

CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

MECHANICAL ENGINEERING



महात्मा ज्योतिबा फुले
रुहेलखण्ड विश्वविद्यालय, बरेली

DEPARTMENT OF MECHANICAL ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY
M. J. P. ROHILKHAND UNIVERSITY,
BAREILLY-243006 (U.P.) INDIA

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN
MECHANICAL ENGINEERING

Diploma in Engineering
First Year, Ist Semester
(For all branches)

First Semester, Ist Year

S.No	Category as per AICTE	New Code of Course	Old Course Code	Subject	Credits	Teaching Schedule Hrs. L T P	Marks
1.	Humanities & Social Science	27001		Communication skill in English	4	3 1 0	100
2.	Basic Science	27002	MAD-101T	Applied Mathematics - I	4	3 1 0	100
3.	Basic Science	27003		Applied Physics – I	4	3 1 0	100
4.	Basic Science	27004	CYD-101T	Applied Chemistry	4	3 1 0	100
5.	Basic Science	27005	CYD-202T	Environmental Studies	1	2 0 0	100
				Total	17	18	500
Laboratory Courses							
6.	Basic Science	28001		Applied Chemistry Lab	1	0 0 2	100
7.	Engineering Science	DME-201P 28002	MED-101P	Engineering Graphics	2	0 0 4	100
8.	Engineering Science	28003		Applied Physics lab	1	0 0 2	100
9.	Engineering Science	DME-203P 28004	MED-103P	Engineering Workshop Practice	2	0 0 4	100
10.	Humanities & Social Science	28005		Communication skills in English Lab	1	0 0 2	100
				Total	7	14	500
				G. Total	24	32	1000

Second Semester, Ist Year

S.No	Category as per AICTE	New Code of Course	Old Course Code	Subject	Credits	Teaching Schedule Hrs. L T P	Marks
1.	Basic Science	27011	MAD-102T	Applied Mathematics – II	4	3 1 0	100
2.	Basic Science	27012		Applied Physics – II	4	3 1 0	100
3.	Engineering Science	DME-202C 27013	MED-102T	Engineering Mechanics	4	3 1 0	100
4.	Engineering Science	27014		Introduction to IT systems	2	2 0 0	100
5.	Engineering Science	27015		Fundamentals of Electrical & Electronics Engineering	4	3 1 0	100
				Total	18	18	500
Laboratory Courses							
6.	Basic Science	28011		Applied Physics Lab	1	0 0 2	100
7.	Engineering Science	DME-202P 28012	MED-102P	Engineering Mechanics Lab	1	0 0 2	100
8.	Engineering Science	28013		Introduction to IT Systems Lab	2	0 0 4	100
				Total	4	8	300
				G. Total	22	26	800

Third Semester, Second Year

S.No	Category as per AICTE	New Code of Course	Old Course Code	Subject	Credits	Teaching Schedule Hrs. L T P	Marks
1.	Program core course		MAD-201T	Applied Mathematics -III	4	3 1 0	100
2.	Program core course	DME-301C	MED-201T	Materials Science	4	3 1 0	100
3.	Program core course	DME-303C	MED-203T	Mechanics of Solids -I	4	3 1 0	100
4.	Program core course	DME-305C	MED-205T	Thermal Engineering	4	3 1 0	100
5.	Humanities & Social Science			Moral values and professional ethics	1	1 0 0	100
				Total	17	17	500
Laboratory Courses							
7.	Program core course	DME-303P	MED-203P	Mechanics of Solids Lab	1	0 0 2	100
8.	Program core course	DME-307P	MED-207P	Manufacturing Engineering Lab	1	0 0 4	100
9.	Program core course	DME-305P	MED-205P	Thermal Engineering Lab	1	0 0 2	100
10.	Program core course	DME-309P	MED-209P	Computer Aided Machine Drawing Practice Lab	2	0 0 4	100
				Total	5	12	400
				G. Total	22	29	900

Fourth Semester, Second Year

S.No	Category as per AICTE	New Code of Course	Old Course Code	Subject	Credits	Teaching Schedule Hrs. L T P	Marks
1.	Program core course	DME-302C	MED-202T	Mechanics of Solids -II	3	2 1 0	100
2.	Program core course	DME-304C	MED-204T	Refrigeration and Air Conditioning	4	3 1 0	100
3.	Program core course	DME-306C	MED-206T	Measurement & Metrology	4	3 1 0	100
4.	Program core course	DME-308C	MED-208T	Computer Aided Design and Manufacturing	4	3 1 0	100
5.	Program core course	DME-310C	MED-210T	Theory of Machine & Mechanism	4	3 1 0	100
				Total	19	19	500
Laboratory Courses							
6.	Program core course	DME-310P	MED-210P	Theory of Machine & Mechanism Lab	1	0 0 2	100
7.	Program core course	DME-304P	MED-204P	Refrigeration and Air Conditioning Lab	2	0 0 4	100
8.	Program core course	DME-306P	MED-206P	Measurement & Metrology Lab	1	0 0 2	100
9.	Program core course	DME-308P	MED-208P	Computer Aided Design and Manufacturing Lab	2	0 0 4	100
				Total	6	12	400
				G. Total	25	31	900

Fifth Semester, Third Year

S.No	Category as per AICTE	New Code of Course	Old Course Code	Subject	Credits	Teaching Schedule Hrs. L T P	Marks
1.	Elective	DME-411E DME-413E	MED-311T MED-313T	Tool Engineering Computer Integrated Manufacturing (Program Elective-I)	4	3 1 0	100
2.	Program core course	DME-401C	MED-301T	Hydraulic & Pneumatics	4	3 1 0	100
3.	Program core course	DME-403C	MED-303T	Machine Design	4	3 1 0	100
4.	Program core course	DME-405C	MED-305T	Operations Management	4	3 1 0	100
5.	Program core course	DME-407C	MED-307T	IC Engine	4	3 1 0	100
				Total	20	20	500
Laboratory Courses							
6.	Program core course	DME-401P	MED-301P	Hydraulic & Pneumatics Lab	2	0 0 4	100
7.	Program core course	DME-407P	MED-307P	IC Engine Lab	2	0 0 4	100
8.	Program core course	DME-409P	MED-309P	Industrial Training (4 Weeks)	2	0 0 4	100
9.				Value Added Courses*			
				Total	6	12	300
				G. Total	26	32	800

***For Value added Courses the Grades would be assigned on the basis of performance.**

Sixth Semester, Third Year

S.No	Category as per AICTE	New Code of Course	Old Course Code	Subject	Credits	Teaching Schedule Hrs. L T P	Marks
1.	Program core course	DME-402C	MED-302T	Industrial Engineering	4	3 1 0	100
2.	Program core course	DME-404C	MED-304T	Industrial Robotics & Automation	4	3 1 0	100
3.	Program core course	DME-412C	MED-312T	Heat Transfer	4	3 1 0	100
4.	Elective			Open Elective	4	3 1 0	100
5.	Elective	DME-414E DME-416E DME-418E	MED-314T MED-316T MED-318T	Automobile Engineering Power Plant Engineering Farm Equipment & Farm Machinery (Program Elective-II)	2	2 0 0	100
				Total	18	18	500
Laboratory Courses							
6.	Program core course	DME-402P	MED-302P	Industrial Engineering Lab	2	0 0 4	100
7.	Program core course	DME-406P	MED-306P	Project Work	4	0 0 8	100
8.	Program core course	DME-408P	MED-308P	Seminar	1	0 0 2	100
				Total	7	14	300
				G. Total	25	32	800

S.No.	Program Elective-I	New Code	Course No.
1.	Tool Engineering	DME-411E	MED-311T
2.	Computer Integrated Manufacturing	DME-413E	MED-313T

S.No.	Program Elective-II	New Code	Course No.
1.	Automobile Engineering	DME-414E	MED-314T
2.	Power Plant Engineering	DME-416E	MED-316T
3.	Farm Equipment & Farm Machinery	DME-418E	MED-318T

S.No.	Open Elective	New Code	Course No.
1.	Material Handling Systems	DME-420E	MED-320T
2.	Hybrid Vehicles	DME-422E	MED-322T

Note: Electives may be floated as per faculty availability

Sub. Code: XXXT

Communication Skills in English

L T P
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Course Objectives

Communication Skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students.

Unit 1:Communication: Theory and Practice

- Basics of Communication, Definition Process of Communication
- Types of communication (formal and informal, verbal and non-verbal), 7 C's of Communication
- Barriers to communication and ways to overcome them
- Tools or devices of Communication

Unit 2: Soft Skills for Professional Excellence

- Introduction to Soft skills and hard skills
- Importance of soft skills
- Applying soft skills across cultures

Unit 3:Reading Comprehension: English for Communication on Communication

- Professional Development of Technicians
- Leadership and Supervision
- The Romance of Reading
- Sir C V Raman

Unit 4:Professional Writing

CV Writing, Covering Letter, Resume, Notices, Precis -Writing, Official Letters (Memo, Circular, Office Orders, Agenda, Minutes of Meeting, Report Wring, E-mail Drafting)

Unit 5:Vocabulary and Grammar

- Sentence and its Types
- Parts of Speech
- Tenses
- Active and Passive Voice
- Punctuation
- One Word Substitution, Idioms and Phrases

Course Objectives

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D, curves in solving various engineering problems of all fields.

Unit 1: Algebra

Series: AP and GP; Sum, nth term, Mean, Binomial theorem for positive, negative and fractional Index (without proof). Application of Binomial theorem, Vector Algebra: Dot and Cross product, Scalar and vector triple product, Complex numbers, Representation, Modulus and amplitude De Moivre theorem, its application in solving algebraic equations, Mod. Function and its properties

Unit 2: Differential Calculus-I

Functions, limits, continuity, functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability. Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logarithmic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.

Unit 3: Differential Calculus-II

Higher order derivatives, Leibnitz theorem (without proof). Simple applications. Application- Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation

Unit 4: Professional Writing

CV Writing, Covering Letter, Resume, Notices, Precis -Writing, Official Letters (Memo, Circular, Office Orders, Agenda, Minutes of Meeting, Report Writing, E-mail Drafting)

Recommended Books:

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.
3. Applied Mathematics-I by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (A) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

Sub. Code:

Applied Physics-I

L	T	P
3	1	2

Course Objectives

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

Unit 1: Units and Dimensions

- Need of Measurement in engineering and science, unit of a physical quantities fundamental and derived units, systems of units (FPS, CGS and SI units)
- Dimensions and dimensional formulae of physical quantities.
- Principle of homogeneity of dimensions
- Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities
- Limitations of dimensional analysis
- Error in measurement, accuracy and precision of instruments measuring instruments least count, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures and rounding off in calculation.

Unit 2: Force and Motion

- Scalar and vector quantities – examples, representation of vector, types of vectors
- Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
- Resolution of Vectors and its application to lawn roller and inclined plane.
- Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.
- Impulse and its Applications
- Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
- Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
- Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist.
- Gravitational force, Kepler's law of planetary motion.
- Acceleration due to gravity and its variation with depth and height from earth surface

Unit 3: Work, Power and Energy

- Work: and its units, examples of zero work, positive work and negative work.
- Friction: modern concept, types, laws of limiting friction, Coefficient of friction, reducing friction and its Engineering Applications.
- Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications
- Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation.
- Mechanical Energy, Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
- Power and its units, calculation of power in numerical problems

Unit 4: Rotational Motion

- Concept of translatory and rotatory motions with examples
- Definition of torque with examples
- Angular momentum, Conservation of angular momentum (quantitative) and its examples
- Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only).
- Rotational kinetic energy, Rolling of sphere on the slant plane
- Comparison of linear motion and rotational motion.

Unit 5: Properties of Matter

- Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve
- Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
- Surface tension: concept, its units, angle of contact cohesive and adhesive forces, Capillary action ascent formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension
- Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
- Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula) and their applications.

