding processes - Green sand, dry sand, loam, Co2 moulding, skin dried, plaster, metal moulding

11. Special Casting Techniques : Die casting - Hot chamber, cold chamber process Investment or lost wax process Centrifugal casting - True, Semi centrifugal, centrifugal Shell moudling Advantages, Disadvantages and application of above processes

12. Melting Furnaces : Cupola furnace - Construction, operation, preparation, charging Crucible furnace of tilting types - construction, operation

13. Castings : Different types of defects Testing of defects - Radiography, magnetic particle inspection, Ultrasonic inspection

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PRACTICALS

1. Making following types of joints by gas welding :

1.1 Preliminary joining practice on gas welding
1.2 Vertical welding

2. Exercises of gas welding on the following

2.1 Aluminium welding
2.2 Brass welding
2.3 Copper welding
2.4 C.I. welding

3. Gas cutting of the following types

3.1 Preliminary gas cutting practice
3.2 Stock cutting by oxy acetylene
3.3 C.I. cutting

4. Making following types of joints by arc welding

4.1 Preliminary joining practice by arc welding
4.2 Butt and lap joint (in vertical position travel up and down)
4.3 Welding of outside corner joint

5. Exercise on spot welding
6. Exercise on brazing
7. Exercise on TIG/MIG/CO2 welding
8. Pattern making : Preparation of solid pattern (single piece) Preparation of split pattern Preparation of self cored pattern

9. Preparation of the following types of moulds . Floor moulding Turn over moulding.

10. Testing of moulding sand- moisture content
11. Moulding and casting of A solid pattern A split pattern

12. Testing and inspection of casting defects visually Foundry exercise can be shown in a nearby industry/ foundry.

REFERENCE BOOKS :

1. A Text Book of Welding Technology O.P. Khanna
2. Welding Technology Tahil Maghnani
3. A Text Book on Foundry Technology M.Lal & O.P.Khanna.

4. Foundry Engineering Tahil Meghnani
5. Manufacturing Process - I R.K. Yadav

Code	Name of Paper	Lecture	Tutorial	Practical
MA34	**THERMAL ENGINEERING - I**	3	-	2

RATIONALE

For technical education in mechanical engineering field the subject of thermal engineering is very important for under standing the basic principles and concept of thermodynamics and its application.

CONTENTS

1. Basic Concept and Gas Laws : Thermodynamics, property-Intensive and Extensive, system - open, closed and isolated Energy - Internal energy, potential energy, kinetic energy, heat, work, specific heat, enthalpy Boyle's law, Charle's law, Joule's law Characteristics gas equation, gas constant, mol, universal gas constant and molar specific heats Simple numerical problems

2. Laws of Thermodynamics : Zeroth law of thermodynamics First law of thermodynamics. Second law of thermodynamics Concept of entropy Constant volume, constant pressure, isothermal, adiabatic polytropic processes, throttling and free expansion, work done during these processes. Simple numerical problems

3. Availability : Available and unavailable energy Effectiveness Irreversibility in flow and non-flow process.

4. Formation of Steam and its Properties : Generation of steam at constant pressure, various stage of steam- wet steam, dry steam saturated steam, dryness fraction, super heated steam, degree of super heat. Critical point, triple point, thermodynamic properties of steam - specific volume, specific enthalpy, specific internal energy, specific entropy. Steam property diagram: temperature - entropy diagram, enthalpy- entropy diagram, pressure - enthalpy diagram Heating and expansion of steam during thermodynamic processes, Change of internal energy and entropy of steam during processes Simple numerical problems Use of steam tables and Mollier charts.

5. Steam Generators : Definition of boiler according to I.B.R., classification of boilers, description and working of Lancashire, Cochran and Babcock and Wilcox boilers, Comparison of water tube and fire tube boilers. Brief description and working of boiler mountings and accessories used in common boilers. Special characteristics of high-pressure boilers, Structural details and working of Lamont, Benson and Schmidt Hartmann boilers Introduction to Indian Boiler Act.

6. Boiler Performance : Actual evaporation, Equivalent evaporation, Factor of evaporation, Boiler efficiency Heat losses in boiler plants, Boiler power, Energy balance sheet of boiler. Simple numerical problems

7. Vapour Power Cycle : Rankine cycle, modified rankine cycle, representation on p-v, t-s and h-s charts and efficiency Simple numerical problems

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PRACTICALS

1. Study by models/charts/actual units of the following: Common type of fire tube and water tube boilers. Boiler mountings Boiler accessories High pressure boilers

2. Determination of dryness fraction of steam by separating and throttling calorimeter

REFERENCE BOOKS :

1. Thermal Engineering (Hindi) Verma & Gulecha
2. Thermal Engineering Vol.1 Mathur & Mehta .
3. Thermal Engineering R.K.Purohit.
4. Thermal Engineering R.S. Khurmi
5. Elements of Heat Engines -Vol.1 Patel & Karam Chandani

Code	Name of Paper	Lecture	Tutorial	Practical
MA35	**MATERIALS AND MATERIAL SCIENCE**	2	-	2

RATIONALE

Lot of development has taken place in the field of materials. New materials are being developed. It has become possible to change the properties of materials to suit the requirements. Diploma holders in mechanical engineering are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and nonferrous materials and various heat treatment processes. This subject aim at developing knowledge about characteristics, testing and usage of various types of materials used in mechanical engineering industry.

CONTENTS

1. Classification and Properties of Materials : Introduction to engineering materials Classification of materials Thermal, chemical, electrical, mechanical properties of various materials Selection criteria for use in industry

2. Structure of Metals and Their Deformation : Metal structure Arrangement of atoms in metals Crystalline structure of metals Crystal imperfections Deformation of metal Impact of cold and hot working on metal structure.

3. Ferrous Materials : Classification of iron and steel Sources of Iron ore and its availability Manufacture of pig iron, wrought iron, cast iron and steel Types of cast iron: white, malleable grey, mottled, nodular and alloy and their usage. Classification of steels Different manufacturing method of steel open hearth, bessemer, electric arc. Specification as per BIS and equivalent standards Effect of various alloying elements on steel Use of alloy steel (high-speed steel, stainless steel, spring steel, silicon steel)

4. Non Ferrous Materials : Important ores and properties of aluminium, copper, zinc, tin, lead Properties and uses of nonferrous alloys

5. Engineering Plastics and Fibers : Introduction of plastics Classification - Thermoplastic and thermosetting Various trade names of engineering plastics Fibers and their classification : Inorganic and organic fibers Uses of fiber

6. Insulating Materials : Various heat insulating material and their usage like asbestos, glass, wool thermocole, cork, puf, china clay. Various electrical insulating materials and their use.

7. Testing of Metals and Alloys : Identification tests : appearance, sound, spark, weight, magnetic, band microstructure, filing

8. Fundamental of Heat Treatment : Principles of heat treatment Theory of solid solution Iron-carbon diagram TTT curve in steels and its importance Basic idea about martenstic transformation Various heat treatment processes - hardening, tempering, annealing, normalising, case hardening and surface hardening. Types of heat treatment surfaces.

PRACTICALS

1. Classification of about 25 specimens of materials / parts into Metals and non metals Metals and alloys Metals and non ferrous metals Metals and non ferrous alloys

2. Given and set of specimen of metals and alloys (copper, brass, aluminium, cast iron HSS, Gun metal) : identify and indicate the various properties posseses by them

3. 3.1 Study of heat treatment furnace Study of thermocouple / pyrometer

4. Study of a metallurgical microscope and a diamond-polishing machine.
5. To prepare specimens of following materials for microscopic examination and to examine the microstructure of the specimens of the following materials :

6. To temper a given specimen and find out difference in hardness (with the help of hardness tester) as a result of tempering.

REFERENCE BOOKS :

1. Engineering Material B.K. Agarwal

2. Elements of Metallurgy H.S. Bawa
3. Materials and Metallurgy Lab Manual Adithan & Bahl
4. Material Science R.K. Rajput

Code	Name of Paper	Lecture	Tutorial	Practical
ME36	**ELECTRICAL ENGINEERING**	3	-	2

RATIONALE

This subject is designed to give basic knowledge of electrical m/c such as transformer, A.C./D.C. machine.

