

1.1 ENGLISH AND COMMUNICATION SKILLS – I

L T P
3 - 2

RATIONALE

Communication skills play an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills.

LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Pronounce properly.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper perspective.
- Read various genres adopting different reading techniques.
- Converse logically.

DETAILED CONTENTS

1. Basics of Communication (12 hrs)
 - 1.1 Definition and process of communication
 - 1.2 Types of communication - formal and informal, oral and written, verbal and non-verbal
 - 1.3 Objectives of communication
 - 1.4 Essentials of communication
 - 1.5 Channels of communication
 - 1.6 Barriers to communication
2. Functional Grammar and Vocabulary (12 hrs)
 - 2.1 Parts of speech
 - 2.2 Article
 - 2.3 Tenses
 - 2.4 Active and passive voice
 - 2.5 Synonyms and antonyms
 - 2.6 Pair of words
 - 2.7 Correction of incorrect sentences
3. Listening (04 hrs)
 - 3.1 Meaning and process of listening
 - 3.2 Importance of listening
 - 3.3 Methods to improve listening skills

4. Speaking (04 hrs)
- 4.1 Importance
- 4.2 Methods to improve speaking
5. Reading (12 hrs)
- 5.1 Meaning
- 5.2 Techniques of reading: skimming, scanning, intensive and extensive reading
- 5.3 Comprehension, vocabulary enrichment and grammar exercises based on following readings:
- Section - I
- God Lives in the Panch – Munshi Prem Chand
 - The Gift of the Magi – O. Henry
 - Uncle Podger Hangs a Picture – Jerome K. Jerome
- Section - II
- Skylark – P.B. Shelley
 - Stopping by Woods on a Snowy Evening – Robert Frost
 - Where the Mind is Without Fear – Rabindranath Tagore
6. Writing (04 hrs)
- 6.1 Significance and effectiveness of writing
- 6.2 Paragraph of 100 – 120 words
- 6.3 Picture composition/Guided composition

LIST OF PRACTICALS

1. Self and peer introduction
2. Looking up words in a dictionary (meaning and pronunciation)
3. Newspaper reading
4. Just a Minute session – extempore
5. Situational conversation and role play
6. Using pre – recorded CDs/DVDs to students to listen and comprehend.
7. Greetings for different occasions
8. Improving pronunciation through tongue twisters.

INSTRUCTIONAL STRATEGY

Use of pre-recorded CDs/DVDs should be made to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Professional Communication by Kavita Tyagi & Padma Misra; Published by PHI Learning Pvt. Ltd; New Delhi.
3. Developing Communication Skills (2nd Edition) by Krishna Mohan & Meera Banerji; Published by Macmillan Publishers India Ltd; New Delhi.
4. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
5. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
6. Communication Skills by Sanjay Kumar & Pushp Lata; Oxford University Press, New Delhi

Websites for Reference:

1. <http://www.mindtools.com/> page 8.html – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	12	25
3	04	08
4	04	08
5	12	26
6	04	08
Total	48	100

1.2 APPLIED MATHEMATICS - I

L T P
5 - -

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like logarithm, binomial theorem, partial fractions, matrices etc. for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Apply Complex Number and its representation for two dimensional designing and related calculations. They will be able to apply this knowledge in many engineering problems like alternating current/voltage. The concept of rotation of a vector using iota will enable them solve many engineering problems.
- Apply the basics concepts of Permutation and Combination to find out how many possible ways or arrangements are possible for a particular problem and its solutions. They will be able to count without actual counting. They will be able to apply this concept in understanding of Binomial Theorem and demonstrate better reasoning in different analytical situations.
- Calculate the approximate value of certain expressions and extract roots of certain expression in many engineering problems by Application of Binomial Theorem.
- Resolve a fraction to further fractions by applying basics concepts of Partial Fractions. They will be able to use and apply this knowledge in Integral Calculus.
- Solve engineering problems that are in matrix format by applying the basic understanding of Matrices and their properties, which are usually less computational. Further, this understanding will work as a backbone for the use and development of software in many engineering applications. Study of matrices and its properties will also provide educational base for continuing study and provide solution to many engineering problems by different methodologies.
- Design and solve related problems like constructions of roads, dams, bridges and calculation of height, distance, elevation etc. By the understanding of basic concepts of Trigonometry and 2 D geometry, they will be able to apply the same in different situations in surveying, navigation, astronomy and many other engineering problems. They will also be able to draw graphs of trigonometrical functions for many applications in the solution of engineering problems.