Unit 6: Heat and Thermometry

- Concept of Heat and Temperature.
- Modes of transfer of heat (Conduction, convection and radiation with examples)
- Different scales of temperature and their relationship and definition of specific heat.
- Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
- Concept of Co-efficient of thermal conductivity and its engineering application.
- Types of thermometers (Mercury Thermometer and Bimetallic Thermometer And Their Uses)

Recommended Books:

1. Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
4. B.Sc.Practical Physics by C L Arora, S. Chand Publication..
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi
7. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8. V. Rajendran, physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
9. Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
10. Physics Volume 1, 5th edition, Haliday Resnick and Krane, Wiley publication

Course Objectives

There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyses and properties of natural raw materials require for producing economical and eco-friendly finished products.

Unit 1: Atomic Structure, Chemical Bonding and Solutions

Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom, Heisenberg uncertainty principle, Quantum numbers – orbital concept. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration. Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H₂, F₂, HF hybridization in BeCl₂, BF₃, CH₄, NH₃, H₂O), coordination bond in NH₃ + and anomalous properties of NH₃, H₂O due to hydrogen bonding, and metallic bonding. Solution – idea of solute, solvent and solution, methods to express the concentration of solution molarity (M = mole per liter), Molality, Normality, ppm, mass percentage, volume percentage and mole fraction.

Unit 2: Water

Graphical presentation of water distribution on Earth (pie or bar diagram). Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness and simple numerical on water hardness. Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by ETDA method, total dissolved solids (TDS) alkalinity estimation.

- i) Water softening techniques – soda lime process, zeolite process and ion exchange process.
- ii) Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.
- iii) Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collect data and understand standards).

Unit 3: Engineering Materials

Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (matrix), flux, slag, metallurgy – brief account of general principles of metallurgy. Extraction of - iron from haematite ore using blast furnace, aluminium from bauxite along with reactions. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications. General chemical composition, Composition based applications (elementary idea only details omitted): Port land cement and hardening, Glasses Refractory and Composite materials. Polymers – monomer, homo and co polymers, degree of polymerization, simple reactions

involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon- 6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

Unit 4: Chemistry of Fuels and Lubricants

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong's formula. Proximate analysis of coal solid fuel Petrol and diesel - fuel rating (octane and cetane numbers), Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas. Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical proper- ties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants.

Unit 5: Electro Chemistry

Electronic concept of oxidation, reduction and redox reactions. Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of Electrolysis and simple numerical problems. Industrial Application of Electrolysis –

- Electrometallurgy
- Electroplating Electrolytic refining.
Application of redox reactions in electrochemical cells –
- Primary cells – dry cell,
- Secondary cell - commercially used lead storage battery, fuel and Solar cells.
Introduction to Corrosion of metals –
- Definition, types of corrosion (chemical and electrochemical), H₂ liberation and O₂ absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.
Internal corrosion preventive measures –
- Purification, alloying and heat treatment and External corrosion preventive measures:
a) Metal (anodic, cathodic) coatings,
b) Organic Inhibitors.

Recommended Books:

1. Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
3. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4. Dara, S. S. & Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, New Del-hi, 2015.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
7. Dr. G. H. Hugar& Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II,NITTTR, Chandigarh, Publications, 2013-14.
8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.

Course Objectives

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

Unit 1: Introduction

Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.

Unit 2: Air Pollution

Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

Unit 3: Water Pollution

Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O₂, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

Unit 4: Soil Pollution

- Sources of soil pollution
- Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
- Effect of Solid waste
- Disposal of Solid Waste- Solid Waste Management

Unit 5: Noise pollution

Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

Unit 6: Environmental Legislation

Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment

Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

List of Activities

- Plantation
- Caring of Plant
- Awareness of environment competition

Recommended Books:

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and DeepPublications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.

Course Objectives

Basic elements of integral calculus, differential calculus, numerical methods, differential equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

Learning Outcomes

- After undergoing this course, the students will be able to:
- Calculate simple integration by methods of integration
- Evaluate the area under curves, surface by using definite integrals.
- Calculate the area and volume under a curve along areas.
- Solve the engineering problems with numerical methods.
- Understand the geometric shapes used in engineering problems by co-ordinate geometry.

Unit 1: Integral Calculus

Indefinite Integration by substitution, rational function, partial fraction and by parts. Definite Integration: Meaning and properties and related problems. Integration of special functions, Beta and Gamma functions. Application of definite integral: Length of simple curves, Finding areas bounded by simple curves Volume of solids of revolution, center of mean of plane areas.

Unit 2: Numerical Analysis

Simpson's 1/3rd and Simpsons 3/8th rule and Trapezoidal Rule: their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton Raphson's method (without proof), Numerical solutions of simultaneous equations; Gauss elimination method (without proof)

Unit 3: Co-ordinate Geometry

2-Dimension: Circle, Equation of circle in standard form. Centre, Radius form, Diameter form, Two intercept form. 3-Dimension: Straight lines and planes in space, Distance between two points in space, direction cosine and direction ratios, Equation of a straight line (without proof), General equation of second degree.

Recommended Books:

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (B) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

Course Objectives

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

Unit 1: Wave motion and its applications

- Wave motion, transverse and longitudinal wave motion with examples. Sound and light waves and their properties. Definition of wave velocity, frequency and wave length and their relationship.
- Wave equation $y = r \sin wt$, phase, phase difference, principle of superposition of waves and amplitude
- Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., study of vibration of cantilever and determination of its time period, concept of simple harmonic progressive wave.
- Free, Damped and forced oscillations, Resonance with examples.
- Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Acoustics of building.
- Ultrasonic – Introduction properties and applications in engineering and medical applications.

Unit 2: Optics

- Basic optical laws - Reflection And Refraction, Refractive Index.
- Images and image formation by mirrors, lenses (concept only), lens formula (without derivation), power of lens, magnification.
- Total internal reflection, critical angle and conditions for total internal reflection, application of total internal reflection in optical fiber.
- Optical instruments - Simple And Compound Microscope, astronomical telescope in normal adjustment, magnifying power, resolving power, use of microscope and telescope.

Unit 3:Electrostatics

- Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.
- Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.
- Capacitor and its working principle, Types of capacitors.Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numerical).
- Dielectric and its effect on capacitance, dielectric break down.

Unit 4: Current Electricity

- Electric Current and its unit, direct and alternating current Resistance and its units, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance of a wire, Colour coding of carbon Resistances, Ohm's law.
- Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge)
- Concept of terminal potential difference and Electromotive force (EMF).
- Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy

Unit 5: Electromagnetism

- Types of magnetic materials. Dia, para and ferromagnetic materials with their properties.
- Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and its units, magnetization.
- Concept of electromagnetic induction, Faraday's Laws, Lorentz force (Force on moving charge in magnetic field). Force on current carrying conductor.
- Moving coil galvanometer – Principle of construction and working.
- Conversion of galvanometer into ammeter and voltmeter.

Unit 6: Semiconductor physics

- Energy bands in solids (Definition only) Types of materials (insulator, semiconductor, conductor), intrinsic and extrinsic semiconductors, p-n junction and P N junction diode and its V-I characteristics
- Diode as rectifier – half wave and full wave rectifier (center taped),
- Semiconductor transistor, PNP and NPN (concepts only) and some electronic application (list only)
- Application of semiconductor diodes (Zener, LED).

Unit 7: Modern Physics

- Lasers: Energy levels, ionization and excitation potential, spontaneous and stimulated emission, population inversion, pumping methods.
- Types of lasers: Ruby, He- Ne lasers, Laser characteristic, Engineering and medical applications of lasers.
- Fiber optics- introduction to optical fibers, light propagation, acceptance angle and numerical aperture, fiber types, application in telecommunication, medical and sensors.
- Nano Science and Nano technology: Introduction, nano particles and nano materials, properties at Nano scale, Nano technology, nanotechnology based devices and applications.

Recommended Books:

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5th edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7th edition, Wiley publication

Course Objectives

The course provides a foundational understanding of mechanics, covering force systems, equilibrium, and beam analysis under different loads. It explores friction and its applications, centroids and moments of inertia for various shapes, and the principles and applications of simple lifting machines.

Unit 1: Basics of Mechanics and Force System

Significance and relevance of mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.

Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

Unit 2: Equilibrium

Equilibrium and Equilibrant, Free body and free body diagram, Analytical and graphical methods of analysing equilibrium. Lami's Theorem – statement and explanation, Application for various engineering problems.

Beam- Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load.

Unit 3: Friction

Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

Unit 4: Centroid and Moment of Inertia

Concept, definition and determination of Centroid of plain figures (square, rectangle, triangle, circle, semi-circle, quarter circle) and Centre of gravity of symmetrical solid bodies (Cube, cuboid, cone, cylinder, sphere, hemisphere).

Concept of moment of inertia, Radius of Gyration, Theorem of perpendicular and parallel axis theorem. Concept of Second moment of area of standard areas (Rectangle, Triangle and circle) and composite area (L,T,I section).

Unit 5: Simple Lifting Machine

Simple lifting machine, load, effort, mechanical advantage, applications and

advantages. Velocity ratio, efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility.

System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application [Simple problems on the above topics]

Recommended Books:

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.
8. Bhavikatti S.S., Engineering Mechanics, New Age International Publishers

Course Objectives

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

Note: Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises.

Unit 1: Introduction to Computers and Peripherals.

Introduction, Computer Generations, Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, Keyboard, Mouse, display devices, Printer, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers

Unit 2: Operating System and Application Software

System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/LibreOffice, Working with windows OS, Desktop components, Menu bars, creating shortcut of program. Installation of Application software's, Antivirus and Drivers.

Unit 3: Office Tools: MS Office/Open Office/ Libre Office

Creation of document, spreadsheets and presentation, Google Suits (Google drive, Google sheet, Google doc, Google presentation).

Unit 4: Internet

Network topologies, Basics of Networking,– LAN,MAN, WAN, Connecting Devices(Bridge, Switch, Router, Gateway),Wi-Fi technologies, Concept of IP Address, DNS, Search Engines, e- mail, Web Browsing.

Unit 5: Basics of Information Security

Introduction to security, Security threats: detection and prevention, Indian Cyber laws

Recommended Books:

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi

4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net...Set...Go... Surviving in an e-world by AnushkaWirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

Reference websites:

1. www.tutorialspoint.com
2. www.sf.net
3. Gsuite.google.com
4. Spoken-tutorial.org
5. Swayam.gov.in

Course Objectives

To learn basic concepts of various active and passive electronic components, signals, measuring instruments, digital electronics, electric and magnetic circuits, ac circuits, transformer, motors and their applications. To help the students deal with the electrical and electronics engineering principles and applications in industrial processes of different fields.

Unit 1: Overview of electronic components

Active and Passive components, Resistor, Capacitor, Inductor and their types. Introduction to semi-conductor, Intrinsic and Extrinsic semi-conductors, P-N Junction diode - forward and reverse bias, V-I characteristics, Zener diode, LED. Bipolar Junction Transistor - PNP and NPN Transistor and their characteristics. Basics of FET, MOSFET.

Unit 2: Basic measuring instruments

Basic concept of Ideal and non-ideal voltage and current sources, sinusoidal and non sinusoidal waveforms, ammeter, voltmeter, wattmeter and digital multimeter, CRO (Block diagram, working and its uses)

Unit 3: Overview of Digital Electronics

Analog and digital signal, advantages of digital system. Introduction to Logic levels and Boolean Algebra, Basics of number system, Logic Gates-Truth Table and Symbol of AND, OR, NOT, NAND, NOR, ExOR, ExNOR Gates. Introduction to Latch, Flip Flops, Combinational Circuit and Sequential Circuit

Unit 4: Electric and Magnetic Circuits

Definitions of basic terms, such as Current, Resistance, EMF, Potential Difference, Power and Energy, Ohm's Law and its limitation, Kirchhoff's laws; M.M.F, magnetic force, flux, permeability, hysteresis loop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits..