CONTENTS

1. D.C. Machines : Construction Operation of D.C. generator Operation of D.C. motor Types of D.C. generator and motor Starters Speed control methods Characteristics of D.C. motors

2. Transformer : Construction of single phase transformer Types of transformer Principle of operation E.M.F equation Testing of T/F Polarity test Open circuit test Short circuit test Efficiency and losses Voltage regulation Single phase auto transformer Types of 3 phase transformers Cooling methods

3. Induction Motor : Construction and working principle of single-phase induction motor Types of single phase induction motors (description only) Production of rotating

magnetic field by three phase currents. Construction and working principle of three-phase induction motor Torque equation Torque slip characteristics Starting and speed control of 3-phase induction motor Various types of starters Methods of increasing starting torque Application

4. Industrial Drives : Elementary idea for industrial drives Application of industrial drives in following fields - Rolling mill Textile mills Paper mill Crane Mines Lathe machine Pumps Food processor, refrigerators punches

5. Electric Heating : Advantages of electric heating over other types of heating Principle of operation, construction and uses of electrical heating in - Resistance heating Induction heating Arc heating Brief idea of high frequency heating, dielectric heating and its application.

6. Illumination : Nature of light Standard terms and definitions Laws of illumination Types of lamps Tungston Halogen Sodium Neon Mercury vapour lamp Fluorescent tubes.

7. Instrumentation and Measurement : Principle, construction and working of the following measuring instruments - Ammeter and voltmeter (moving coil and moving iron type) Dynamometer types wattmeter Single phase AC energy meter Multimeter and megger Transducers Measurements of mechanical quantities like pressure, strain, temperature

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PRACTICALS

1. Study of D.C. machines.
2. Study of D.C. starter
3. Connecting starting and reversing the direction of D.C. motor
4. Determination of turn ratio of transformer
5. Open circuit and short circuit test on a single phase transformer
6. Determination of efficiency and regulation of a 1-phase transformer by direct loading.
7. Connecting, starting and reversing the direction of 1-phase induction motor
8. Starting of 3 phase Induction motor by D.O.L. starter / star- delta starter.motor.
9. Study of various types of transducers.
10. Study and calibration of different ammeter and voltmeter
11. Use of megger and multimeter.

REFERENCE BOOKS :

1. Electrical Engineering (Hindi & English) K.D. Sharma 2. Electrical Technology B.L.Theraja 3. Utilization of Electrical Power H.Pratap

Code	Name of Paper	Lecture	Tutorial	Practical
MA37	**MACHINE DRAWING**	-	-	6

RATIONALE

In order to produce a good product, a neat drawing is a must. There fore technicians must be well acquainted with the knowledge of machine drawing. Machine drawing is the universal language of engineers and student must be made familiar with all the relevant aspect topics of machine drawing.
Subject contents various drawings of machine and components to clarify the manufacturing and construction details for the students.

CONTENTS

1. Coupling : Split muff coupling Universal coupling Flexible bushed pin type

2. Bearings : Types of bearings Plumber block Foot step bearing

3. Machine Components : Machine vice Tail stock of lathe Shaper tool head

4. Valves : Classification of valves Valve seats Steam stop valve Feed check valve

5. I. C. Engine Components : Piston and connecting rod assembly

6. Jigs and Fixtures : Definitions Types of jig, bushes Drilling jigs Types of fixtures

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PRACTICALS

Preparation of assembly drawing sheets from detailed drawings :

1. Couplings
2. Plummer block and foot step bearing
3. Machine vice
4. Tail stock
5. Shaper tool head
6. Steam stop valve

7. Feed check valve
8. I.C. Engine connecting rod and piston
9. Drilling jig

Exercises for sketch book :

1. Jigs, Bushes and fixtures
2. Pulleys : Straight arm pulley, loose and fast pulley
3. Pipe fittings and pipe joints - Pipe fittings and their symbols, flanged pipe joint and spigot and socket joint

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REFERENCE BOOKS :

1. Machine Drawing Laxmi Narayanan & Mathur
2. Machine Drawing P.S Gill
3. Machine Drawing R.B.Gupta
4. Machine Drawing Sidheswar

CE41 MA41 ME41	STRENGTH OF MATERIALS - II	2	2/2	2

RATIONALE

In Engineering every structure or machine element is designed for aparticularapplication.Then it is tested. A Diploma holder should be capable of designingthevarious elementsfor particular requirements. For this he must be able to calculate the stresses in an elements and their nature.

CONTENTS

1. Deflection : Concept of deflection of a beam Use of standard formula for calculating deflection (for point loads, U.D.L. and their combination) Cantilever beam Simply supported beam

2. Columns and Struts : Concept of column and struts Modes of failure Types of column; long and short Buckling loads Slenderness ratio Euler's formula (without proof) Both ends hinged One end fixed and other end free Both ends fixed One end fixed and Rankine's formula

3. Torsion of Shaft : Concept of torsion Angle of twist Polar moment of Inertia Assumptions in the theory of pure torsion Derivation and use of Relation between power and torque Combined stress due to bending and torsion in solid and hollow shaft

4. Springs : Introduction and classification of springs Flat carriage springs Application of flat carriage springs Determination of number of leaves and their sections, deflection and radius of curvature Quarter elliptical spring Closely coiled helical springs : Application of closely coiled helical springs Determination of deflection, angle of twist, number of coils and stiffness under axial loading in closely coiled helical springs.

5. Thin Cylindrical Shells : Use of cylinders Stresses due to internal pressure Circumferential stress or hoop stress Longitudinal stress Design of thin cylinders - calculation of the various dimensions of a thin cylinder

6. Combined Direct and Bending Stress : Effect of eccentricity Stress due to eccentric load Middle third rule

7. Frames : Different types of frames Calculation of forces in the members of determinate frames Method of Joints Method of section Graphical method

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PRACTICALS

1. Determination of deflection for various types of loading
2. Torsion test on brass and mild steel
3. Compression test on columns
4. Determination of stiffness of close coiled spring
5. Deflection test on leaf spring.

REFERENCE BOOKS :

1. Strength of Materials & B.C.Punmia Theory of Structures (Vol. I)
2. Strength of Materials Ramamurtham
3. Strength of Materials Junarkar
4. Strength of Materials R.S. Khurmi
5. Strength of Materials (Hindi) Gurcharan Singh

Code	Name of Paper	Lecture	Tutorial	Practical
MA42	FLUID MACHINES	2	2/2	2

RATIONALE

A Diploma holder has to supervise the various machines working on the principles of hydraulics. Major among those machines are hydraulic turbines, pumps, hydraulic crane, presses etc. The aim of this subject is to impart the knowledge of working principles, construction and working of various machines.

CONTENTS

1. Flow Through Pipes : Types of flow in pipes (Reynold's experiment) Laminar flow Turbulent flow Transient flow Law of fluid friction Laminar flow Turbulent flow Loss of head due to friction (No. proof) Darcy's Weisbach equations Chezy's formula Manning formula Other energy losses in pipe (only expressions) Total energy line and hydraulic gradient line Pipe arrangement Pipes in series Pipes in parallel Transmission of power through pipes Siphon Water hammer

2. Impact of Free Jet : Impulse momentum equation (no proof) Force exerted by a fluid jet on stationery flat plate Plate normal to the jet Plate inclined to the jet Force exerted by fluid jet on moving flat plate Plate normal to the jet Plate inclined to the jet Force exerted by fluid jet on stationary curved vane Jet strikes at the centre of symmetrical cured vane Jet strikes tangentially at one Force exerted by a fluid jet on moving curved vane.

3. Hydraulic Turbines : Classification of water turbines Pelton turbine Working principle Constructional features Francis turbine and Kaplan turbine Working principle Constructional features Draft tube Cavitation Governing of Turbines Need for governing Simple governing mechanism Surge tank Turbine performance Heads - gross, net Efficiency - Hydraulic, Mechanical, Volumetric, Overall Unit quantities Specific speed Introduction to characteristics curve (no numerical problems) Numerical problems on turbines

4. Centrifugal Pump : Introduction and working principles Advantages over reciprocating pump Classification Constructional features Mechanical manometric and overall efficiency Head of a pump - static, manometric Power required to drive the pump Losses in pump and efficiency Minimum stating speed Pumps in series and parallel Priming Description and working of multistage centrifugal pump, submersible, deepwell pump and gear pump. Numerical problems

5. Reciprocating Pump : Types of pump Main components and working Slip Percentage slip Negative slip Work down by a reciprocating pump Acceleration of piston Its effect on velocity and pressure Air vessel Troubles in Reciprocating pump and their remedies. Numerical problems

6. Miscellaneous Hydraulic Machines : Description, working principle of following machines Hydraulic accumulator Hydraulic intensifier Hydraulic press Hydraulic coupling and torque converter

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PRACTICALS

1. Determination of coefficient of friction for pipes
2. Determination of slip, coefficient of Discharge for a reciprocating pump
3. To draw characteristics curves and efficiency curves of 3.1 Centrifugal pump
3.2 Pelton wheel turbine
3.3 Francis turbine4. Study of model of Kaplan turbine
5. Study of submersible pump, jet pump, deepwell pump.