- Write the equations of a geometric shape used in many engineering problems such as straight line and circle. With the use of coordinate geometry, they will be able to explore and evaluate the idea of location, graph, linear relationships between two forms, and distance between two lines, which will be useful in solving engineering problems. They will be able to calculate the distance between a point and a line.

DETAILED CONTENTS

1. Algebra (30 hrs)
 - 1.1 Complex Numbers: Complex number, representation, modulus and amplitude.
 - 1.2 Basics and properties of logarithms.
 - 1.3 Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors).
 - 1.4 Meaning of ${}^n P_r$ & ${}^n C_r$ (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof), first and second binomial approximation with applications to engineering problems.
 - 1.5 Determinants and Matrices – Expansion of determinants (upto 3rd order, using properties and otherwise), solution of equations (upto 3 unknowns) by Cramer's rule, definition of Matrices with types, addition, subtraction and multiplication of matrices (upto 3rd order), Minors and Co-factors, inverse of a Matrix by Adjoint method (upto 3rd order), solution of simultaneous equations (upto 3rd order) by Matrix method. Area of a triangle using determinants.
2. Trigonometry (25 hrs)
 - 2.1 Concept of angle, measurement of angle in degrees, grades and radians and their conversions.
 - 2.2 T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T-Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2).
 - 2.3 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

3. Co-ordinate Geometry (25 hrs)
- 3.1 Cartesian and Polar coordinates (two dimensional), conversion from Cartesian to Polar coordinates and vice-versa
- 3.2 Slope of a line, equation of straight line in various standard forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle between straight lines, parallel and perpendicular lines, perpendicular distance formula, conversion of general form of equation to the various forms.
- 3.3 General equation of a circle and its characteristics. To find the equation of a circle, given:
- * Centre and radius
 - * Three points lying on it
 - * Coordinates of end points of a diameter

INSTRUCTIONAL STRATEGY

Basic elements of algebra, trigonometry and coordinate geometry can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students.

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Applied Mathematics, Vol. I & II by SS Sabharwal & Dr Sunita Jain, Eagle Parkashan, Jalandhar
3. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
4. Applied Mathematics I, Archana Sharma, Lords Publications, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (%)
1.	30	35
2.	25	35
3.	25	30
Total	80	100

1.3 APPLIED PHYSICS – I

L T P
4 - 2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in 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 will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the 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 appreciate learning of these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOME

After undergoing this subject, the student will be able to:

- Identify physical quantities, parameters and select their units for use in engineering solutions and make measurements with accuracy by optimising different types of errors.
- Represent physical quantities as scalar and vectors and calculate area of an engineering design and determine net flow (flux) through a given closed surface, etc.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Define work, energy and power and their units. Drive work, power and energy relationship and solve problems about work and power.
- Classify sources of energy as renewable or non renewable. State the principle of conservation of energy. Give advantages and disadvantages of each energy source and Identify forms of energy, conversions. Compare and contrast the physical properties associated with linear motion and rotational motion and give examples of conservation of angular momentum. Describe the surface tension phenomenon and its units, cause of surface tension and effects of temperature on surface tension and Solve statics problems that involve surface tension related forces.
- Describe the viscosity of liquids, coefficient of viscosity and the various factors affecting its value. calculate the viscosity of an unknown fluid using Stokes' Law and the terminal velocity
- Define stress and strain. State Hooke's law and conditions under which it is valid. Given an engineering stress–strain diagram, determine (a) the modulus of elasticity, (b) the yield strength (0.002 strain offset), and (c) the tensile strength, and (d) estimate the percent elongation.

- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Define the terms: specific heat capacity, specific latent heat, analyse the result of heat transfer between bodies at different temperatures and states measure the specific heat capacity of a solid or a liquid

DETAILED CONTENTS

1. Units and Dimensions (10 hrs)
 - 1.1 Physical quantities Units - fundamental and derived units, systems of units (FPS, CGS and SI units)
 - 1.2 Dimensions and dimensional formulae of physical quantities (area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, surface tension, coefficient of viscosity, stress, strain, moment of inertia, gravitational constant.)
 - 1.3 Principle of homogeneity of dimensions
 - 1.4 Dimensional equations and their applications, conversion from one system of units to other, checking of dimensional equations and derivation of simple equations)
 - 1.5 Limitations of dimensional analysis
 - 1.6 Error in measurement, absolute error, relative error, rules for representing significant figures in calculation.
 - 1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and non metallic blocks, wires, pipes etc (at least two each).
2. Force and Motion (12 hrs)
 - 2.1 Scalar and vector quantities – examples, representation of vector, types of vectors
 - 2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
 - 2.3 Resolution of Vectors and its application to lawn roller.
 - 2.4 Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.
 - 2.5 Impulse and its Applications
 - 2.6 Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
 - 2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
 - 2.8 Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist

- 2.9 Application of various forces in lifts, cranes, large steam engines and turbines
3. Work, Power and Energy (10 hrs)
- 3.1 Work: and its units, examples of zero work, positive work and negative work
 - 3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.
 - 3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications
 - 3.4 Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation
 - 3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
 - 3.6 Power and its units, calculation of power in numerical problems
 - 3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.
- 4 Rotational Motion (10 hrs)
- 4.1 Concept of translatory and rotatory motions with examples
 - 4.2 Definition of torque and angular momentum and their examples
 - 4.3 Conservation of angular momentum (quantitative) and its examples
 - 4.4 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).
 - 4.5 Application of rotational motions in transport vehicles, and machines.
5. Properties of Matter (12 hrs)
- 5.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve
 - 5.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
 - 5.3 Surface tension: concept, its units, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension
 - 5.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
 - 5.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications (no derivation and numerical).

6. Thermometry (10 hrs)
- 6.1 Difference between heat and temperature
 - 6.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
 - 6.3 Different scales of temperature and their relationship
 - 6.4 Types of Thermometer (Mercury Thermometer, Bimetallic Thermometer, Platinum resistance Thermometer, Pyrometer)
 - 6.5 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
 - 6.6 Concept of Co-efficient of thermal conductivity
 - 6.7 Application of various systems of thermometry in refrigeration and air-conditioning etc.

LIST OF PRACTICALS (to perform minimum eight experiments)

1. To find volume of solid sphere using a vernier calipers
2. To find internal diameter and depth of a beaker using a vernier calipers and hence find its volume.
3. To find the diameter of wire using a screw gauge
4. To determine the thickness of glass strip using a spherometer
5. To verify parallelogram law of forces
6. To study conservation of energy of a ball or cylinder rolling down an inclined plane.
7. To find the Moment of Inertia of a flywheel about its axis of rotation
8. To determine the atmospheric pressure at a place using Fortin's Barometer
9. To determine the viscosity of glycerin by Stoke's method
10. To determine the coefficient of linear expansion of a metal rod
11. To determine force constant of spring using Hooks law

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics of mechanics, work power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

RECOMMENDED BOOKS

1. Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi
3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
4. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
5. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
6. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
7. Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan, Jalandhar
8. Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (%)
1.	10	15
2.	12	20
3.	10	15
4.	10	15
5.	12	20
6.	10	15
Total	64	100

1.4 APPLIED CHEMISTRY – I

L T P
4 - 2

RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- Classify various substances based on state of aggregation
- Ascertain qualitatively few physical properties of substances such as density melting and boiling points etc qualitatively.
- Calculate qualitative and quantitative of simple chemical substances.
- Explain and substantiate the laws of chemical combinations.
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain various engineering properties of substances.
- Prepare solution of required concentrations.
- Prepare pH and buffer solutions and understand their significance in industrial process such as electrolysis, electrochemical machining of materials etc.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification to achieve water quality standards required for domestic, agricultural and industrial applications.
- Explain the reasons for scarcity of natural water (locally and globally) on mother Earth.
- Think critically, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- Classify the substance based on the electric behavior and apply these laws/principles efficiently in industrial electrochemical processes.
- Distinguish and construct electrochemical cells and electrolytic cells.
- Explain the principle and mechanisms of latest electrochemical machining technology.
- Explain various biochemical process, pollutions and their control measures polymers composites etc.