Unit 5: V A.C. Circuits:

Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R- L-C series circuits; Power in A. C. Circuits, power triangle; Relationship between line and phase voltage and line and phase current in Star and Delta connections.

Unit 6: Transformers and Machines:

Single phase transformer: Construction, working principle, types, EMF equation, transformation ratio of transformers. Brief idea of Auto transformer. Machines: DC machines: Types, EMF equation of generator and motor. Single Phase Induction Motor: Principle of operation and introduction to methods of starting. Three Phase Induction Motor: Construction and Principle of operation.

Recommended Books:

1. RituSahdev, Basic Electrical Engineering, Khanna Publishing House.
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978- 0-07-0088572-5.
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition, ISBN: 9781107464353.
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405.
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375.
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN: 97881236529513.
7. Sedha, R.S., A Textbook of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978- 8121927833.
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13: 0070634244-978.
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13: 9788121924504.
10. Bell, David, Fundamentals of Electronic Devices and Circuits, Oxford University Press, New Delhi, 2015, ISBN: 9780195425239.

Course Objectives

Contents of this course provide understanding of some elementary and advanced mathematics algorithms and their applications of solving engineering problems. Content of this course will enable students to use some advanced techniques like Beta-Gamma function, Fourier series, Laplace transform and probability distributions in solving complex engineering problems.

Unit 1: Matrices

Algebra of Matrices, Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew Hermitian, Orthogonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix, Definition and Computation of inverse of a matrix., Elementary Row/Column Transformation, Meaning and use in computing inverse and rank of a matrix., Linear Dependence, Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations. Definition and evaluation of eigen values and eigen vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix. Basics of FET, MOSFET.

Unit 2: Vector Calculus and Multivariable Calculus

Vector Calculus: Vector function, Differentiation and integration of vector functions, Gradient, Divergence and Curl, Directional derivatives, Vector Identities.
Multivariable Calculus: Function of two variables, Partial Differentiation: Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians

Unit 3: Probability and Statistics

Probability: Introduction, Addition and Multiplication theorem and simple problems.
Distribution: Discrete and Continuous distribution, Binomial distribution, Poisson distribution, Normal distribution

Recommended Books:

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt.Ltd.,
3. Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-III by Chauhan and Chauhan, Krishna Publication, Meerut.

Course Objectives

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course 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 non-ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

Unit 1: Introduction

Material, History of Material Origin, Scope of Material Science, Overview of different engineering materials and applications, Classification of materials, Thermal, Chemical, Electrical, Mechanical properties of various materials, Present and future needs of materials, Overview of Biomaterials and semi-conducting materials, Various issues of Material Usage-Economical, Environment and Social.

Unit 2: Crystallography

Fundamentals: Crystal, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor.

Deformation: Overview of deformation behavior and its mechanism, behavior of material under load control and strain control.

Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep

Unit 3: Metals and Alloys

Ferrous Materials: Different iron ores, Raw materials in production of iron and steel, Basic process of iron-making and steel-making, Classification of iron and steel Cast Iron: Different types of Cast Iron, manufacture and their use. Classification of Grey cast iron and S.G. iron.

Steels: Steels and alloy steel, Classification of plain carbon steels, Properties and usage of different types of Plain Carbon Steels, Effect of various alloys on properties of steel, Uses of alloy steels (high speed steel, stainless steel, spring steel, silicon steel)

Non Ferrous Materials: Properties and uses of Aluminum, Copper and Zinc and their alloys

Unit 4: Heat Treatment

Purpose of heat treatment, Solid solutions and its types, Formation and decomposition of Austenite, Martensitic Transformation – Simplified Transformation Cooling Curves. Various heat treatment processes- hardening, tempering, annealing, normalizing, Case hardening and surface hardening, Hardenability of steels, Selection of case carburizing and induction hardening steels. Types of heat treatment furnaces (only basic idea)

Unit 5: V A.C. Circuits:

Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R- L-C series circuits; Power in A. C. Circuits, power triangle; Relationship between line and phase voltage and line and phase current in Star and Delta connections.

Unit 6: Plastics

Important sources of plastics, Classification-thermoplastic and thermoset and their uses, Various trade names of plastics, Plastic coatings, food grade plastics. Applications of plastics in automobile and domestic use. Rubber classification - Natural and synthetic. Selection of rubber.

Unit 7: Miscellaneous Materials

Overview of -Tool and Die materials, Materials for bearing metals

Recommended Books:

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana
2. Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science by Hazra, Chaudhary
5. Material Science and Engineering Raghuan by Raghvaan PHI

Course Objectives

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

Unit 1: Stresses and Strains

- Basic assumptions; Concept of load, stress and strain
- Tensile compressive and shear stresses and strains
- Concept of Elasticity, Elastic limit and limit of proportionality.
- Nominal and true stress-strain diagrams.
- Hook's Law
- Young Modulus of elasticity
- Nominal stress
- Yield point, plastic stage
- Ultimate strength and breaking stress
- Percentage elongation
- Proof stress and working stress
- Factor of safety
- Poisson's Ratio
- Shear modulus
- Deflection and stiffness
- Concepts of fatigue, creep and stress concentration
- Thermal stresses

Unit 2: Resilience

- Resilience, proof resilience and modulus of resilience
- Strain energy due to direct stresses
- Stresses due to gradual, sudden and falling load.

Unit 3: Metals and Alloys

- Concept of moment of inertia and second moment of area
- Radius of gyration
- Theorem of perpendicular axis and parallel axis (without derivation)
- Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
- Section modulus

Unit 4: Bending Stresses

- Concept of Bending stresses

- Theory of simple bending
- Use of the equation $\sigma/y = M/I = E/R$
- Concept of moment of resistance
- Bending stress diagram
- Calculation of maximum bending stress in beams of rectangular, circular, and T section.
- Permissible bending stress Section modulus for rectangular, circular and symmetrical I section

Recommended Books:

1. SOM by Birinder Singh; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand& Co; New Delhi
3. Mechanics of Materials by Dr. Kirpal Singh; Standard Publishers Distribution, New Delhi.
4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.
5. Mechanics of Solids by Karmveer Saini, Krishna Publication House, Meerut.

Course Objectives

A diploma holder in this course is supposed to maintain steam generators, turbines, compressors and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, compressors and about IC engines.

Unit 1: Fundamental Concepts

Thermodynamic state and system, boundary, surrounding, universe, thermodynamic systems – closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic, properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy.

Unit 2: Laws of Perfect Gases

Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants, derivation Specific heat at constant pressure, specific heat at constant volume of gas, simple problems on gas equation.

Unit 3: Thermodynamic Processes on Gases

Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes Derivation of work done, change in internal energy, rate of heat transfer for the above processes.

Unit 4: Laws of Thermodynamics

Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Application of first law of thermodynamics to non-flow systems – Constant volume, constant pressure, Adiabatic and polytropic processes. Steady flow energy equation, Application of steady flow energy to equation, turbines, pump, boilers, nozzles. Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Clasius statement, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy, ideal and real gases.

Unit 5: Properties of Steam

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes.

Unit 6: Air Standard Cycles

Meaning of air standard cycle – its use, condition of reversibility of a cycle
Description of Carnot cycle, Otto cycle, Diesel cycle, simple problems on efficiency, calculation for different cycles
Reasons for highest efficiency of Carnot cycle over all other cycles working between same temperature limits

Unit 7: Introduction to Heat Transfer

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

Unit 8: I C Engines

Introduction, Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle, Location and functions of various parts of IC engines and materials used for them. Testing of IC Engines: Engine power - indicated and brake power, Efficiency - mechanical, thermal, relative and volumetric, Methods of finding indicated and brake power, Morse test for petrol engine, Heat balance sheet, simple numerical problems, Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO – 2.

Recommended Books:

1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
3. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi.
4. A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.
5. Internal Commercial Engine by V. Ganeshan; Tata McGraw Hill, Education
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Course Objectives

This introductory course input is intended a. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Unit 1: Course Introduction Need, Basic Guidelines, Content and Process for Value Education:

Understanding the need, basic guidelines, content and process for Value Education. Self Exploration-what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Unit 2: Understanding Harmony in the Human Being Harmony in Myself:

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit 3: Understanding Harmony in the Family and Society-

Harmony in Human - Human Relationship: Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sahastitva as comprehensive Human Goals. Visualizing a universal harmonious order in

society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha) from family to world family!

Unit 4: Understanding Harmony in the Nature and Existence:

Whole existence as Co-existence: Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah- astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

- i. Ability to utilize the professional competence for augmenting universal human order,
- ii. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
- iii. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

- a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers.
- b) At the level of society: as mutually enriching institutions and organizations.

Recommended Books:

1. RR Gaur, R Sangal, GP Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Course Objectives

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

Unit 1: Torsion

- Concept of torsion- difference between torque and torsion.
- Use of torque equation for circular shaft
- Comparison between solid and hollow shaft with regard to their strength and weight.
- Power transmitted by shaft
- Concept of mean and maximum torque
- Concept of Principal stresses, principal planes and max. shear stress.
- Determination of shaft diameter under combined bending and torsion.

Unit 2: Shear Force and Bending Moment

- Concept of beam and form of loading
- Concept of end supports-Roller, hinged and fixed
- Concept of bending moment and shearing force
- S.F. and B.M. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated load and U.D.L.

Unit 3: Columns

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

Unit 4: Thin Cylinder and Spherical Shells

- Introduction to longitudinal stresses, circumferential or hoop stresses and radial stresses
- Longitudinal and circumferential stresses in thin cylinder
- Longitudinal and circumferential stresses in thin Spherical shells

Unit 5: Slope and Deflections of Beams:

- Definition of slope and deflection, sign convention. Circular bending. Calculation of maximum slope and deflection for the following standard cases by double integration or moment area method.
- Cantilever having point load at the free end
- Cantilever having point load at any point of the span
- Cantilever with uniformly distributed load over the entire span
- Cantilever having U.D.L. over part of the span from free end
- Cantilever having U.D.L. over a part of span from fixed end
- Simply supported beam with point load at centre of the span.
- Simply supported beam with U.D. L. over entire span.

Note: All examples will be for constant moment of inertia without derivation of formula

Sub. Code: MED-204T
New Code: DME-304C

Refrigeration and Air Conditioning

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Course Objectives

The diploma holders in Mechanical Engineering are responsible for supervising and maintenance of RAC system. For this purpose, the knowledge and skill covering basic principles of refrigeration and air conditioning is required to be imparted to the students. Moreover, RAC industry is expanding and employment opportunities in this field are good.

REFRIGERATION

Unit 1: Fundamentals of Refrigeration

Introduction to refrigeration, air conditioning, necessity of refrigeration meaning of refrigerating effect, units of refrigeration, COP, difference between COP and efficiency, methods of refrigeration, Reversed carnot cycle and its representation on P-V and T-S diagram. Major application areas of refrigeration and air conditioning.

Unit 2: Vapour Compression System

Introduction, principle, function, parts and necessity of vapour compression system, T-S and p-h charts, dry, wet and superheated compression. Effect of sub cooling, super heating, mass flow rate, entropy, enthalpy, work done, Refrigerating effect and COP. actual vapour compression system.

Unit 3: Refrigerants

Functions, classification of refrigerants, Nomenclature of refrigerant, Desirable properties of refrigerant, selection of refrigerant.

Unit 4: Air Refrigeration System

Introduction, advantages and disadvantages of air-refrigeration system over vapour compression system, bell – Collemann cycle, Boot strap system, calculation of mass flow rate, work done and COP.

Unit 5: Vapour Absorption System

Introduction, principle and working of simple absorption system and domestic electrolux refrigeration systems. Solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression system.