REFERENCE BOOKS :

1. Fluid Mech. & Machines Dr. Jagdish Lal
2. Fluid Mech. & Machines Dr. R.K.Bansal
3. Fluid Mechanics & machines R.S.Khurmi.
4. Hydraulics & Pneumatics H.L. Stewart
5. Fluid Machines S.S. Ratan

Code	Name of Paper	Lecture	Tutorial	Practical
MA45	**WORKSHOP TECHNOLOGY - I**	2	-	6

RATIONALE

This subject would impart the knowledge of various production machinery. The knowledge of metal cutting would help the student in acquiring requisite skills to open up his own workshop or in an industry.

CONTENTS

1. Cutting Tools and Materials : Cutting tools Standard shape of single point tool Cutting angles, effect of rake angle, importance of clearance angle Heat produced by cutting and its effect Cutting speed, feed and depth of cut Materials Materials of cutting tools and their properties High-speed steel, cobalt steel, tungsten carbide, cemented carbide, stellite, diamond, ceramics.

2. Lathe Machine : Specifications, Classification of lathe machines Constructional features of a centre lathe and its function Functions of various parts of lathe Different operations, which can be performed on the centre, lathe with and without attachments. Calculation of gear trains for thread cuttings Lathe attachments and lathe accessories.

3. Drilling Machines : Description, working and uses of different drilling machines, Multi spindle drill, gang drill, deep hole drill and small diameter hole drill machines. Specifications and constructional features of radial arm and upright drilling machines Work holding devices, tool holding devices Description and types of drills and reamers Various operations of drilling machines e.g. drilling, reaming, boring, counter-boring, counter sinking, spot facing, tapping. Selection of drill Cutting speed and feed according to material of job.

4. Shaping, Planning and Slotting Machines : Description, working and uses of various types of shapers, planers and slotters Specification, constructional features of a shaper and planner in detail Mechanism used in shaper - crank and slotted link, whitworth quick return and hydraulic mechanism, Feed mechanism Mechanism of planner Various works holding devices and clamping devices used on shaper and planner Various shaper and planner operations Shaper and planner tools Cutting speed, feed and depth of cut on shaper and planner Difference between shaper, planner and slotter

5. Cutting Fluids and Cooling Process : Difference between cutting fluid and coolant Functions of cutting fluid and its action Requirements of good cutting fluid Types of cutting fluids Selection of cutting fluids for different material and operations.

PRACTICALS

1. Grinding of various types of single point cutting tool
2. Simple exercise on Lathe Machine involving following operation

2.1 Simple turning, facing, step turning, Grooving and knurling and taper turning, by compound rest
2.2 Facing, drilling, boring and step turning, parting off.
2.3 Taper turning by tails tock off set method

2.4 V threading, square threading and taper threading by attachment
2.5 A utility job on lathe machine with an accuracy of ± 0.2 mm

3. Preparing a M.S. block with all faces finished and V grooved on shaper machine
4. Planning practice on a planner on a rectangular C.I plate.
5. Internal slot cutting on the slotter machine

REFERENCE BOOKS :

1. Workshop Technology (Hindi) - II Tahil Manghnani
2. Workshop Technology (Hindi) - II B.S.Raghuvanshi
3. Workshop Technology - II Hazra & Chaudhary.
4. Workshop Technology (Hindi) S.K.Bhatnagar
5. Production Technology R.K. Jain
6. All about M/C tools Gerling

Code	Name of Paper	Lecture	Tutorial	Practical
MA46	**METROLOGY**	2	-	2

RATIONALE

Technicians have to carry out the job of measurement and inspection in the factories for controlling the quality of products. Therefore they must have the knowledge of science of measurements or metrology. They must be familiar with the concept and technique of inspection and quality control methods. This subject i.e. Metrology has been designed to impart all the related and concerned knowledge to the student to fulfill the need. The content of syllabus broadly includes linear and angular measurement of surfaces, measurements by comparators, light wave interferometry, gear, screw measurements and inspection. Finally, to develop the skill in measurement a list of practicals is also given which should be carried out by the students in metrology laboratories.

CONTEN

1. Introduction : Units and standards of measurement International, National and company standards Line and end standards Errors in measurement Precision and accuracy

2. Linear and Angular Measurement : Vernier calliper, micrometers, height and depth gauges Bevel protractor, sine bar, slip gauges, angle gauges and clinometers Auto collimator, angle dekkar, Taper measurements Cylinder bore gauge, Telescopic gauge, feeler and wire gauge

3. Measurement of Surface Finish : Meaning of surface texture, primary and secondary texture Terminology of surface roughness Factors affecting surface finish Representation of surface roughness parameters CLA and RMS values Comparison and direct instrument methods of surface finish measurements. Classification, advantages and working mechanism of dial indicators, passmeters Mechanical, Electrical, Electronic and pneumatic comparators

5. Light Wave Interference : Principle of interference Interferometry applied to flatness testing N.P.L. flatness interferometer

6. Gear and Screw Measurement : Screw thread terminology, errors in threads Effective diameter measurement by two wire and three wire methods Major and minor diameter measurement, Thread micrometers Gear tooth terminology Gear tooth vernier calliper and its application Measurement of gear pitch.

7. Limits, Fits and Tolerance : Interchangeability - control and need Definitions and Terminology of limits, fits and tolerances Basis of limit system Type of fits Limit gauges

8. Machine Tool Metrology : Alignment tests Performance tests Alignment test on lathe and drilling machine

9. Inspection : Inspection - concept, need and methods Types of inspection.

PRACTICALS

1. Internal and External measurement with the vernier calliper
2. Internal and External measurement with micrometer
3. Measurement with height and depth gauges.
4. Measurement with dial indicator using surface plate and accessories for –

4.1 Flatness
4.2 Concentricity

5. Measurement with combination set and bevels protractor
6. Measurement of thread characteristics
7. Study and use of slip gauges
8. Study of limit gauges.
9. Internal and External taper measurement.
10. Measurement of gear characteristics
11. Measurement of angle with sine bar and slip gauges
12. Study and use of comparators
13. Study and use of tool room microscopes.
14. Measurement of bore with cylinder dial gauge for ovality and taper.
15. Measurement of worn out I.C. Engine piston, clearance between cylinder and piston and between bearing and journal

Note : Industrial visit can be arranged to show these practicals to the students.

REFERENCE BOOKS :

1. Engineering Metrology R.K.Jain
2. Engineering Precision Metrology R.C.Gupta
3. Engineering Metrology (Hindi) Mittal
4. Engineering Metrology (Hindi) Bhatnagar.
5. Engineering Metrology R.K.Rajput
6. Metrology Lab Manual Adithen, Bahl
7. Metrology M. Mahajan

Code	Name of Paper	Lecture	Tutorial	Practical
MA47	**THEORY OF MACHINES**	3	2	-

RATIONALE

An engineer should be well acquainted with the motion of mechanism of different machine element. With this view the study of Theory of machine is very much important. The contents of this subject include simple mechanism, kinematics of machine, dynamics of reciprocating parts, friction involved in the machine elements, power transmission, governors, balancing and vibrations in machine.

CONTENTS

1. Simple Mechanism : Introduction to link, kinematic pair, kinematic chain, structure, mechanism, machine Slider crank mechanism and its inversion Double slider crank chain Example of mechanism with higher pairs

2. Velocity and Acceleration in Mechanism : Velocity diagrams of four bar and single slider crank mechanisms by relative velocity method and instantaneous centre method Acceleration diagram of four bar chain and reciprocating engine mechanism

3. Dynamics of Reciprocating Parts : Analytical method for velocity and acceleration of piston Piston effort, crank pin effort, turning moment diagrams Fluctuation of energy and speed Energy of a flywheel Calculating the weight of flywheel.

4. Friction : Friction of collars and pivots Friction clutches-plate clutch and centrifugal clutch Friction in journal bearings Rolling friction Prony brake, Rope brake and Froude's hydraulic dynamometer.