DETAILED CONTENTS

1. Basic Concept of Chemistry (08 hrs)
 - 1.1 Physical Classification of matter –solids, liquids, gases.
 - 1.2 Chemical Classification of matter – element, compounds and mixtures
 - 1.3 Symbols of elements and valency, writing of chemical formulae of simple compounds.
 - 1.4 Calculation of percentage of elements in the following compounds using atomic and molecular masses of CaCO_3 , NaCl , CuSO_4 , NaOH , Ca(OH)_2 , H_2SO_4 , $\text{C}_2\text{H}_2\text{O}_4$. (Atomic mass of elements should be provided)
 - 1.5 Chemical equations, thermo-chemical equations, balancing of chemical equations (hit and trial method)

2. Atomic Structure, Periodic Table and Chemical Bonding (14 hrs)
 - 2.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.
 - 2.2 Bohr's model of atom and successes and drawbacks of Bohr's Model of atom (qualitative treatment only).
 - 2.3 Atomic number, atomic mass number isotopes and isobars.
 - 2.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
 - 2.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).
 - 2.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)
 - 2.7 Chemical bonding and cause of bonding and types of chemical bonding ; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H_2 , O_2 , N_2 and CH_4 . Elementary idea of hybridization and its types (sp^3 , sp^2 & sp) with examples of CH_4 , BF_3 & BeCl_2 .
 - 2.8 Metallic bonding- explanation with the help of electron gas (sea) model.

3. Solutions (08 hrs)
 - 3.1 Definition of solution, solute and solvent with examples
 - 3.2 Methods to express the concentration of solution- molarity (M), molality (m) and normality (N) and numericals based on calculation of M , m and N
 - 3.3 Introduction to pH of solution, simple numericals on pH and industrial applications of pH.
 - 3.4 Definition of buffer solution and types of buffer solutions with examples and industrial applications of buffers solutions.

4. Water (14 hrs)
 - 4.1 Demonstration of water resources on Earth using pie chart.
 - 4.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numericals.
 - 4.3 Disadvantages caused by the use of hard water in domestic and boiler feed water.
 - 4.4 Removal of hardness -Permutit process and Ion-exchange process.
 - 4.5 Chemical analysis of water for estimation of
 - a) Total dissolved solids (TDS)
 - b) Alkalinity of water .
 - 4.6 Drinking water and characteristics of drinking water.
 - 4.7 Natural water sterilization by chlorine and UV radiation and reverse osmosis (elementary idea).
5. Electro Chemistry (14 hrs)
 - 5.1 Electronic concept of oxidation, reduction and redox reactions
 - 5.2 Definition of terms: electrolytes, non-electrolytes with suitable examples
 - 5.3 Faradays laws of electrolysis and simple numerical problems.
 - 5.4 Industrial Application of Electrolysis – Electroplating, electrolytic refining and electrometallurgy.
 - 5.5 Application of redox reactions in electrochemical cells – commercial dry cell (Primary), commercially used lead storage battery (Secondary cell).
6. Organic Chemistry (06 hrs)
 - 6.1 Tetra valency and catenation property of carbon to produce huge organic compounds.
 - 6.2 Classification of organic compounds on the bases of functional groups
 - 6.3 Nomenclature of simple organic compounds in accordance with I.U.P.A.C. (compounds having two carbon atoms in a molecule belongs to alkanes, alkenes, alkynes, alkyl chlorides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines) (compounds containing more than one functional groups are excluded) and their common names (if any)

LIST OF PRACTICALS

1. Volumetric analysis and apparatus used in volumetric analysis
2. Preparation of standard solution of oxalic acid or potassium permanganate
3. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
4. Volumetric estimation of ferrous ammonium sulfate solution by titrating it against standard potassium permanganate solution in acidic medium
5. To prepare iodoform from ethanol or acetone.

6. To prepare Mohr's salt from ferrous sulfate and ammonium sulfate
7. Determination of pH of given solution using pH meter
8. To distinguish between aldehyde and ketone by Tollen's reagent (benzaldehyde and acetone may be used).
9. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India.

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1.	08	12
2.	14	22
3.	08	12
4.	14	22
5.	14	22
6.	06	10
Total	64	100

1.5 BASICS OF INFORMATION TECHNOLOGY

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RATIONALE

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. There will not be any theory examination.