Unit 6: Refrigeration Equipment

- Compressors- Function, various types of compressors
- Condensers - Function, various types of condensers
- Evaporators- Function, types of evaporators
- Expansion Valves - Function, various types such as capillary tube, thermostatic expansion valve, low side and high side float valves, application of various expansion valves

- Safety Devices-Thermostat, overload protector LP, HP cut out switch.

AIR CONDITIONING

Unit 7: Psychrometry

Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air.

Unit 8: Applied Psychrometry and Heat Load Estimation

Psychrometric chart, sensible heating and cooling, Adiabatic cooling, Humidification and dehumidification, cooling and humidification, cooling and dehumidification, heating and humidification, heating and dehumidification, by pass factor, room sensible heat factor, effective room sensible heat factor, grand sensible heat factor, ADP, room DPT. Heating and cooling load calculation.

Heating and humidification, cooling and dehumidification, window air-conditioning, split type air-conditioning, car air-conditioning, central air-conditioning..

Unit 9: Latest development in refrigeration and air conditioning

Unit 10: Inverter technology, auto-defrosting, blast cooling, star rating

Recommended Books:

1. Refrigeration and Air Conditioning by Domkundwar; Dhanpat Rai and Sons, Delhi.
2. Refrigeration and Air Conditioning by CP Arora; Tata McGraw Hill, New Delhi.
3. Refrigeration and Air Conditioning by R.S Khurmi and J.K. Gupta; S Chand and Company Limited, New Delhi.

Course Objectives

- To study advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

Unit 1: Introduction to measurements

Definition of measurement; Significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error.

Measuring instruments

Introduction; Thread measurements: Thread gauge micrometre; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester; Co-ordinating measuring machine.

Unit 2: Transducers and Strain gauges

Introduction; Transducers: Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements.

Measurement of force, torque, and pressure

Introduction; Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: Mcloed gauge.

Unit 3: Applied mechanical measurements

Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotometers, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer.

Miscellaneous measurements

Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmomanometer.

Unit 4: Limits, Fits & Tolerances

Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole And Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919-1993 (Limits, Fits & Tolerances, Gauges) IS 3477-1973; concept of multi gauging and inspection.

Angular Measurement

Concept; Instruments For Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges (With Numerical on Setting of Angle Gauges).

Screw thread Measurements

ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floating carriage dial micrometer.

Unit 5: Gear Measurement and Testing

Analytical and functional inspection; Rolling test; Measurement of tooth thickness (constant chord method); Gear tooth vernier; Errors in gears such as backlash, runout, composite.

Machine tool testing

Parallelism; Straightness; Squareness; Coaxiality; roundness; run out; alignment testing of machine tools as per IS standard procedure.

Recommended Books:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Anand K Bewoor, Vinaykulakarni, Tata McGraw Hill, New Delhi, 2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Principles of Engineering Metrology – Rega Rajendra, Jaico publishers, 2008
5. Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition, Tata cgraw Hill, 2005.
7. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.
8. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS
10. Engineering Metrology – K. J. Hume, Kalyani publishers

Sub. Code: MED-208T
New Code: DME-308C

Computer Aided Design and Manufacturing

L T P
3 1 4

Course Objectives:

To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.

- To understand concepts of drafting and modelling using CAD.
- To understand the need for integration of CAD and CAM.
- To understand the concepts of flexible manufacturing system.

Unit 1: Fundamentals of CAD/CAM

Automation; Design process; Application of computers for design; Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure.

Geometric Modeling

3D-Wire frame modeling; Wire frame entities and their definitions; Interpolation and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques.

Unit 2: Surface Modeling

Algebraic and Geometric form; Parametric space of surface; Blending functions; Cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Bezier surface; Solid Modelling: Definition of cell composition and spatial occupancy enumeration; Sweep representation; Constructive solid geometry; Boundary representations.

Unit 3: NC Control Production Systems

Numerical control; Elements of NC system; NC part programming; Methods of NC part programming; Manual part programming, Computer assisted part programming; Post processor; Computerized part program.

Unit 4: Flexible manufacturing system

F.M.S equipment; Layouts; Analysis methods and benefits; Computer aided quality control; Automated inspection: Offline, Online, Contact, Non-contact; Coordinate measuring machines; Machine vision; CIM system and Benefits.

Recommended Books:

1. CAD/CAM Principles and Applications, P.N.Rao, Tata McGraw-Hill
2. Computer Aided Design and Manufacturing, Groover M.P. & Zimmers Jr, Prentice hall of India
3. CAD/CAM/CIM, RadhaKrishna P. & Subramanyam, Wiley Eastern Ltd

Course Objectives:

- To understand different types of cams and their motions and also to draw cam profiles for various motions.
- To understand the mechanism of various types of drives available for transmission of power.
- To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working.
- To understand the need for balancing of masses in the same plane
- To Know different types of governors.

Unit 1: Cams and Followers

Concept; Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).

Unit 2: Power Transmission

Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications; Material for flat and V-belt; Angle of lap, Belt length. Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numerical); Chain Drives – Advantages & Disadvantages; Selection of Chain & Sprocket wheels; Methods of lubrication; Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for compound, reverted and simple epicyclic gear train; Methods of lubrication; Law of gearing; Rope Drives – Types, applications, advantages & limitations of Steel ropes.

Unit 3: Flywheel and Governors

Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numerical); Co efficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance; Governors - Types and explanation with neat sketches (Centrifugal, Watt and Porter); Concept, function and applications & Terminology of Governors; Comparison between Flywheel and Governor.

Unit 4: Brakes, Dynamometers, Clutches & Bearings

Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake; Concept of Self Locking & Self energizing brakes; Numerical problems to find braking force and braking torque for shoe & band brakes; Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometers; Clutches- Uniform pressure and Uniform Wear theories; Function of Clutch and its

application; Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch and v) Diaphragm clutch. (Simple numerical on single and Multiplate clutch); Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numerical.

Unit 5: Balancing & Vibrations

Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane; Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.

Recommended Books:

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
2. Theory of machines – R.K.Bansal ,Laxmi publications
3. Theory of machines – R.S. Khurmi&J.K.Gupta , S.Chand publications.
4. Dynamics of Machines – J B K Das, Sapna Publications.
5. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.

Course Objectives:

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions

Unit 1: Introduction

Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units..

Unit 2: Pressure and its Measurement

- Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure)
- Pressure measuring devices: piezometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems
- Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge

Unit 3: Flow of Fluids

Types of fluid flow – steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; potential energy of a flowing fluid; total head; Bernoulli's theorem (statement and proof) and its applications. Discharge measurement with the help of venturi-meter, orifice meter, pitot-tube, limitations of Bernoulli's theorem simple problems.

Unit 4: Flow through Pipes

- Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss (without proof), Reynold's number and its effect on pipe friction; siphon, power developed. Water hammer, anchor block, syphon, surge tank (concept only).
- Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof)

Unit 5: Hydraulic System

Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press.

Unit 6: Water Turbines and Pumps

- Concept of a turbine, types of turbines –impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine, Propeller and Kaplan turbines. Unit speed, unit power, unit discharge, specific speed of turbines, Cavitations.
- Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps.
- Construction, working and operation of centrifugal pump. Performance, efficiencies and specifications of a centrifugal pump, pitting, cavitation, priming.

Unit 7: Introduction to Oil Power Hydraulics and Pneumatics

- Introduction to oil power hydraulic and pneumatic system
- Statement of Pascal law and its applications
- Industrial applications of oil power hydraulic and pneumatic system

Unit 8: Components of Hydraulic Systems

- Basic components of hydraulic system, function of each component in a hydraulic circuit.
- Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,
- Filters- definition and purpose, classification
- Seals and packing- classification of seals, sealing materials

Unit 9: Components of Pneumatic Systems

- Basic components – function of each component
- Air compressors - Introduction
- Air cylinder – types, function, single acting, double acting, rotating, non-rotating, piston type, diaphragm type, tandem cylinder, double ended cylinder, duplex cylinder.
- Air filter, regulator and lubricator – their necessity in pneumatic circuit.
- Installation, maintenance and application of air cylinders.

Recommended Books:

1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi;S.Chand& Co. Ltd., New Delhi.
3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi

Course Objectives:

A diploma holder in this course is required to assist in the Design and Development of Prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

Unit 1: Introduction

- Design – Definition, Type of design, necessity of design
- Comparison of designed and undesigned work
- Design procedure
- Characteristics of a good designer
- Design terminology, factor of safety, affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit.
- General design consideration
- Codes and Standards (BIS standards)
- Selection of materials, criteria of material selection
- Ergonomics and Aesthetic Consideration in design
- Ergonomics of design-man-machine relationship. Design of equipment for control, environment and safety.
- Aesthetic consideration regarding shape, size, color and surface finish

Unit 2: Design Failure

- Theories of failure.
- Classification of loads
- Design under tensile, compressive and torsional loads

Unit 3: Design of Shaft

Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaft available. Shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of:

- Strength criterion.
- Rigidity criterion

Determination of shaft diameter (hollow and solid shaft) subjected to bending.

Determination of shaft diameter (hollow and solid shaft) subjected to combined torsion and bending.

Unit 4: Design of Key

- Types of key, materials of key, functions of key
- Failure of key (by Shearing and Crushing).
- Design of key (Determination of key dimension)
- Effect of keyway on shaft strength. (Figures and problems).

Unit 5: Design of Joints

Types of joints - Temporary and permanent joints, utility of various joints

Temporary Joint:

- Knuckle Joints – Different parts of the joint, material used for the joint, type of knuckle joint, design of the knuckle joint. (Figures and problems).
- Cotter Joint – Different parts of the spigot and socket joints, Design of spigot and socket joint.

Permanent Joint:

- Welded Joint - Welding symbols. Type of welded joint, strength of parallel and transverse fillet welds.
- Strength of combined parallel and transverse weld.
- Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint caulking and fullering.
- Different modes of rivet joint failure.
- Design of riveted joint – Lap and butt, single and multi-riveted joint.

Unit 6: Design of Flange Coupling

Necessity of a coupling, advantages of a coupling, types of couplings, design of muff coupling, design of flange coupling. (Both protected type and unprotected type).

Unit 7: Design of Screwed Joints

- Introduction, Advantages and Disadvantages of screw joints, location of screw joints.
- Important terms used in screw threads, designation of screw threads
- Initial stresses due to screw up forces, stresses due to combined forces
- Design of power screws (Press, screw jack, screw clamp)

Note:

- a) Use of design data book during the examination is allowed.
- b) The paper setter should normally provide all the relevant data for the machine Design in the question paper.

Recommended Books:

1. Machine Design by R.S. Khurmi and JK Gupta, Eurasia Publishing House (Pvt.) Limited, New Delhi.
2. Machine Design by V.B.Bhandari, Tata McGraw Hill, New Delhi.
3. Engineering Design by George Dieter; Tata McGraw Hill Publishers, New Delhi.
4. Mechanical Engineering Design by Joseph Edward Shigley; McGraw Hill, Delhi.
5. Machine Design by Sharma and Agrawal; Katson Publishing House, Ludhiana.

Sub. Code: MED-305T
New Code: DME-405C

Operations Management

L T P
3 1 0

Unit 1:

The Operation Function: Operations management operation decisions frame work, operation as a process. Operations strategy model, operations, Objectives.

Unit 2:

Product Design: Strategies for new product, New product development process, cross functional product Design, Value analysis. Process & Service Design: (a) Product flow characteristics, process selection decisions. (b) Service definition, service matrix, customer contact Technology in service.

Unit 3:

Fore Casting: A fore casting frame work qualitative fore casting methods, times services fore casting , moving average, forecast errors selection of fore casting method.

Unit 4:

Facilities & Aggregate Planning: facilities decisions, facility strategy Aggregate Planning, Planning options Aggregate Planning costs.