5. Transmission of Power : Flat and V-belt drives Velocity ratio of belt drives, slip in belt, and creep in belt. Length of open and cross belt drives Power transmitted by a belt Ratio of driving tension, centrifugal tension, Condition for the maximum power transmission, initial tension in the belt. Chain drives - types of chain drives roller chain and inverted tooth chain. Gear drives - Types of gear wheels, proportions of gear tooth Gear trains - Simple gear train, compound gear train, reverted gear train and simple epicyclical gear train.

6. Balancing : Static and dynamic balancing Balancing of single rotating mass by a single mass in the same plane, by two masses rotating in different planes. Partial primary balancing of a single cylinder reciprocating engine

7. Vibration : Causes of vibrations in machine, their effects and method of reducing them Free or natural vibration Forced vibration Damped vibration.

REFERENCE BOOKS :

1. Theory of Machines Jagdishlal
2. Theory of Machines R.S.Khurmi
3. Theory of Machines Abdullah Sharif
4. Theory of Machines Malhotra, Gupta
5. Theory of Machines S.S. Ratan

Code	Name of Paper	Lecture	Tutorial	Practical
ME51	**INDUSTRIAL ENGINEERING**	3	2/2	-

RATIONALE

To achieve the target and goals of an industry, it is essential to co-ordinate the entire manufacturing system, for efficient working of an organisation, evaluation and improvement in manufacturing of jobs and components. For this purpose topic like plant location and layout, work-study and production, planning and control are included in this subject. By learning of above topics, capacity to work as middle level manager is developed amongst the students. It is suggested that students should be taken to nearby industries to acquaint them with various engineering aspects of an industry.

CONTENTS

1. Production, Planning and Control : Definition and importance, types of production - job, batch and mass forecasting, routing, scheduling, dispatching and follow up. Break even analysis and Gantt chart Project scheduling, application of CPM and PERT techniques Analysis and control of project cost in CPM and PERT, simple numerical problems.

2. Inventory Control : Definition, types of inventory - Codification and standardization ABC analysis. Economic ordering quantity Procurement cost, carrying charges, lead-time, re-order point, simple problems. Definitions, types of inspection and procedure Statistical quality control - Basic theory of quality control, Process capability Control

charts for variables - and R, relationship between control limits and specification limits. Control chart for fraction defective (p), control chart for number of defect (c) Acceptance sampling - Selection of samples, sample size, method of taking samples. Samplings plan - single, double, sequential. Acceptance quality level (AQL), lot tolerance percentage defective (LTPD), producer's risk, consumer's risk. Operating characteristic curve, simple problems. Introduction to QC tools - Check sheet, stratification, cause and effect diagram, histogram, scatter diagram, Pareto analysis Concept of ISO 9000 & TQM.

4. Work Study : Definition, advantages and procedure of work-study. Difference between production and productivity, Factors to improve productivity Method Study :- Definition, objectives and procedure of method study. Symbols, flow process chart (man-machine-material), flow diagram, machine chart, two hand chart Critical examination. Developing a new method Principles of motion economy. Therblig symbols, SIMO chart, simple problems. Work Measurement -time study, definition, principle and method of time study Stop watch study - number of reading, calculation of basic time, rating techniques, normal time, allowances, standard time Simple numerical problems. Work Sampling - Definition, method, advantages and disadvantage of work sampling Applications.

5. Plant Location and Layout : Definition, factors affecting the site selection of plant Factor affecting plant layout Types of layout - process, product, combination and fixed position layout Techniques in making layout-Flow diagram, templates, distance volume matrix, travel chart Line balancing, workstation

6. Material Handling : Principles of economic material handling Hoisting equipment - forklift truck, Cranes- mobile motor cranes, overhead cranes, travelling bridges crane. Derrick crane. Whiler crane Conveying equipment - Package conveyors, gravity roller conveyors, screw conveyors, flight or scraper conveyors, bucket conveyors, bucket elevators, belt conveyors, pneumatic conveyors.

REFERENCE BOOKS :

1. Industrial Engineering (Hindi) V.K.Sharma
2. Industrial Engineering S.C.Sharma
3. Industrial Engg. & Management T.R.Banga
4. Elements of Work Study Suresh Dalela
5. Construction Equipment Mahesh Verma
6. Construction Equipment S.C.Sharma
7. Industrial Engg. & Management O.P. Khanna
8. Production, Operation Management B.S. Goel

Code	Name of Paper	Lecture	Tutorial	Practical

ME52	**INDUSTRIAL AND COMPUTER AIDED DRAFTING**	3	2/2	-

RATIONALE

In the previous semesters students have been given knowledge and practice of assembly drawing. In this subject students will be given exercises to draw detailed drawings from assembled drawings.
In the present scenario computer is becoming more and more important in every field. Computer software for drafting are widely used for drawing work.

CONTENTS

1. Preparation of Detailed Drawings from Assembly Drawings : Self aligning roller bearing Diesel fuel Injector

2. Working Drawings : Using Code IS : 919 Limits, fits and tolerances Type of fits Hole basis and shaft basis system Show symbols for tolerances including machining symbols, geometrical tolerancing, surface finish, material etc. on following machine parts as per I S: S P- 46. Bush Bearing Ball and Roller bearing Lathe machine spindle Crankshaft

3. Gear Tooth Profiles : Drawing involute tooth profile by Approximate method Prof. Unwin's method

4. Drawing of Cam Profiles Simple harmonic motion, Uniform acceleration & retardation and uniform velocity motion of follower Follower types : knife edge, flat faced and roller Cams with and without offset

5. Computer AIDED Drawing (Latest version of Auto CAD available in the institution should be used): Concept of Auto CAD Creating and editing Dimensioning Using coordinate system of specify points, using direct distance entry, shifting and rotating the coordinate system Different line commands - p-line, x-line, m-line, ray, hidden, centre line, dash, zig zag line. Types of different editing commands - scale, erase, copy, stretch, lengthen, and explode Types of object, snap setting options - ortho mode, snap, grid, geometric snap mode Principle of drawing curved objects; create point objects, changing drawing order of objects creating solid filled areas and regions Modifying of curved objects Drawing to scale, dimensioning and text, tolerancing, modifying dimensions and tolerances Command for hatching and sectioning

Note: No question will be asked in theory paper on chapter 5th and Board's practical (PR) exam will be based on chapter 5th only.

REFERENCE BOOKS :

1. Machine drawing Laxmi Naryan & Mathur
2. Mastering Auto CAD B.P.B.Publishers
3. Machine Drawing P.S. Gill
4. Auto CAD 14 for Engineers P. Nageshwara Rao (TMH)
5. Auto CAD 2000 Instant Reference G. Omura (BPB)

Code	Name of Paper	Lecture	Tutorial	Practical
ME53	**INDUSTRIAL ELECTRONICS**	2	-	2

RATIONALE

Diploma mechanical engineer working on the shop floor should have the knowledge of various electronics systems used in machines. He must be aware about semiconductor diode, transistors and thyristors. The knowledge of digital electronics, power electronics and industrial electronics is an added advantage for a diploma engineer.

CONTENTS

1. Semiconductor and P-N Junction Diode : Intrinsic and extrinsic semiconductor Description of conductor, insulator and semiconductor P-N junction diode Space charge and barrier potential Volt-ampere characteristics (forward and reverse bias) Zener and avalanche breakdown LED and LCD

2. Bipolar Junction Transistor : Fundamentals of BJT operation Amplification phenomenon CE, CB and CC configuration and DC current relationship Input and output characteristic of CE, CC and CB.

3. Digital Electronics : Binary, Decimal, Octal and Hexadecimal number system Logic gates - OR, AND, NOT, NAND, NOR, Ex-OR, Ex-NOR

4. Power Electronics : Introduction of SCR's, Diac, Triac, UJT Series and parallel connection of SCR's Half wave and full wave rectifiers using SCR's with resistive and inductive load Snubber circuit Application of SCR's in speed control of AC and DC motors.

5. Relays Contactors and Timers : Type of relays Relay parts Construction and working of relays, contactors and timers. DC operated time delay relay AC operated time delay relay.

6. Photo Electric Devices : Photo cells Photo transistors LDR's Solar cells - working principle and applications

7. Heating and Welding : Principle of induction heating Principle of dielectric heating Principle of resistance welding Control circuit to control heat in resistance welding

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PRACTICALS

1. To plot V-I characteristics of P-N diode.
2. To plot V-I characteristics of Zener diode.
3. To plot V-I characteristics of NPN transistor in CE, CB, CC configuration.
4. To plot V-I characteristics of PNP transistor as above
5. Study of logic gates of- AND, OR, NOT , NAND, NOR, Ex-OR, Ex-NOR
6. To plot the characteristics of SCR's, Triac, UJT
7. Study and testing of solar cell and photo cells
8. Study of induction heating and dielectric heating systems.