LEARNING OUTCOME

After undergoing the subject, the students will be able to:

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

Information Technology concept and scope, applications of IT. in office, Air and Railway Ticket reservation, Banks financial transactions, E-Commerce and E-Governance applications etc., Ethics of IT, concept of online frauds, threats of IT crimes.

2. Computer Hardware:

Block diagram of a computer, components of computer system, CPU, Memory, Input devices; keyboard, Scanner, mouse etc; Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory: RAM, ROM, magnetic disks – tracks and sectors, optical disk (CD , DVD & Blue Ray Disk.), USB/Flash Drive.

3. Software Concepts:

System software, Application software, Virtualization software and Utility software, Introduction of Operating System, Installation of Window / linux, Features of OPEN OFFICE/MS_OFFICE(MS word, Excel, PowerPoint) .

4. Internet Concepts:

Basics of Networking – LAN, WAN, Wi-Fi technologies and sharing of printers and other resources, Concept of IP addresses, DNS, introduction of internet, applications of internet like: e-mail and browsing, concept of search engine and safe searching. Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox, use of cookies and history, WWW (World Wide Web), hyperlinks, introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, name its various components and peripherals. List their functions .
2. Installing various components of computer system and installing system software and application software
3. Installation of I/O devices, printers and installation of operating system viz. Windows/BOSS/ LINUX
4. Features of Windows as an operating system
 - Start
 - Shut down and restore
 - Creating and operating on the icons
 - Opening, closing and sizing the windows and working with windows interfacing elements (option buttons, checkbox, scroll etc.)

- Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file and folders
- Changing settings like, date, time, colour (back ground and fore ground etc.)
- Using short cuts
- Using on line help

5. Word Processing (MS Office/Open Office)

- a) File Management:
 - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file
- b) Page set up:
 - Setting margins, tab setting, ruler, indenting
- c) Editing a document:
 - Entering text, cut, copy, paste using tool- bars
- d) Formatting a document:
 - Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
 - Aligning of text in a document, justification of document, inserting bullets and numbering
 - Formatting paragraph, inserting page breaks and column breaks, line spacing
 - Use of headers, footers: Inserting footnote, end note, use of comments, autotext
 - Inserting date, time, special symbols, importing graphic images, drawing tools
- e) Tables and Borders:
 - Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
 - Print preview, zoom, page set up, printing options
 - Using find, replace options
- f) Using Tools like:
 - Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and lables
 - Using shapes and drawing toolbar,
 - Working with more than one window .

6. Spread Sheet Processing (MS Office/Open Office)

- a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

- b) Menu commands:
Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working
- c) Work books:
Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations
Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting
- d) Creating a chart:
Working with chart types, changing data in chart, formatting a chart, use chart to analyze data
Using a list to organize data, sorting and filtering data in list
- e) Retrieve data with query:
Create a pivot table, customizing a pivot table. Statistical analysis of data
- f) Exchange data with other application:
Embedding objects, linking to other applications, import, export document.

7. PowerPoint Presentation (MS Office/Open Office)

- a) Introduction to PowerPoint
 - How to start PowerPoint
 - Working environment: concept of toolbars, slide layout & templates.
 - Opening a new/existing presentation
 - Different views for viewing slides in a presentation: normal, slide sorter.
- b) Addition, deletion and saving of slides
- c) Insertion of multimedia elements
 - Adding text boxes
 - Adding/importing pictures
 - Adding movies and sound
 - Adding tables and charts etc.
 - Adding organizational chart
 - Editing objects
 - Working with Clip Art
- d) Formatting slides
 - Using slide master
 - Text formatting
 - Changing slide layout
 - Changing slide colour scheme
 - Changing background
 - Applying design template

- e) How to view the slide show?
 - Viewing the presentation using slide navigator
 - Slide transition
 - Animation effects, timing, order etc.
 - f) Use of Pack and Go Options.
8. Internet and its Applications
- a) Establishing an internet connection.
 - b) Browsing and down loading of information from internet.
 - c) Sending and receiving e-mail
 - Creating a message
 - Creating an address book
 - Attaching a file with e-mail message
 - Receiving a message
 - Deleting a message
 - d) Assigning IP Addresses to computers and use of domain names.
9. Functioning of Antivirus
- a) Installation and updation of an antivirus.
 - b) How to scan and remove the virus.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office in addition to working on internet. The student should be made capable of working on computers independently.