Unit 5:

Project Planning & Scheduling Objectives and Trade off, scheduling methods PERT methods CPM method.

Recommended Books:

1. Operation Management: Contemporary Concepts and Cases by Roger G. Schroeder.
2. Production and Industrial management By James Telsang
3. Operations Management: Theory& Practice ByD. Mahadevan

Sub. Code: MED-307T
New Code: DME-407C

I C Engine

L T P
3 1 4

Course Objectives:

These days, automobile has become a necessity instead of luxury. The diploma holders in this course are required to supervise production and repair and maintenance of vehicles. For this purpose, knowledge and skills are required to be imparted to them regarding automobile industry as a whole. This subject aims at developing required knowledge and skills in this area.

Unit 1: Introduction to I. C. Engines

Classification of I.C. Engine, Difference between two stroke and four stroke engines, difference between SI & CI engines. I. C. Engine: cycles-Otto, diesel and dual; calculation of air standard efficiency, work ratio, mean effective pressure, volumetric efficiency IHP, BHP etc.

Unit 2: Combustion in SI Engines

Introduction; ignition limits, stages of combustion; ignition lag, factors affecting detonation, effects of detonation, control of detonation, knock, rating of volatile fuels, octane number, firing order; salient feature of different combustion chamber.

Unit 3: Carburetion

Introduction, different mixture requirement in SI engine, Elementary carburetor, complete carburetor, additional systems required, carburetor types; calculation of air fuel ratio for simple carburetor; petrol injection- Introduction, continuous and timed injection system. Fuel injection- Introduction, requirements of a fuel injection system; Types of injection System-Air and solid injection system; type of fuel injectors.

Unit 4: Ignition System

Introduction, Magneto and Battery ignition systems. Advantages and disadvantages of both the systems.

Unit 5: Supercharging

Introduction, object of supercharging of SI and CI engines, Turbo charging its effect on engine.

Unit 6: Cooling

Introduction, Necessity of cooling, disadvantages of overcooling, cooling systems- Air and water or liquid cooling, types of liquid cooling; Advantages and disadvantage of air and water cooling; Radiator. Lubrication- Introduction, function of a lubricating system, Different lubrication systems, mist and wet sump lubrication systems. Properties of lubricants.

Recommended Books:

1. Automobile Engineering by GBS Narang; Khanna Publishers, Delhi.
2. Automobile Engineering by Dr.Kirpal Singh; Standard Publishers and Distributors, Delhi.
3. Automotive Mechanics, by W.Crouse and Anglin; Tata McGraw Hill, Delhi.

Course Objectives:

A diploma holder in this course will have to conduct time and motion study to improve the methods/system. For this, knowledge and related skills in method study and work measurement are essential. Knowledge of industrial safety is also required. Hence this subject.

Unit 1: Productivity

Introduction to productivity, factors affecting productivity, practical measurement of productivity, difference between production and productivity, causes of low productivity and methods to improve productivity, contribution of standardization in improving productivity.

Unit 2: Work Study

Definition and scope of work study; factors for selection of work study job, uses and limitations of work study, Interrelation between method study and work measurement; Human aspects of work study; Role of work study in improving productivity.

Unit 3: Method Study

Definition, Objectives and procedure for Method study analysis; Information collection and recording techniques through various diagrams.

Unit 4: Motion Analysis

Principles of Motion analysis; Therbligs and SIMO charts; Normal work area (Principle of motion economy), design and arrangement of work place. Ergonomics, design of tools and equipments.

Unit 5: Work Measurement

Objectives; work measurement techniques, stop watch time study; principle, equipment used and procedure; systems of performance rating; standard elements of time, calculation of basic times; various allowances; guide for rest allowance in Indian conditions, calculation of standard time, work sampling, standard data and its usage. Work sampling.

Unit 6: Wages and Incentive Schemes

Introduction to wages, Wage payment for direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour.

Unit 7: Stores Management

Different Layout and structures of stores, Inventory control, calculation of EOQ, Bin cards and various forms required in stores for documentation. Purchase procedures.

Unit 8: Industrial Safety

- Accident- causes, types, results and control.
- Mechanical and electrical hazards- types, causes and preventive steps/procedure.
- Describe salient points of Factories Act 1948 for health and safety- wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels etc.
- Safety colour codes.

- Fire prevention and fire fighting, equipment and methods

Recommended Books:

1. Work Study and Ergonomics by S Dalela and Sourabh
2. Industrial Engineering and Management by O.P. Khanna, Dhanpat Rai and Sons, Delhi.

Course Objectives:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To select the robots according to its usage.
- To discuss about the various applications of robots, justification and implementation of robot.
- To Conceptualize automation and understand applications of robots in various industries.

Unit 1: Fundamentals of Robotics

Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.

Unit 2: Robotic Drive System and Controller

Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.

Unit 3: Sensors

Requirements of a sensor; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing.

Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videocon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.

Unit 4: Robot kinematics and Robot Programming

Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effector commands; and Simple programs.

Unit 5: Automation

Basic elements of automated system, advanced automation functions, levels of automation.

Industrial Applications

Application of robots in machining; welding; assembly and material handling.

Recommended Books:

1. Introduction to Robotics: Analysis, Systems, Applications–Saeed B. Niku, Pearson Education Inc. New Delhi 2006.
2. Industrial Robotics: Technology, Programming and Applications–M.P. Groover, Tata McGraw Hill Co, 2001.
3. Robotics Control, Sensing, Vision and Intelligence–Fu. K.S. Gonzalz. R. Cand Lee C. S. G, McGraw Hill Book Co, 1987.
4. Robotics for Engineers–Yoram Koren, McGraw Hill BookCo,1992.
5. A Text book on Industrial Robotics–Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.
6. Robotics Technology and Flexible Automation–S. R. Deb & Sankha Deb, Tata McGraw Hill, 2010.
7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House,Delhi,2018

Course Objectives:

- To understand the concepts of conduction.
- To understand the concepts of Fins heat transfer.
- To understand the concepts of radiation.
- To understand the concepts of convection.
- To understand the basics of heat exchangers.

Unit 1: Conduction

Fourier law of heat conduction for isotropic material; Thermal conductivity; Derivation of the energy equation in three dimensions including transient effect; Nondimensional thermal diffusivity and Fourier number; Types of boundary conditions (Dirchlet, Neumann, mixed-type); One-dimensional solution with and without heat generation; Analogy with electrical circuits; Critical thickness of insulation.

Unit 2: Fins

Rectangular and pin fins; Fin effectiveness and efficiency; Lumped parameter approach and physical significance of time constant; Biot number; Validity of lumped parameter approach; Introduction to Heissler Chart.

Unit 3: Convection

Introduction; Newton's law of cooling; Momentum and energy equations in two dimensions; Non-dimensionalisation; Importance of non-dimensional quantities and their physical significance; Velocity and thermal boundary layer thickness by integral method; Analogies between momentum, heat, and mass transfer; Natural convection; Effect of coupling on the conservation equations.

Unit 4: Radiation

Physical mechanism of thermal radiation; Laws of radiation; Definitions of blackbody, emissive power, intensity of radiation, emissivity, reflectivity, transmissivity, irradiation; Radiation exchange between black bodies; Concept of Gray-Diffuse Isotropic (GDI) surface; Radiation exchange between GDI surfaces by radiation network and radiosity matrix method; Radiation shielding.

Unit 5: Heat Exchangers

Types of heat exchangers; Parallel and counter flow types; Introduction to LMTD; Correction factors; Fouling factor; NTU method for heat exchangers.

Recommended Books:

1. Fundamentals of Heat and Mass Transfer by F.P. Incropera and D.P. Dewitt, 4th ed., John Wiley & Sons.
2. Heat Transfer: A Basic Approach by M.N. Ozisik, McGraw-Hill.
3. Heat Transfer by J.P. Holman, 8th ed., McGraw-Hill.
4. Elements of Heat & Mass Transfer by Vijay Gupta, 2nd ed., New Age International Publishers.

Sub. Code: MED-311T
New Code: DME-411E

Tool Engineering
(Program Elective-I)

L T P
3 1 0

Course Objectives:

- To understand metal cutting and forming process and factors affecting machinability.
- To develop knowledge of tools, dies and tool materials.
- To understand processes for increased productivity and quality.

Unit 1: Metal Cutting

Mechanics of Metal cutting; requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle; simple numerical only; types of metal cutting process; orthogonal; oblique and form cutting;

Cutting fluids: Types; characteristics and applications.

Tool wear: Types of wear; Tool life; Tool life equations.

Unit 2: Machinability

Definition; factors affecting machinability; machinability index.

Tool materials: Types; characteristics; applications; Heat treatment of tool steels; Specification of Carbide tips; Types of ceramic coatings.

Cutting Tool Geometry: Single point cutting tool; drills; reamers; milling; cutters.

Unit 3: Types of dies and construction

Simple Die; Compound Die; Progressive Die; Combination Die.

Punch & Die mountings: pilots; strippers; misfeed detectors; Pressure Pads; Knockouts; stock guide; Feed Stop; guide bush; guide pins.

Unit 4: Die Design Fundamentals

Die Operations; blanking; piercing; shearing; cropping; notching; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor.

Unit 5: Forming Dies

Bending methods; Bending Dies; bend allowance; spring back; spanning; bending pressure; pressure pads; development of blank length.

Drawing: operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies.

Fundamentals of other Tools: Constructional features of Pressure Die casting dies; metal extrusion dies; injection molding dies; forging dies; plastic extrusion dies.

Recommended Books:

1. Tool Design Donalds on Anglin, Tata McGrawHill.
2. Production Technology H. M. T. Jain, Tata McGrawHill.
3. A Text Book of Production engineering–P.C. Sharma, S.Chand & Co.
4. Production Technology, R.K. Jain, Khanna Publishers.

Sub. Code: MED-313T
New Code: DME-413E

Computer Integrated Manufacturing
(Program Elective-I)

L T P
3 1 0

Course Objectives:

- Students will be able to describe the basic components of Computer Integrated Manufacturing (CIM) systems.
- Students will be able to utilize CAD software for product modeling and automatic drafting.
- Students will gain proficiency in creating NC part programs using computer-assisted techniques.
- Students will gain the concept of Flexible Manufacturing Systems and their application..

Unit 1: Concept of Computer Integrated Manufacturing (CIM)

Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

Unit 2: Computer Aided Design (CAD)

CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre..

Unit 3: Computer Aided Manufacturing (CAM)

Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirements planning (MRP).

Unit 4:

Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.

Unit 5:

Integrating NC machines, robots, AGVs, and other NC equipment; Computer aided quality control; business functions, computer aided forecasting; office automation.

Recommended Books:

1. CAD, CAM, CIMP. Radhakrishnan and S. Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation– S.R. Deb, Tata McGrawHill.

Sub. Code: MED-314T
New Code: DME-414E

Automobile Engineering
(Program Elective-II)

L T P
3 1 0

Course Objectives:

- To understand the basic structure and components of an automobile.
- To understand the concepts of cooling and lubricating systems.
- To understand the concepts of Ignition and transmission and steering systems.
- To understand the classification and necessity of suspension system.
- To identify different special vehicles.

Unit 1: Introduction to basic structure of an automobile

Basic engine components; Cylinder block; Cylinder head; Gaskets; cylinder liners, types of cylinder liners; Piston and piston pin; piston rings, types of piston rings; Connecting rod; Crank shaft; Cam shaft; Crankcase; Engine valves; Flywheel and Governor.