REFERENCE BOOKS :

1. Power Electronics P.S. Bhimbara
2. Electronics V.K. Mehta
3. Integrated Electronics Millman Halkias
4. Industrial Electronics Bhattacharya
5. Basic Electronics B.L. Theraja
6. Electronics Principles (For Mechanical) L.M. Shaikh
7. Industrial Electronics & control (Hindi) Kumar & Tyagi (Nav Bharat)

Code	Name of Paper	Lecture	Tutorial	Practical
ME54	**THERMAL ENGINEERING - II**	2	2/2	2/2

RATIONALE

Due to the increased use of thermal power plants in power generation the students are required to know about the steam nozzles, steam turbines, steam condensers, air pumps, cooling towers and various modes of heat transfer. This subject will impart necessary knowledge about all these.

CONTENTS

1. Steam Nozzles : Flow of steam through convergent, divergent nozzle Velocity of steam leaving nozzles, Mass of steam discharged through nozzles. Critical pressure ratio. Area of cross section of throat and exit for maximum discharge. Length of nozzle Numerical problems.

2. Steam Turbines : Classification and industrial application of steam turbines. Principle and operation of impulse and reaction turbine Blade materials and defects in blades Compounding of turbines Description of simple De-Laval turbine, velocity diagram, work done and efficiency. Description of Parson's reaction turbine, velocity diagram, work done and efficiency. Reheating of steam, Bleeding of steam' Lubrication system for steam turbines Simple numerical problems.

3. Steam Condenser : Introduction, main elements of a condensing plant Types of condenser Low level, high level and ejector type of jet condenser Down flow, central flow, inverted flow, regenerative and evaporative type of surface condenser Source of air leakage and its effect

4. Air Pumps and Cooling Tower : Types of air pumps Description of wet and dry types air pumps Types of cooling towers Description of cooling towers

5. Heat Transfer : Introduction to conduction, convection and Radiation Fourier's law, Steafan - Boltzman Law and Newton's law Overall heat transfer coefficient Heat transfer by conduction through a plane and composite wall Radial heat transfer by conduction through a thick cylinder and sphere Critical insulation Heat exchangers : Direct contact type, Regenerator or Storage type and Recuperator or Transfer type (no. analysis)

PRACTICALS

1. Study of steam turbine
2. Study of steam condensers, Jet condenser and surface condenser
3. Study of air pump
4. Study of cooling towers
5. Study of heat transfer equipments available in the laboratory.

REFERENCE BOOKS :

1. Thermal Engineering Vol. I & Vol. II Mathur & Mehta
2. Thermal Engineering R.K. Rajput
3. Thermal Engineering R.K. Purohit
4. Thermal Engineering Raynor Joel
5. Elements of Heat Engineering (Vol I & II) Patel & Karamchandani
6. Thermal Engineering Rai & Sonrao (Satya Prakashan)

Code	Name of Paper	Lecture	Tutorial	Practical
MA55	**WORKSHOP TECHNOLOGY - II**	3	-	6

RATIONALE

This subject gives knowledge to the students with regard to many kinds of machine tools used in industry. Major thrust is to expose the students to acquire practical skill in handling milling machines, grinding machines, capstan and turret lathes and many other kinds of machines. This enables students to perform well on the shop floor in the industry.

CONTENTS

1. Metal Cutting Saws : Specifications, description, working and uses of sawing machine Description, specification of cutters/ blade for sawing machines, blade setting.

2. Boring : Principle of boring Classification of boring machines and their description Specification of boring machine Boring tools Boring bars and boring heads Description of Jig boring machine

3. Milling Machine : Specifications and working principle of milling machine Classification of milling machines and their brief description and their applications. Details of column and knee type milling machine Milling machine accessories and attachment -Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, spiral milling attachment, slotting attachment and rack milling attachment. Work holding devices. Milling methods-up milling and down milling Various types of milling cutters and mandrels for milling machines Milling operations-face milling, angular milling, form milling, straddle milling and gang milling Cutting speed and feed. Simple numerical problems Indexing on dividing heads, plain and universal dividing heads Indexing methods : direct, plain or simple, compound, differential and angular indexing. Numerical problems on indexing Helical and spiral milling Introduction to machining centre

4. Grinding and Grinding Machines : Purpose of grinding Various elements of grinding wheel - Abrasive, Grade, Structure, Bond Common wheel shapes and types of

wheels - built up wheels, mounted wheels and diamond wheels. Specifications of grinding wheels as per BIS Truing and dressing, balancing and mounting of wheel Grinding methods: surface grinding, cylindrical grinding and centreless grinding. Grinding Machines- cylindrical grinders, surface grinders, internal grinders, centreless grinders and tools and cutter grinders. Selection of grinding wheel

5. Capstan and Turret Lathes : Concept of ram or capstan type and turret or saddle type machine Principal parts of capstan and turret lathes Capstan and Turret lathe mechanism : Turret indexing mechanism, Bar feeding mechanism Work holding devices : Jaw and collet chucks Tool holding devices : slide tool holder, knee tool holder, knurling tool holder, recessing tool holder, form tool holder, Tap and Die holder, V-steady box tool holder, roller steady box tool holder Introduction to turret tooling layout Difference among capstan, turret and conventional lathe.

6. Automatic Machines : Brief description of single spindle and multi-spindle automatic machines viz. Swiss type automatic screw machine and Turret type screw machines

7. Metal Finishing Processes : Purpose of finishing surfaces Description of lapping, super finishing, polishing and buffing processes Description of honing machine and honing tools

8. Maintenance of Machine Tools : Importance of maintenance Different type of maintenance Sequence of maintenance operation : Disassembly, washing, fault finding, assembly

9. Installation and Testing of Machine Tools : Different types of machine foundation Foundation plan Machine tool testing

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PRACTICALS

1. Face milling.
2. Gear cutting on a milling machine. (Spur and Bevel)
3. Key way cutting on shaft
4. Exercise on gang milling
5. Job on Capstan lathe and Turret lathe.
6. Job on grinding machine.

6.1 Surface grinding
6.2 Cylindrical grinding (internal and external)
6.3 Centre less grinding (internal and external)

7. Milling cutter grinding on tool and cutter grinder
8. Job using copying attachment on lathe
9. Exercises on honing and lapping machine

10. Super finishing practice on lathe
11. Maintenance of milling, Grinding and Lathe machines

REFERENCE BOOKS :

1. Workshop Technology II Hazra Chaudhary
2. Workshop Technology II Raghuvanshi
3. Production Technology R.K.Jain & S.C. Gupta
4. Workshop Technology (Hindi) Tahil Maghnani
5. Production Technology H.M.T
6. Workshop Technology II & III Chapman
7. Production Technology Pandey & Singh

Code	Name of Paper	Lecture	Tutorial	Practical
MA561	**POWER PLANT ENGINEERING**	3	2/2	-

RATIONALE

With the increased consumption of electrical power in industries, agriculture and human comfort, more and more thermal, hydro and nuclear power plants are being installed through out the country. Gas turbine power plants are also being set up. This all has necessitated to train more and more people for the operation of different types of power plants. This subject provides basic knowledge about operation of power plant to the students.

CONTENTS

1. Introduction : Different types of conventional sources of energy Base load and peak load plants Scope of conventional energy sources in India Status of conventional power plants in India

2. Thermal Power Plants : General layout and working Factors of site selection Methods of coal handling Unloading devices Ash handling system Concept of super thermal power plants Combustion equipment Basic requirements Methods of coal burning : Hand firing, Stroker fired systems, Pulverised fuel fired system Coal Burners : Stream line, Turbulent types Combustion control, fluidised bed combustion

3. Hydro-Electric Power Plant : Advantages and application of hydroelectric power plants Elements of hydroelectric power plant Plant layout of low head and high head intake Combination of Hydel - Thermal power plants Hydro electric power plants in India.

4. Nuclear Power Plant : Introduction to nuclear reactions and nuclear fuels Site selection of nuclear power plants Nuclear reactors : various elements of nuclear reactors. Comparison of nuclear power plant with thermal and hydel power plants Common types of nuclear reactors Pressurised water reactor Boiling water reactor Gas cooled reactors Liquid metal cooled reactor Fast breeder reactor Nuclear power plants in India Hazards in nuclear power plants and safety measures Nuclear waste disposal

5. Diesel Power Plants : Elements of a diesel power plant Building and general layout Use of diesel engine with steam power plants Applications of diesel power plants Limitation of diesel power plants

6. Gas Turbine Plants : Classification and application Elementary description of gas turbines Details of elements of a gas turbine plant and plant layout Advantages over thermal and diesel power plants

7. Power Plant Economics : Elements of cost of power Factors affecting economics of generation and distribution of power Factors affecting choice and type of power plants on economics of power generation Simple numerical problems on cost of power generation.

REFERENCE BOOKS :

1. Power Plant Engineering Dr. Mahesh Verma
2. Power Plant Engineering Keshwani
3. Power Plant Engineering Domkumdwar
4. Power Plant Engineering (Hindi) Prakash & Kumar
5. Power Plants Engineering P.K. Nag (TMH)
6. Power Plants G.R. Nagpal
7. Power Plants Technology M.M. EI-Wakil (Mc-Graw Hill)

Code	Name of Paper	Lecture	Tutorial	Practical
ME562	**MACHINE TOOL ENGINEERING**	2	-	2

RATIONALE

Diploma holders in mechanical engineering are required to supervise production to meet production target. For that it is necessary for them to ensure that various machine tool and tooling equipment remain in working order. For this purpose, knowledge about jigs and fixture, press tools and other tooling equipment is essential. This subject aims at development of knowledge and skills regarding press tools, jigs and fixtures and other equipment for increased productivity and quality.

CONTENTS

1. Cutting Tool Materials : Requirements of cutting tool material Factors affecting selection of tool material Various cutting tool materials used in industries Development in cutting tool materials - UCON, CBN. Coated carbides, multi coating

2. Geometry of Cutting Tools : sSingle point cutting tools Multiple cutting point tools : drills, reamers and milling cutters

3. Press Tools : Basics of press tool working Press tool terms and main parts Power press- working and classification Die sets- types Nomenclature of cutting dies Theory of cutting dies such as blanking, piercing, notching, cutting off, trimming. Scrap strip layout Feeding mechanism Cutting and stripper force calculations Punches, dies, pilots, strippers, stops, knockouts - their design and material selection. Forming operations such as bending, curling with exposure to embossing, coining, drawing, deepdrawing. Working of compound and progressive tool Single action and double action presses Design of blanking tool, piercing tool, notching tool, trimming tool Design of press tools for forming operation Design of compound and progressive type of press tools.

4. Jigs and Fixtures : Definition, purpose and basic elements Principles of designing jig and fixture Work holding devices Degree of freedom principle of location Locating devices Various clamping devices Tool guiding methods and guide bushings Types of drill jigs and their application Common types of milling fixtures. Welding fixtures

PRACTICLAS

1. Sketch of a single point cutting tools geometry
2. Design and drawing of a drill jig for a given component
3. Design and drawing of a plain milling fixture for a given job.
4. Making a cut off tool and drawing tool
5. Making and drawing of blanking and trimming tool
6. Drawing of compound press tools.
7. Drawing of general arrangement of progressive press tools
8. Visit to an industry engaged in mass production. Various tools, jigs and fixtures and press tools to be shown to the students during the operations.

REFERENCE BOOKS :

1. Tool Design Donaldson (TMH)
2. Introduction to Jig & Tool Design Kempster (Std. Pub)
3. Tool Engg. & Design G.R. Nagpal (Std. Pub.)
4. Jig & Fixture P.H. Joshi (TMH)

Code	Name of Paper	Lecture	Tutorial	Practical
MA563	**AUTOMBOILE AIR CONDITIONING**	2	-	2

RATIONALE

The use of refrigeration and air-conditioning is not limited to human comfort only but it is extended to commercial and industrial application such as storage and preserving of food stuffs medicines, chemicals, wines etc. and during transportation also. It also requires producing suitable environment conditions for process works.

CONTENTS

1. Refrigeration and Refrigerants : Introduction, principles and applications Refrigeration methods, units and rating of machines Classification and properties of refrigerants Nomenclature of refrigerants

2. Refrigeration System : Air refrigeration system Reversed carnot cycle, theoretical Application, advantages and disadvantages of cycle Simple numerical problems Vapour Compression Cycle : Theoretical and actual vapour compressions cycle Effect of sub-cooling, super heating on compression cycle Coefficient of performance (COP) Effect of varying condensing and suction temperature and pressure on COP Use of P-H chart, simple numerical problem Methods of improving COP Simple vapour absorption system and comparison with vapour compression cycle.

3. Psychrometry : Properties of air vapour mixture Saturation of air, dry and wet bulb temperature, specific humidity, degree of saturation and relative humidity Enthalpy of moist air Psychrometric charts and its uses Psychrometric process, sensible heating and cooling, cooling dehumidification and humidification, evaporative cooling Mixing of air streams Simple numerical problems

4. Automobile Air Conditioning : Various transport air conditioning applications Physiological basis of air conditioning Human comfort, metabolism in human body, Classification of air conditioning system, room air conditioners, package air conditioning Operations of automobile air conditioning Components and controls : Compressors - reciprocating, rotary and centrifugal Various types of Condenser Cooling towers, spray ponds Evaporators of various types Defrosting and throttling devices Automatic expansion valve, thermostatic expansion valve Capillary tube, solenoid valve Receiver – driers Magnetic clutch control Suction throttle control Insulation Air distribution system

Installation procedure Trouble chart for Auto-air conditioning Various methods of air conditioning control

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PRACTICALS

1. To aquatint with the use of refrigeration tools, charging board, special refrigeration tube fittings.
2. Copper tube jointing practice, flaring and brazing.
3. Study of domestic refrigerator and room air conditioner with electrical system and equipment arrangement.
4. Study of following components-

4.1 Compressor open and hermetic sealed type
4.2 Expansion valves
4.3 Starting and over load relay
4.4 Thermostats
4.5 Strainer and drier
4.6 Magnetic clutch

5. Charging practice on refrigerating machine including making vacuum, pressure testing, charging and final testing for performance
6. Determination of psychrometric properties of air at different places with the help of sling- psychrometer and hygrometer.
7. Using refrigeration trainer test rig to find out its refrigerating capacity, power input and C.O.P.
8. Use of Air-conditioning trainer to find out C.O.P

REFERENCE BOOKS :

1. Refrigeration & Air Conditioning Domkundwar
2. Refrigeration & Air Conditioning Manohar Prasad
3. Refrigeration & Air Conditioning C.P.Arora
4. Principles of Refrigeration Dossatt
5. Refrigeration & Air Conditioning R.K. Rajput
6. Refrigeration & Air Conditioning R.S. Khurmi
7. Refrigeration & Air Conditioning Rao -Sarao

Code	Name of Paper	Lecture	Tutorial	Practical
CH571	**'C' PROGRAMMING**	2	-	2

Common for All Branches of Engineering except CS & IT

RATIONALE

'C' is computer programming language and also structured programming language. In 'C' programming language we consider various syntax used in programming. By having good knowledge of 'C', students can write modular application and system programs. 'C' can be used in the engineering applications. By acquiring a sound knowledge of 'C' students will be able to understand the concept of all the application areas. This course is specially designed for engineering students of all diploma streams.

CONTENTS

1. Introduction : Scope of 'C' Language Distinction and similarities with other HLLs Special features and Application areas

2. Elements of 'C' : Character setKey wordsData typesConstants and VariablesOperators: unary, binary, ternaryOperator precedence

3. Console Input-Output : Types of I-O Console I-OUnformatted console I-O: getchar(),putchar(), gets(), puts(), getch(),getche()Formatted I-O: scanf(), printf()

4. Control Flow : Statements and blocksifswitchLoops: for, while, do-whilegoto and labelsbreak, continue, exitNesting control statements

5. Arrays : Basic concepts Memory representation One dimensional array Two dimensional array

6. Functions : Basic concepts Declaration and prototypes Calling Arguments Scope rules Recursion Storage classes types Library of functions: math, string, system

7. Pointers : Basic concepts &, * operator Pointer expression: assignment, arithmetic, comparison Dynamic memory allocation Pointer v/s Arrays Basic concepts Declaration and memory map Elements of structures Enumerated data types : typedef, enum Union

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PRACTICALS

1. Problems based on arithmetic expression, fixed mode arithmetic.
2. Problems based on conditional statements and control structures.
3. Problems based on arrays (1-D, 2-D), functions and pointers.
4. Problems based on Engineering applications.