Unit 2: Cooling and lubrication system

The necessity of cooling system; Types of cooling system-air cooling and water cooling; Air cooling system; Types of water cooling system –Thermosyphon system and pump circulation system; Advantages and disadvantages of air cooling and water cooling systems; The components of water cooling system –fan, radiator, pump and thermostat; The necessity of lubrication system; Types of lubrication system; Petrol lubrication and high pressure lubrication system. Fuel feed system: Conventional fuels and alternative fuels: Cetane and octane numbers; Types of carburettors; Working of simple carburettor; Multi point and single point fuel injection systems; Different fuel transfer pumps; Working of S.U electrical and A.C mechanical pump; Fuel filters; Fuel injection pump; Fuel injectors.

Unit 3: Ignition system

Introduction to ignition system; Battery Ignition systems; Electronic Ignition system; Elements of charging system; Elements of starting system; Types of lights used in the automobile: Transmission and steering system: General arrangement of clutch; Principle of friction clutches; Constructional details of Single plate clutch; Constructional details of multi-plate clutch; Constructional details of centrifugal clutch; Necessity for gear ratios in transmission; Types of gear boxes; Working of sliding mesh gear box; Working of constant mesh gear box; Working of propeller shaft, Working of propeller shaft; Working of universal joint; Working of differential; Types of rear axle; Purpose of front axle; Necessity of steering system; Caster, camber and king pin inclination; Rack and pinion steering system; Power steering

Unit 4: Suspension system

Necessity of suspension system; Torsion bar suspension systems; Leaf spring and coil spring suspension system; Independent suspension for front wheel and rear wheel; Working of telescopic shock absorber; Functions of brakes; Types of brakes; Working of internal expanding brake; Working of disc brake.

Unit 5: Special vehicles

Introduction to Special vehicles; Tractor; Motor grader; Scrappers; Excavators; Duper trucks.

Recommended Books:

1. Automobile Engineering Vol I, II, Kirpal Singh, Standard Publishers Distributors, Delhi. 2012.
2. Automobile Mechanics, A.K. Babu, S.C. Sharma, Khanna Publications, New Delhi
3. Automotive Mechanics: Principles and Practices, Joseph Heitner, East West Press
4. Automotive Mechanics, S. Srinivasan, 2nd Edition, Tata McGraw Hill
5. Automobile Engineering Vol I and Vol II, K. M. Gupta, Umesh Publications.
6. Automotive Engineering, Jain and Asthana, Tata McGraw Hill.

Sub. Code: MED-316T
New Code: DME-416E

Power Plant Engineering
(Program Elective-II)

L T P
3 1 0

Course Objectives:

- To understand the presents scenario of power in India.
- To understand hydro working principles
- To understand working of Diesel, Gas and Nuclear power plants.
- To understand the issues and safety precautions in power plants.

Unit 1: Introduction to Power Plant

Introduction to power plant; Indian Energy scenario in India; Location of power plant; Choice of Power plant; Classification of power plants.

Unit 2: Economics of Power Plant

Terminology used in power plant: Peak load, Base load, Load factor, Load curve; Various factors affecting the operation of power plants; Methods of meeting the fluctuating load in power plants; Load sharing cost of power tariff methods; Performance and operating characteristics of power plants.

Unit 3: Hydro Power Plant

Introduction to Hydroelectric power plant; Rainfall, Runoff and its measurement, Hydrograph, flow duration curve; Selection of sites for hydroelectric power plant; General layout of Hydroelectric power plant and its working; Classification of the Plant: Run-off river plant, storage river plant, pumped storage plant; Advantages and disadvantages of hydroelectric power plants.

Unit 4: Diesel and Gas Turbine Plant

The layout of diesel power plant; Components and the working of diesel power plant; Advantages and disadvantages of diesel power plant; Gas turbine power Plant: Schematic diagram, components and its working; Combined cycle power generation: Combined gas and steam turbine power plant operation (only flow diagram).

Nuclear Power Plant

Introduction; Nuclear Power-Radio activity -Radioactive charge-types of reactions; Working of a nuclear power plant; Thermal fission Reactors: PWR, BWR and gas-cooled reactors; Advantages and Disadvantages of Nuclear power plants

Unit 5: Environmental Impact of Power Plant

Social and Economical issues of power plant; Greenhouse effect; Acid Precipitation: Acid rain, Acid snow, Dry deposition, Acid fog; Air, water, Thermal pollution from power plants; Radiations from nuclear power plant effluents.

Power Plant Safety

Plant safety concept; Safety policy to be observed in power plants; Safety practices to be observed in boiler operation; Safety in oil handling system; Safety in Chemical handling system; Statutory provision related to boiler operation

Recommended Books:

1. Power Plant Engineering - P.K. Nag, 4th edition, Tata McGraw Hill Education, 2014.
2. Power Plant Engineering - Frederick T. Morse, Litton Educational Publishing Inc., 1953.
3. A Course in Power Plant Engineering - Subhash C. Arora, S. Domakundwar, DhanpatRai, 1984.
4. Power Plant Engineering - P.C. Sharma, S.K. Kataria & Sons, 2009.
5. Power System Engineering - R.K. Rajput, Firewell Media, 2006.

Sub. Code: MED-318T
New Code: DME-418E

Farm Equipment and Farm Machinery
(Program Elective-II)

L T P
3 1 0

Course Objectives:

- To find and characterize the machinery based on crop production.
- To find the field efficiency and capacities to calculate the economics of machinery.
- To find the machines usages for different tillage, and its power requirement calculations.
- To understand sowing, planting & transplanting equipment based on crop.
- To understand machinery materials and heat effects for different farm machinery equipment.

Unit 1: Introduction to farm mechanization

Classification of farm machines, Unit operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery.

Unit 2: Calculation of field capacities and field efficiency

Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earthmoving equipment.

Unit 3: Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage

Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould board plough, disc plough, chisel plough, sub soiler, harrows, puddler, cultivators, identification of major functional components. Attachments with tillage machinery.

Unit 4: Introduction to sowing, planting & transplanting equipment

Introduction to seed drills, no till drills, and strip-till drills. Introduction to planters, bed planters and other planting equipment like sugar cane, potato. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/planters. Adjustments during operation.

Unit 5: Introduction to materials used in construction of farm machines

Heat treatment processes and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines. Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components.

Recommended Books:

1. Principles of Farm Machinery - R.A. Kepner, Roy Bainer, and E.L. Berger
2. Farm Machinery and Equipment - H.P. Smith
3. Farm Machinery and Equipment - C.P. Nakra
4. Engineering Principles of Agril. Machines - Dr. Ajit K. Srivastav, Carroll E. Goering and Roger P. Rohrbach
5. Farm Machinery: An Approach - S.C Jain & Grace Phillips Agril.
6. Engineering Through Worked Out Examples - Dr. R. Lal and Dr. A.C. Dutta
7. Farm Power and Machinery Engineering - Dr. R. Suresh and Sanjay Kumar

Sub. Code: MED-320T
New Code: DME-420E

Material Handling System
(Open Elective)

L T P
3 1 0

Course Objectives:

- To know the operational features of the material handling equipment & its practical applications.
- To understand, select, operate and maintain the material handling equipments.
- To understand different material handling processes used in industries.
- To understand & appreciate safety instrumentation for equipment.

Unit 1: Introduction to Material Handling System

Main types of Material handling equipment & their applications; Types of load to be handled; Types of Movements; Methods of stacking, loading & unloading systems; Principles of Material Handling Systems; Modern trends in Materials handling.

Unit 2: Hoisting Machinery & Equipment

Construction, Working & Maintenance of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Differential hoists, Worm geared and Spur geared hoists, Electric & Pneumatic hoists, Jumper; Construction, Working & Maintenance of different types of cranes such as Rotary cranes, Trackless cranes, Mobile cranes, Bridge cranes, Cable cranes, Floating cranes & Cranes traveling on guide rails; Construction, Working & Maintenance of Elevating equipment such as Stackers, Industrial lifts, Freight elevators, Passenger lifts, and Mast type's elevators, Vertical skip hoist elevators..

Unit 3: Conveying Machinery

Construction, Working & Maintenance of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators; Construction, Working & Maintenance of Tractionless type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders. Surface Transportation Equipment: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle, Industrial Trailers; Construction, Function, Working of Cross handling equipment such as Winches, Capstans, Turntables, Transfer tables, Monorail conveyors.

Unit 4: Components of Material Handling Systems

Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, Fastening methods of wire & chains, Eyebolts, Lifting tackles, Lifting & Rigging practices; Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter d) Grabbing attachment for loose materials e) Crane attachment for handling liquids/molten metals; Construction & Working of Arresting gear & Brakes; Construction & use of electromagnetic shoe brakes, Thruster operated shoe brakes, Control brakes.

Unit 5: Mechanism used in Material Handling Equipment

Steady state motion; Starting & stopping of motion in the following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism, Slewing Mechanism,

Rope & chain operated Cross Traverse Mechanism. Selection of Material Handling Equipment: Factors affecting the choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel, Methods of stocking at initial, final & intermediate points, Nature of production process involved, Specific load conditions & Economics of material handling system.

Recommended Books:

1. Material Handling (Principles & Practice) - Allegri T.H., CBS Publisher, New Delhi.
2. Plant Layout & Materials Handling - Apple J.M., John Wiley Publishers.
3. Material Handling Equipment - N. Rundenko, Peace Publisher, Moscow.
4. Material Handling Equipment - M.P. Alexandrov, MIR Publisher, Moscow.
5. Material Handling Equipment - Y.I. Oberman, MIR Publisher, Moscow

Sub. Code: MED-322T
New Code: DME-422E

Hybrid Vehicles
(Open Elective)

L T P
3 1 0

Course Objectives:

- To understand the basics of electric vehicle history and components.
- To understand properties of batteries.
- To understand the electrical machine properties and classifications.
- To understand the properties of electric vehicle drive systems
- To understand the concepts of hybrid electric vehicles.

Unit 1: Electric Vehicles

Introduction; History of Hybrid and Electric Vehicles; Social and Environmental importance of Hybrid and Electric Vehicles; Components, Vehicle mechanics: Roadway fundamentals, Vehicle kinetics, Dynamics of vehicle motion; Propulsion System Design.

Unit 2: Battery

Basics; Types; Parameters: Capacity, Discharge rate, State of charge, State of Discharge, Depth of Discharge; Technical characteristics, Battery pack Design, Properties of Batteries.

Unit 3: DC & AC Electrical Machines

Motor and Engine rating; Requirements; DC machines; Three-phase A/C machines; Induction machines; Permanent magnet machines; Switched reluctance machines.

Unit 4: Electric Vehicle Drive Train

Transmission configuration; Components: Gears, Differential, Clutch, Brakes; Regenerative braking, Motor sizing; Fuel efficiency analysis.

Unit 5: Hybrid Electric Vehicles Types

Parallel, Series, Parallel and Series configurations; Drivetrain; Sizing of components; Basics of Micro, Mild, Mini, Plugin and Fully hybrid.

Recommended Books:

1. Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018.
2. Electric & Hybrid Vehicles – Design Fundamentals Iqbal Hussain, Second Edition, CRC Press, 2011.
3. Electric Vehicle Technology Explained James Larminie, John Wiley & Sons, 2003.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals Mehrdad Ehsani, Yimin Gao, Ali Emadi, CRC Press, 2010.
5. Electric Vehicle Battery Systems Sandeep Dhameja, Newnes, 2000

**Diploma in Engineering
First Year Labs**

S. No.	Subject	New Code	Subject Code
Ist Semester			
1	Applied Physics – I Lab		XXXT
2	Applied Chemistry Lab		CYD-101P
3	Engineering Graphics	DME-201P	MED-101P
4	Communication Skills In English Lab		XXXT
5	Engineering Workshop Practice	DME-203P	MED- 103P
IInd Semester			
1	Applied Physics – II Lab		XXXT
2	Engineering Mechanics Lab	DME-202P	MED-102P
3	Introduction to IT Systems Lab		XXXT

Course Objectives:

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

List of Practicals**(To perform any Six Practicals)**

1. To measure length, radius of a given cylindrical body like test tube, beaker using a one-year calipers and find volume of each object.
2. To determine diameter of a wire, a solid ball using a screw gauge.
3. To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
4. To verify parallelogram law of forces.
5. To find the coefficient of friction between wood and glass using a horizontal board.
6. To determine the atmospheric pressure at a place using Fortin's Barometer
7. To determine the viscosity of glycerin by Stoke's method
8. To verify law of conservation of mechanical energy (PE to KE).
9. To measure room temperature and temperature of hot bath using mercury thermometer and convert it into different scales.
10. To determine force constant of spring using Hooks law.