REFERENCE BOOKS :

1. 'C' Programming Stephen Kochan
2. Programming with 'C' Schaum's Series
3. 'C' Programming V.Balguru Swami
4. 'C' Programming Kernighan & Ritchie
5. Let us 'C' Yashwant Kanetkar

Code	Name of Paper	Lecture	Tutorial	Practical
CH572	**COMPUTER IN BUSINESS SYSTEMS**	2	-	2

Common for All Branches of Engineering except CS & IT

RATIONALE

Computer is a tool, which can be applied to any field. It is not necessary to apply it in only engineering application but can be applied to various commercial applications equally. The student from engineering streams must have some knowledge about commercial application, as these are basic need for every one. This course is aimed to fulfil all the requirements of some one in commercial applications using FoxPro.

CONTENTS

1 Business Data Processing : Business System Management Functions Levels of Management Information Requirement Basic tasks in business data processing
1.6 Examples of business data processing Payroll, Financial, Accounting, Inventory

2 Business Files : Files, Records, Fields, Elements Fixed and Variable Length Records Master File, Transaction File Record Updating in Sequential File and Direct File

3 Design, Analysis and Development of : Computerized Invoicing Data Entry Screens Validations Receipt Data Entry Reports Computerized Payroll Factors Involved in Payroll Exposure to structure, processing and reports File maintenance Computerized Inventory Control Introduction and Aim of Inventory Inventory Costs Inventory Control Process Inventory transactions Inventory reports

4 FoxPro (A tool for Business System) : Starting FoxPro FoxPro Menus and Menu Options, Elementary Level Creating Data Base File (DBF) Adding and Editing Records : Browse, Append Viewing Records SET commands : Talk, Date, Century, Default, Printer, Deleted, Safety Querying DBF : Simple and RQBE Updating, Deleting and recalling records Sorting, Indexing and Searching Screen, Label, Menu, Report Generator

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PRACTICALS

1. Hands on Experience with FoxPro
2. Creating Simple DBF, adding record, viewing data
3. Creating a simple DBF for Invoice
4. Querying Invoice DBF
5. Creating a simple DBF for Payroll
6. Report Generation for Payroll
7. Creating Inventory DBF
8. Inventory Report Generation

REFERENCE BOOKS :

1. FoxPro Made Simple R.K.Taxali
2. Business Systems Satish Jain
3. Computer Fundamentals V.K.Kapoor
4. FoxPro Programming Michael P.Antonovich, Galgotia Pub.

Code	Name of Paper	Lecture	Tutorial	Practical
ME61	**REFRIGERATION AND AIR-CONDITIONING**	3	-	3

RATIONALE

In modern society the use of refrigeration and air-conditions is not limited to comfort only but it is extended to commercial and industrial applications such as storage of food production, medicines, chemicals, wines, beverages. It also requires producing suitable environment conditions for process work, CAM. Surgery superconductivity. This subject will help the students to have adequate knowledge.

CONTENTS

1. Principles of Refrigeration : Meaning : heat pump, refrigeration Refrigeration methods Units of refrigeration machines Rating of refrigeration machines

2. Refrigeration System : Air Refrigeration System Reversed Carnot cycle, theoretical and actual. Reversed Brayton cycle-closed and open system. Applications and limitations Advantages and disadvantages of air refrigeration cycle Vapour Compression System Theoretical vapour compression cycle Effect of sub- cooling, super heating on compression cycle Deviation of actual cycle from theoretical cycle Coefficient of performance Effect of varying condensing and suction temperatures and pressure on C.O.P. Use of p-h chart. Simple numerical problems Methods of improving C.O.P. Flash chamber Sub cooling of liquid refrigerant by using vapour refrigerant Sub cooling by Vapour Absorption System Simple vapour absorption systems Comparison with vapour compression system Electrolux refrigerator Classification Important properties of refrigerants Nomenclature of refrigerants. Refrigerants - primary refrigerants, secondary refrigerants. New refrigerants viz : Tetraflouroethane, propone and isobutene

4. Refrigeration System, Components and Controls : Reciprocating compressors, rotary compressors, centrifugal compressors Condensers of various types Cooling towers, spray ponds, Evaporators of various types Defrosting and throttling devices Automatic expansion valve, thermostatic expansion valve and capillary tube, solenoid valve.

5. Refrigeration Applications : Domestic and commercial refrigerators, their systems, specifications and types Water coolers of various types Effect of moisture in refrigeration system and methods of removing it.

6. Production of Low Temperature : Introduction Limitation of vapour compression system for production of low temperature Two stage cascade refrigeration system (no analysis) Manufacturing of dry ice (no numerical problems)

7. Pshychrometry : Properties of air vapour mixture Saturation of air, dry and wet bulb temperatures, dew point temperature, specific humidity, degree of saturation and relative humidity. Enthalpy of moist air Psychrometric chart and its uses. Psychrometric processes, sensible heating and cooling, cooling with dehumidification and humidification, evaporative cooling, Mixing of air streams.

8. Air-conditioning : Physiological basis of air conditioning Human comfort, metabolism in human body, comfort chart and effective temperature. Summer and winter design conditions Classification of air-conditioning systems, room air conditioners,package air conditioners. Air distribution system.

PRACTICALS

1. To aquatint with the use of refrigeration tools, charging board, special refrigeration tube fittings.
2. Copper tube jointing practice, flaring and brazing.
3. Study of domestic refrigerator & water cooler with electrical system and equipment arrangement.

4. Study of Room Air-conditioner.
5. Study of following components-

5.1 Compressor open and hermetic sealed type
5.2 Expansion valves
5.3 Starting and over load relay
5.4 Thermostates
5.5 Strainer and drier

6. Charging practice on refrigerating machine including making vacuum, pressure testing, charging and final testing for performance
7. Determination of psychrometric properties of air at different places with the help of sling- psychrometer and hygrometer.
8. Using refrigeration trainer test rig to find out its refrigerating capacity, power input and C.O.P.
9. Use of Air-conditioning trainer to find out C.O.P
10. To determine the Ice-making capacity and C.O.P. of an Ice plant.
11. Study of following plants by industrial visits.

11.1 Ice plant
11.2 Cold storage plant
11.3 Central air conditioning plant.

12. A seminar on study of various models of refrigerator and A.C. available in the market.

REFERENCE BOOKS :

1. Refrigeration & Air Conditioning Domkundwar
2. Refrigeration & Air Conditioning Manohar Singh
3. Refrigeration & Air Conditioning C.P.Arora
4. Principles of Refrigeration Dossatt
5. Refrigeration & Air Conditioning R.K. Rajput
6. Refrigeration & Air Conditioning R.S. Khurm

Code	Name of Paper	Lecture	Tutorial	Practical
ME62	**AUTOMOBILE ENGINEERING**	3	-	2

RATIONALE

In the modern society the use of automobiles is increasing fastly. Therefore diploma engineers should have a thorough knowledge of systems of automobile. The contents of

the syllabus include introduction to automobiles, study of engine unit, electrical, power transmission, brakes, wheels and tyre, frame and suspension, steering system and also the study of maintenance procedures. To develop skill, certain practical exercises have been included.