Course Objectives:

There are numerous number of materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. The course aims to supplement the factual knowledge gained in the lectures by first hand manipulation of processes and apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.

LIST OF PRACTICALS**Volumetric and Gravimetric analysis: (Perform any Ten Laboratory Practicals.)**

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. Standardization of KMnO_4 solution using standard oxalic acid and determine the percentage of iron present in given Hematite ore by KMnO_4 solution.
4. Iodometric estimation of copper in the copper pyrite ore.
5. Volumetric estimation of total acid number (TAN) of given oil.
6. Volumetric estimation of:
7. Total hardness of given water sample using standard EDTA solution.
8. Alkalinity of given water sample using 0.01M sulphuric acid.
9. Proximate analysis of coal:
10. Gravimetric estimation of moisture in given coal sample.
11. Gravimetric estimation of ash in given coal sample.

Instrumental analysis:

1. Determine the conductivity of given water sample.
2. Determination of the iron content in given cement sample using colorimeter.
3. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
4. Determination of viscosity of lubricating oil using Redwood viscometer.
5. Determination of flash and fire point of lubricating oil using Abel's flash point apparatus.
6. To verify the first law of electrolysis of copper sulfate using copper electrode.
7. Construction and measurement of emf of electrochemical cell (Daniel cell).
8. To study the effect of dissimilar metal combination.

Sub. Code: MED-103P
New Code: DME-203P

Engineering Workshop Practice

L T P
0 0 4

Course Objectives:

The course aims to provide hands-on experience and practical skills in various essential workshops, including carpentry, fitting, welding, sheet metal, plumbing, and painting and polishing. Students will gain proficiency in using different tools and machines, understanding and executing various processes and operations, and completing multiple jobs that involve intricate tasks. This practical knowledge will equip students with the necessary skills to handle real-world tasks efficiently, fostering a deeper understanding of the techniques and safety measures required in each shop..

Course Outcomes

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

- Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking, and cutting tools & equipment's and machines
- Explain job drawing and complete jobs as per specifications in allotted time
- Inspect the job for the desired dimensions and shape
- Operate, control different machines and equipment's adopting safety practices

Details of Practical Contents

CARPENTRY SHOP

- Demonstration of different wood working tools / machines.
- Demonstration of different wood working processes, like planing, marking, chiselling, grooving, turning of wood etc.
- Three jobs involving joint like mortise and tenon, dovetail, bridle, and half lap.

FITTING SHOP

- Demonstration of different fitting tools and drilling machines and power tools
- Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.
- Three fitting job involving practice of cutting, chipping, filing, marking, hacksawing, drilling, tapping, etc.

WELDING SHOP

- Demonstration of different welding tools/machines.
- Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting and rebuilding of broken parts with welding.
- Two simple job involving butt and lap joint and T. Joint using electric arc welding.

SHEET METAL SHOP

- Demonstration of different sheet metal tools/machines.
- Demonstration of different sheet metal operations like sheet cutting, bending, edging,

end curling, lancing, soldering, brazing, and riveting.

- Three simple job involving sheet metal operations, soldering, and riveting.
- Jobs
- Cutting Practices
- Single / Double Seam Joint
- Cylinders

PLUMBING SHOP

- Demonstration of different plumbing tools, accessories, valves and different pipe fittings and joints (GI and PVC).
- Demonstration of different plumbing operations like cutting, threading, pipe fitting (GI and PVC).
- One simple job involving pipe cutting and external thread cutting on GI pipe.

PAINTING AND POLISHING SHOP

- Introduction of paints, Varnishes, Reason for Surface preparation, Advantage of painting, other method of surface coating i.e. Electroplating etc.
- Jobs
- To prepare a wooden surface for painting apply primer on side and to paint in the same side.
- To prepare metal surface for painting, apply primer and paint on same side.

REFERENCES:

1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
2. B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
3. J.P. Bhati, Engineering Workshop, C.B.H. Publication, Jaipur.
4. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
5. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York
6. Roop Lal and Bharadwaj P. K., PrarambhikKaryashalaTakneeki (Hindi), Vayu Education of India, New Delhi.

Course Objectives:

Communication skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students. Thus, the objectives of this course are:

To develop listening skills for enhancing communication.

- To develop speaking skills with a focus on correct pronunciation and fluency.
- To introduce the need for Personality development- Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc. for that purpose group discussion, extempore and other activities should be conducted during lab classes.

Unit 1: Listening Skills

Listening Process and Practice: Introduction to recorded lectures, poems, interviews and speeches, listening tests.

Unit 2: Introduction to Phonetics

Sounds: consonant, vowel, diphthongs, etc. transcription of words (IPA), weak forms, syllable division, word stress, intonation, voice etc.

Unit 3: Speaking Skills

Standard and formal speech: Group discussion, oral presentations, public speaking, business presentations etc. Conversation practice and role playing, mock interviews etc.

Unit 4: Building vocabulary

Etymological study of words and construction of words, phrasal verbs, foreign phrases, idioms and phrases. Jargon/ Register related to organizational set up, word exercises and word games to enhance self-expression and vocabulary of participants.

Recommended Books:

1. Daniel Jones. The Pronunciation of English. Cambridge: Cambridge University Press, 1956.
2. James Hartman & et al. Ed. English Pronouncing Dictionary. Cambridge: Cambridge University Press, 2006.
3. Kulbushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
5. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London: Wilson and Sons, 1908.
6. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
7. J.Sethi & et al. A Practice Course in English Pronunciation. New Delhi: Prentice Hall, 2004.
8. Pfeiffer, William Sanborn and T.V.S Padmaja. Technical Communication: A Practical Approach. 6th ed. Delhi: Pearson, 2007.

Course Objectives:

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Unit 1: Basic elements of Drawing

Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. Different types of lines as per BIS specifications Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.

Common symbols and conventions of materials used in engineering.

Free hand and instrumental lettering (Alphabet and numerals) – Capital Letter, single stroke, vertical and inclined, series of 5,8,12 mm in the ratio of 7:4.

Dimensioning

Necessity, method and principles, Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches Scales.

Scales

Needs & importance (theory), R.F., type of scales, and length of scale, drawing of plain and diagonal scales..

Unit 2: Orthographic projections

Introduction, Projection of Points in different quadrant, Projection of Straight Line-parallel to both planes, perpendicular and inclined to reference plane, Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only, Three views of orthographic projection of different objects. Identification of surfaces.

Unit 3: Projection of Solid and Sections

Definition and types of Solids, To make projections, sources, Top view, Front view and Side view of various types of Solid, Importance and salient features.

Drawing of full section, half section, partial or broken out sections, Off-set sections, revolved sections and removed sections, Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections.

Unit 4: Isometric Projections

Introduction, Isometric scale and Natural scale, Isometric view and isometric projection, Illustrative problems related to objects containing lines, circles and arcs shape only. Conversion of orthographic views into isometric view /projection.

Recommended Books:

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria& Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication

Sub. Code:

Applied Physics – II Lab

L T P
0 0 2

Course Objectives:

Concrete use of physical principles and analysis in various fields of engineering and technology is very prominent. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

List of Practicals

(To perform any Six Practicals)

1. To determine the time period of a cantilever.
2. To verify the laws of reflection from a plane mirror / interface.
3. To verify the laws of refraction (Snell's law) using a glass slab.
4. To determine the focal length and magnifying power of a convex lens.
5. To verify laws of resistances in series and parallel combination.
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using Slide Wire bridge
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To draw characteristics of a PN junction diode and determine knee and break down voltages.
10. To verify the Kirchhoff's Law using electric circuit.
11. To find numerical aperture of an optical fiber.

Sub. Code: MED-102P
New Code: DME-202P

Engineering Mechanics Lab

L T P
0 0 2

Course Objectives:

Following are the objectives of this course:

- To obtain resultant of various forces
- To calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

List of practical to be performed:

(To perform 8-10 experiments)

1. To study various equipment related to Engineering Mechanics.
2. To find the M.A.,V.R., Efficiency and law of machine for differential Axle and Wheel.
3. To find the M.A.,V.R., Efficiency and law of machine for Simple Screw Jack.
4. Derive Law of machine using Worm and worm wheel.
5. Determine resultant of concurrent force system applying law of Polygon of forces using force table.
6. Determine resultant of concurrent force system graphically.
7. Determine resultant of parallel force system graphically.
8. Verify Lami's theorem.
9. Study forces in various members of Jib crane.
10. Determine force reaction's for simply supported beam.
11. Determine Coefficient of friction for motion on horizontal and inclined plane.
12. Determine centroid of geometrical plane figures.

Sub. Code:

Introduction to IT Systems Lab

L T P
0 0 4

Course Objectives:

This Lab course is intended to practice whatever is taught in theory class of 'Introduction of IT Systems' and become proficient in using computing environment - basic computer skills, basic application software tools, Computer Hardware, cyber security features, etc.

List of Practical Exercises

(To perform minimum seven experiments)

1. Identify various components, peripherals of computer and list their functions.
2. Installation of operating system. (windows/linux/others)
3. Installation of various application software and peripheral drivers.
4. Creation and Management of files and folders (Rename, delete, search)
5. Installation of Antivirus and remove virus.
6. Scanning and printing documents.
7. Browsing, Downloading, Information using Internet.
8. E-Mail ID creation, composing, sending and receiving e-mail. Attaching a file with e-mail message.
9. Word Processing (MS Office/Open Office) File Management, Editing documents, Mail Merge, Security etc.
10. Spread Sheet Processing (MS Office/Open Office/Libre Office) Addition, deletion, formulation, Security etc.
11. PowerPoint Presentation (MS Office/Open Office/Libre Office) Preparing Slides, customization, animation, Security etc.
12. Google Suite.

**Diploma in Engineering
Second Year Labs**

S. No.	Subject	New Code	Subject Code
IIIrd Semester			
1	Mechanics Of Solids Lab	DME-303P	MED-203P
2	Manufacturing Engineering Lab	DME-307P	MED-207P
3	Thermal Engineering Lab	DME-305P	MED-205P
4	Computer Aided Machine Drawing Practice Lab	DME-309P	MED-209P
IVth Semester			
1	Theory Of Machine & Mechanism	DME-310P	MED-210P
2	Refrigeration And Air Conditioning	DME-304P	MED-204P
3	Measurements & Metrology Lab	DME-306P	MED-206P
4	CAD/CAM Lab	DME-308P	MED-208P

Sub. Code: MED-203P
New Code: DME-303P

Mechanics of Solids Lab

L T P
0 0 2

Course Objectives:

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

List of practicals:

(To perform 8-10 experiments)

1. To find the shear force at a given section of simply supported beam for different loading.
2. To find the value of 'E' for a steel beam by method of deflection for different loads.
3. To determine the Max-Fiber stress in X-section of simply supported beam with concentrated loads and to find the neutral axis of the section.
4. To determine the ultimate tensile strength, its modulus of Elasticity, stress at yield point, Elongation and contraction in X-sectional area of the specimen by U.T.M. through necking phenomenon.
5. To determine the ultimate crushing strength of materials like steel and copper and compare their strength.
6. To determine Rockwell Hardness No. and Brinell Hardness No. of a sample.
7. To estimate the Shock Resistance of different qualities of materials by Izod's test and Charpy test.
8. To determine the bending moment at a given section of a simply supported beam for different loading.
9. To determine the various parameters of helical coil spring.
10. To determine the angle of twist for a given torque by torsion apparatus and to plot a graph between torque and angle of twist.