CONTENTS

1. Introduction : Components of an automobile Classification of vehicles on the basis of load, wheels, final drive, fuel used, position of engine Layout of chassis, conventional frame and frame less construction

2. Engine Unit : S.I. and C.I. engines Multi cylinders engine, engine balancing Schematic diagrams of fuel feed and exhaust system Air cleaners - viscous type and dry type Intake manifold, exhaust system, exhaust manifold, muffler or silencer. Engine troubleshooting and remedies

3. Power Transmission System : Clutch – Function Constructional details of single plate and multi-plate clutch Gear box Functions construction of sliding mesh and constant mesh gear box Synchro mesh gear box Shifting mechanism Final drive Functions and working of propeller shaft, universal joint, slip joint Differential gear box

4. Electrical System : Storage battery Generator Working of generator Cut out relay, regulator for generators Comparison between alternator and dynamo Starting motor Working of starting motor Drive unit of starting motor Ignition Introduction Types of ignition system - battery and magneto ignition system Electronic ignition system Ignition timing, effect of advance and retard Ignition system troubles and remedies Lighting and wiring circuit of an automobile

5. Brakes : Functions of brakes and classification Construction and principle of mechanical brakes : internal expanding brakes and disc type brake Hydraulic brake system, master cylinder, wheel cylinder Bleeding of brakes Introduction of air brakes, parking and emergency brake Maintenance of brakes, brake troubles and remedies

6. Wheels and Tyres : Wheels, assembly, types of wheels - disc wheel and wire wheel Types of tyres - Tube tyre and tubeless tyre, tyre properties. Tyre specifications (size), constituents of tyre, Importance of tyre pressure, tyre wears Tyre maintenance, tyre troubles and repairs Introduction to wheel balancing

7. Steering System : Function of steering system Steering mechanisms and steering gear box Steering linkage, wheel alignment Steering geometry - camber, king pin inclination, caster, toe-in and toe-out Power steering, collapsible steering

8. Suspension System : Function of suspension system Suspension systems- rigid axle, front wheel suspension and independent front wheel suspension Leaf springs, coil springs and torsion bar Shock absorbers - Function and working of telescopic shock absorbers

9. Air Pollution : Sources of air pollution Characteristics of various pollutants -carbon mono oxide, oxides of nitrogen, Hydrocarbons Elementary knowledge about Euro standards I and II

PRACTICALS

1. Study of various tools, instruments and equipments used in an automobile shop.
2. Study of an automobile chassis.
3. Practice on dismantling, inspection, assembling and noting down the details of the following assemblies on car/ jeep and scooter.

3.1 Clutch - Single plate and multi-plate clutch
3.2 Gear box

3.2.1 Sliding mesh gearbox
3.2.2 Synchro mesh gearbox

3.3 Propeller shaft, differential and rear axle

4. Study of steering system of a four-wheeler
5. Study of braking system in car/jeep and scooter
6. Study of complete electrical system
7. Starting of an automobile engine after rectification of simple starting trouble in

7.1 Ignition system - Battery and magneto
7.2 Fuel system - Carburetors, Injector, fuel pump

8. To aquatint with the use of exhaust gas analyser and to check the percentage of carbon monoxide and hydrocarbon in case of 2-stroke and 4-stroke engine vehicle.
9. Operating practice on two wheeler/ jeep/car and acquaintance with various controls.
10. Visit to an auto repair shop and service station.
11. A seminar on study of various systems of different vehicles available in the market.

REFERENCE BOOKS :

1. Automobile Engineering G.B.S Narang
2. Automobile Engineering R.B.Gupta
3. Automobile Engineering (Hindi) Kirpal singh

4. Automotive Mechanics Crouse/Anglin
5. Auto Mechanics Srinivasan (TMH)
6. The Automobile Harbans Singh Reyat
7. Automotive Technology Sethi (TMH)

Code	Name of Paper	Lecture	Tutorial	Practical
ME65	**MACHINE DESIGN**	3	2	-

RATIONALE

Knowledge of method of finding shapes and sizes of various machine elements is very essential from their strength and stiffness/rigidity viewpoints. Also the knowledge of calculation of manufacturing cost of machine elements is essential. This subject would impart the basic knowledge about the designing of various machine elements.

CONTENTS

1. Introduction : General consideration in machine design General procedure in machine design Selection of material Working stress and factor of safety, selection of factor of safety Stress concentration, stress concentration factor and methods of reducing stress concentration Fatigue and endurance limit Effect of load, surface finish and size on endurance limit Preferred number

2. Design of Welding Joints : Types of welded joint and Design of lap joint and butt joint Strength of transverse and parallel fillet welded joints in axial loading Basic welding symbols

3. Designs of Screw and Bolts : Initial stresses due to screwing up Stress due to external forces Stress due to combined forces Bolt of uniform strength Screw thread, designations and its dimensions. Design of screw jack

4. Design of Joints : Design of simple cotter joints Design of knuckle joints Design of turnbuckle

5. Design of Keys and Couplings : Design of sunk key Design of rigid flange coupling

6. Design of Shaft : Shaft subjected to twisting moment Shaft subjected to bending moment Shaft subjected to combined twisting and bending moment

7. Design of Components : Cast Iron pulley Flywheel Helical spring

8. Bearings (no numerical problems) : Introduction and Classification Material used for bearings and their properties Types and uses of rolling contact bearings Standard dimension and designations of ball bearings Selection of rolling elements bearings

REFERENCE BOOKS :

1. Machine Design Pandya & shah
2. Machine Design R.S.Khurmi
3. Machine Design Sharma & Aggrawal
4. Machine Design V. B. Bhandari
5. Engineering Design George Dieter (McGraw-Hill)

Code	Name of Paper	Lecture	Tutorial	Practical
MA661	**MECHANICAL ESTIMATING AND COSTING**	2	2	-

RATIONALE

The Knowledge about estimation and costing is required for engineers. This subject is designed to develop understanding of various components of costs and making cost estimation.

CONTENTS

1. Introduction : Estimating Definition Importance of estimating
Aims and functionsEstimating procedure Costing Definition Aims of costing Procedure of costing Difference between estimating and costing

2. Elements of Costs : Material cost Labour cost Expenses Direct expenses Indirect expenses Component of cost Overhead cost Allocation of on cost

3. Estimation of Material Cost : Estimation of volumes, weights and cost of materials for Pulley Spindle Lathe centre Fly wheel Crank shaft

4. Estimation in Machining : Cutting speed, feed and depth of cut Setup time, operation time, machining, time tear down time, handling time Allowances Estimation of machining time for various lathe operations : Turning Facing Threading Drilling Chamfering Estimation of machining time for Milling operation Estimation of machining time for Shaping operation Estimation of machining time for Grinding operation Metal removal rates

5. Estimation in Welding Shop : Estimation of electric are welding cost Estimation of gas welding Estimation of gas cutting

6. Estimation in Forging Shop : Hand forging Machine forging Estimation of losses in forging operation and net weight Estimation of cost of forging operation

7. Estimation in Pattern Making and Foundry Shop : Pattern allowances Estimation of pattern cost Estimation of foundry shop

8. Estimation in Sheet Metal Shop : Sheet metal operations Sheet metal joints Estimation of time and cost in sheet metal operations

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REFERENCE BOOKS :

1. Estimating & Costing Banga & Sharma
2. Mechanical Estimating & Costing O.P. Khanna
3. Mechanical Estimating & Costing T.T.T.I.Madras

Code	Name of Paper	Lecture	Tutorial	Practical
CE672	**ENTREPRENEURSHIP DEVELOPMENT**	2	2	-

Common for All Branches of Engineering

RATIONALE

This subject will introduce the students about how to set up a small-scale industry. The subject includes the procedure for how to select, proceed and start the SSI, which also involves a concrete market survey report and project formulation.

CONTENTS

1. Entrepreneurship : Role of entrepreneurship and its advantage Classification of industries (based on scale) Classification of industries (based on type)

2. Industrial Policy : New industrial policy M.R.T.P. act.

3. Entrepreneurial Development : Product identification/ selection Site selection Plant layout Institutional support needed Pre-market survey

4. Entrepreneurship Support System: Role of District Industries Centre in setting up industry Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMDC Role of state finance corporation, state electricity board, pollution control board, RAJCON, BIS, I.S.O. etc.

5. Setting up SSI : Registration of SSI Allotment of land by RIICO Preparation of project report Structure of organization Building construction Establishment of machines

6. Raw Material Management : Allotment of iron and steel, coke/ coal Allotment of other indigenous raw material from NSIC Allotment of imported raw material and parts . Marketing Facilities : Supply of product to state govt, to defence, to railways, to CSPO, to CSD Participation in international exhibition and fairs, trade centres, state emporium and departmental stores Quality consciousness and its effect on product sales

8. Financial Sources for SSI : Various institutions providing loans for industries Various types of loans Subsidies

9. Contracts and Tenders : Type of contracts Necessity of contract and tenders Type of tenders Tendering procedure

10. Project Report : Procedure of preparing a project report Format of project report Preparation of project report for some SSI items

11. ISO : 9000 Series of Quality System : Definition of few important terms related to ISO quality system Various models for quality assurance in ISO : 9000 series Various elements of ISO : 9001 model (20 points) Benefits by becoming an ISO : 9000 company Introduction to total quality management (TQM)

REFERENCE BOOKS :

1. Hand Book of Small Scale Industry P.M. Bhandari
2. Hand Book on Entrepreneurship Development O.P. Harkut
3. Entrepreneurial Development S.S. Khanka
4. Statistical Quality Control Mahohar Mahajan
5. ISO : 9000 Quality System S. Dalela

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