Sub. Code: MED-207P
New Code: DME-307P

Manufacturing Engineering Lab

L T P
0 0 2

Course Objectives:

- To Practice the casting principles and operations in foundry.
- To Practice the operation of Lathe.
- To Practice the joining of metals using different Welding techniques.

List of practicals:

(To perform minimum seven experiments)

1. Moulding & casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
2. Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Joint
3. Gas welding (i) Lap Joint (ii) Butt Joint
4. Spot welding (i) Lap Joint
5. Turning Exercise (i) Facing, Step Turning & Chamfering (ii) Step Turning & Taper Turning (iii) Groove Cutting (iv) Knurling (v) Thread Cutting (vi) Drilling
6. Grinding the Lathe Cutting tools to the required angles.
7. Study of Lathe, Drilling machine, shaping machine and slotting machine.
8. The dismantling some of the components of lathe and then assemble the same.
9. List the faults associated with lathe and its remedies.
10. The routine and preventive maintenance procedure for lathe.

Sub. Code: MED-205P
New Code: DME-305P

Thermal Engineering Lab

L T P
0 0 2

Course Objectives:

A diploma holder in this course is supposed to maintain steam generators, turbines, compressors and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, compressors and about IC engines.

List of practicals:

1. Study of cut model of two and four stroke IC engine.
2. Demonstration of actual working of petrol and diesel engine.
3. Study of the various dismantles part of IC engine.
4. Experimental study on performance parameter of multi cylinder 4 stroke diesel engine.
5. Experimental study on performance of parameter of single cylinder to stroke petrol engine.
6. Determine the thermal conductivity of metal rod using Fourier law of heat conduction.
7. Evolution of the Stephen Bolt man constant for radiation heat transfer.
8. Evolution of conductive heat transfers Coefficient for free and forced convection.

Sub. Code: MED-209P
New Code: DME-309P

Computer Aided Machine Drawing Practice Lab

L T P
0 0 4

Course Objectives:

- To use computer aided drafting,
- To prepare geometrical model of various machine elements
- To draw the different views of machine elements
- To interpret the drawing in engineering field and illustrate three dimensional objects

List of practicals:

(To perform minimum seven experiments)

1. Introduction to CAD software.
2. Drawing aids and editing commands.
3. Basic dimensioning, hatching, blocks and views.
4. Isometric drawing, printing and plotting
5. Machine Drawing practice using Auto CAD: Detailed drawings of following machine parts are to be given to the students to assemble and draw the sectional or plain elevations, plans and side views with dimensioning and bill of materials using cad software.
 - Sleeve & Cotter Joint
 - Spigot & Cotter Joint
 - Knuckle Joint
 - Stuffing Box
 - Screw
 - Jack
 - Foot Step Bearing
 - Universal Coupling
 - Plummer Block
 - Simple Eccentric
 - Machine Vice
 - Connecting Rod
 - Protected Type Flanged Coupling.

Sub. Code: MED-210P
New Code: DME-310P

Theory of Machine & Mechanism

L T P
0 0 2

Course Objectives:

This lab course is designed to provide hands-on experience with fundamental concepts in machine dynamics and mechanisms.

List of practicals:

(To perform any 7-8 experiments)

1. Measure the velocity ratio and tension in a belt drive.
2. Observe slip and creep in a flat belt drive.
3. Study the effect of load changes on a centrifugal governor.
4. Observe energy fluctuation in a flywheel.
5. Calculate braking force for different brake types.
6. Perform a balancing experiment for a single rotating mass.
7. Observe slip and calculate angle of lap in a V-belt drive.
8. Identify vibration frequencies in machine parts.
9. Measure velocity ratios in simple and compound gear trains

Sub. Code: MED-204P
New Code: DME-304P

Refrigeration and Air Conditioning Lab

L T P
0 0 4

Course Objectives:

- To understand the basics of Refrigeration cycles.
- To understand basics of vapour compression and vapour absorption systems.
- To identify components and refrigerants and lubricants of a refrigeration system.
- To understand control strategies for refrigeration system.
- To understand the basics about air conditioning systems.

List of practicals:

(To perform any 8-10 experiments)

1. Demonstration of various refrigeration tools and equipment.
2. Practice in cutting, bending, flaring, swaging and brazing of tubes.
3. Study of thermostatic switch, LP/HP cut out overload protector filters, strainers and filter driers.
4. Identify various parts of a refrigerator and window air conditioner.
5. To find COP of Refrigeration system
6. To measure air flow using anemometer.
7. Charging of a refrigerator/ air conditioner.
8. To detect faults in a refrigerator/ air conditioner
9. Visit to an ice plant or cold storage plant. or central air conditioning plant.
10. Demonstration and working of window type air-conditioner.
11. Demonstration and working of split type air-conditioner.

Sub. Code: MED-206P
New Code: DME-306P

Measurements & Metrology Lab

L T P
0 0 2

Course Objectives:

To understand techniques for precise measurement of the dimensions of various objects and shapes.

List of practicals:

1. Measure the diameter of a wire using micrometre and compare the result with digital micrometre
2. Measure the angle of the machined surface using sine bar with slip gauges.
3. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
4. Measure the dimensions of ground MS flat/cylindrical bush using Vernier Caliper compare with Digital/Dial Vernier Caliper.
5. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
6. Measure the thickness of ground MS plates using slip gauges.

Sub. Code: MED-208P
New Code: DME-308P

Computer Aided Design and Manufacturing Lab

L T P
0 0 4

Course Objectives:

- To understand the fundamentals and use CAD.
- To conceptualize drafting and modeling in CAD.
- To interpret the various features in the menu of solid modeling package.
- To synthesize various parts or components in an assembly.
- To prepare CNC programmes for various jobs.

PART-A

Introduction:

Part modelling; Datum Plane; constraint; sketch; dimensioning; extrude; revolve; sweep; blend; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.

Exercises: 3D Drawings of

- 1). Geneva Wheel;
- 2). Bearing Block;
- 3). Bushed bearing;
- 4). Gib and Cotter joint;
- 5). Screw Jack;
- 6). Connecting Rod:

Note: Print the orthographic view and sectional view from the above assembled 3D drawing.

PART-B

CNC Programming and Machining:

Introduction;

- 1). Study of CNC lathe, milling;
- 2). Study of international standard codes: G-Codes and M-Codes;
- 3). Format – Dimensioning methods;
- 4). Program writing – Turning simulator – Milling simulator, IS practice – commands menus;
- 5). Editing the program in the CNC machines;
- 6). Execute the program in the CNC machines;

Exercises:

Note: Print the Program from the Simulation Software and make the Component in the CNC Machine.

CNC Turning Machine: (Material: Aluminium/Acrylic/Plastic rod)

1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.
2. Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.
3. Using canned cycle - Create a part program for thread cutting, grooving and produce

component in the Machine.

CNC Milling Machine (Material: Aluminum/ Acrylic/ Plastic)

1. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.
2. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.
3. Using subprogram - Create a part program for mirroring and produce component in the Machine.

**Diploma in Engineering
Third Year Labs**

S. No.	Subject	New Code	Subject Code
Vth Semester			
1	Hydraulics &Pneumatics Lab	DME-401P	MED-301P
2	IC Engine Lab	DME-407P	MED-307P
3	Industrial Training	DME-409P	MED-309P
VIth Semester			
1	Industrial Engineering Lab	DME-402P	MED-302P
2	Project Work	DME-406P	MED-306P
3	Seminar	DME-408P	MED-308P

Sub. Code: MED-301P
New Code: DME-401P

Hydraulics &Pneumatics Lab

L T P
0 0 4

Course Objectives:

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

List of practicals:

(To perform 8-10 experiments)

1. Measurement of pressure head by employing.
 - i. Piezometer tube
 - ii. Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.
9. Direct operation of single and double acting cylinder.
10. Automatic operation of double acting cylinder in single cycle using limit switch.
11. Operation of double acting cylinder with quick exhaust wall.

Sub. Code: MED-307P
New Code: DME-407P

IC Engine Lab

L T P
0 0 4

Course Objectives:

- To understand the basic structure and components of an automobile.
- To understand the concepts of cooling and lubricating systems.
- To understand the concepts of Ignition and transmission and steering systems.
- To understand the classification and necessity of suspension system.
- To identify different special vehicles.

List of practicals:

(To perform 8-10 experiments)

1. Study & Demonstration of Fault and their remedies in Battery Ignition system
2. Study & Demonstration of adjustment of Head Light Beam (ii) Wiper and Indicators.
3. Study & Demonstration of dismantling and inspection of (i) AC Pump (ii) SU Pump
4. Study & Demonstration of dismantle (i) rear axle (ii) differential and find out the gear ratio of crown wheel & driven sun gear and planet pinion.
5. Study & Demonstration of fault finding practices on an automobile - four wheelers (petrol/ diesel vehicles).
6. Study & Demonstration of servicing/Tuning of a 2 wheeler/4 wheeler.
7. Study & Demonstration of servicing of hydraulic brakes :
 - a. adjustment of brakes
 - b. bleeding of brakes
 - c. fitting of leather pads
8. Study & Demonstration of tuning of an automobile engine.
9. Study & Demonstration of testing and charging of an automobile battery and measuring cell voltage and specific gravity of electrolyte.
10. Study & Demonstration of changing of wheels and inflation of tyres, balancing of wheels.
11. Study & Demonstration of measuring spark gap, valve clearance and ring clearance; carrying out cleaning operations for adjustment.

Sub. Code: MED-309P
New Code: DME-409P

Industrial Training (4 Weeks)

L T P
0 0 0

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at three year Diploma in Engineering. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as Diploma Engineers in the world of work and enables them to integrate theory with practice. three year Diploma in Engineering have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 100 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

Sub. Code: MED-302P
New Code: DME-402P

Industrial Engineering Lab

L T P
0 0 4

Course Objectives:

- To take the right decisions to optimize resources utilization by improving productivity of the Lands, Buildings, People, Materials, Machines, Money, Methods and Management effectively.
- To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.
- To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

List of practicals:

(To perform 8-10 experiments)

1. Stop watch time study on any machine like lathe, drilling machine or milling machine
2. Method improvement - Assembly of bolt, nut and 3 washers
3. Determination of standard time for assembly of electrical switch
4. Preparation of flow process chart
5. Preparation of SIMO chart
6. Preparation of flow diagram
7. Preventive measure in case of electrocution
8. Preventive measures in case of snake/poisonous creature sitting
9. Use of first aid in case of minor accidents
10. Use of five extenuates/five drill

Sub. Code: MED-306P
New Code: DME-406P

Project Work

L T P
0 0 8

Course Objectives:

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

Learning Outcomes:

After undergoing the project work, students will be able to:

Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance. Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, three year Diploma in Engineering may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

The projects given to students should be such for which someone is waiting for solution. Some of the suggested project activities are given below:

1. Projects connected with repair and maintenance of machines.
2. Estimating and costing projects.
3. Design of jigs / fixtures.
4. Projects related to quality control.
5. Project work related to increasing productivity.
6. Projects relating to installation, calibration and testing of machines.
7. Projects related to wastage reduction.
8. Project, related to fabrication.
9. Energy efficiency related projects.
10. Projects related to improving an existing system

Note: Each student has to take one project individually and one to be shared with a group of four-five students depending upon cost and time involved. There is no binding to take up the above projects as it is only a suggestive list of projects.

Important Notes:

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.
4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

Sub. Code: MED-308P
New Code: DME-408P

Seminar

L T P
0 0 2

Value Added Courses

1. CAD/CAM Training
2. Industry Oriented Study