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 Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

1.6 ENGINEERING DRAWING - I

L T P

- - 6

RATIONALE

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.

Note:

- i) First angle projection is to be followed
- ii) Minimum of 16 sheets to be prepared and atleast 2 sheets on AutoCAD
- iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

LEARNING OUTCOME

After undergoing the subject, the students will be able to:

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)
 - 1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.

- 1.2 Different types of lines in Engineering drawing as per BIS specifications
- 1.3 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.
- 1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4
2. Dimensioning Technique (01 sheet)
 - 2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)
 - 2.2 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
3. Scales (02 sheets)
 - 3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale
 - 3.2 Drawing of plain and diagonal scales
4. Orthographic Projections (06 sheets)
 - 4.1 Theory of orthographic projections (Elaborate theoretical instructions)
 - 4.2 Projection of Points in different quadrant
 - 4.3 Projection of Straight Line (1st and 3rd angle)
 - 4.3.1. Line parallel to both the planes
 - 4.3.2. Line perpendicular to any one of the reference plane
 - 4.3.3. Line inclined to any one of the reference plane.
 - 4.4 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
 - 4.5 Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)
 - 4.6 Identification of surfaces

5. Sections (02 sheets)
 - 5.1 Importance and salient features
 - 5.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
 - 5.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
 - 5.4 Orthographic sectional views of different objects.
6. Isometric Views (02 sheets)
 - 6.1 Fundamentals of isometric projections and isometric scale.
 - 6.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.
7. Common Symbols and Conventions used in Engineering (02 sheets)
 - 7.1 Civil Engineering sanitary fitting symbols
 - 7.2 Electrical fitting symbols for domestic interior installations
- *8. Introduction to AutoCAD (02 sheets)

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

*** Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

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.

1.7 GENERAL WORKSHOP PRACTICE – I

(Common for Mechanical Engineering, Mechanical Engineering (RAC), Production and Industrial Engineering, Automobile Engineering and Civil Engineering)

L T P
- - 6

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

LEARNING OUTCOME

After completing the course the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and measures.
- Use safety equipment.

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Welding Shop – I
2. Fitting Shop – I
3. Sheet Metal Shop – I
4. Electric Shop-I
5. Carpentry Shop – I
6. Smithy Shop – I

1. WELDING SHOP – I

- 1.1 Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.
- 1.2 Jobs to be prepared
 - Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).
 - Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).
 - Job III Preparation of lap joint using arc welding process.
 - Job IV Preparation of butt joint using arc welding process. (100 mm long).
 - Job V Preparation of T Joint using gas or arc welding (100mm x 6 mm M.S. Flat).

2. FITTING SHOP – I

- 2.1 Use of personal protective equipment and safety precautions while working.
- 2.2 Basic deburring processes.
- 2.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
- 2.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
- 2.5 Identification of various steel sections (flat, angle, channel, bar etc.).
- 2.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).
 - Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).
 - Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of $\pm .25$ mm.
 - Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping.

3. SHEET METAL SHOP – I

- 3.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.
- 3.2 Introduction and demonstration of hand tools used in sheet metal shop.
- 3.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,

Turning Machine, Wiring Machine, Setting Down Machine, Forming Machine, Brake etc.

- 3.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.
- 3.5 Study of various types of nuts, bolts, rivets, screws etc.
 - Job I Shearing practice on a sheet using hand shears.
 - Job II Practice on making Single riveted lap joint/Double riveted lap Joint.
 - Job III Practice on making Single cover plate chain type, zig-zag type and single rivetted Butt Joint.

4. ELECTRIC SHOP - I

- 4.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories.
- 4.2 Study of electrical safety measures and protective devices.
 - Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs.
 - Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping.
- 4.3 Study of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.
- 4.4 Introduction to the construction of lead acid battery and its working.
 - Job III Installation of battery and connecting two or three batteries in series and parallel.
- 4.5 Introduction to battery charger and its functioning.
 - Job IV Charging a battery and testing with hydrometer and cell tester

5. CARPENTRY SHOP - I

- 5.1 General Shop Talk
 - 5.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials
 - 5.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.
 - 5.1.3 Specification of tools used in carpentry shop.
 - 5.1.4 Different types of Timbers, their properties, uses & defects.
 - 5.1.5 Seasoning of wood.
 - 5.1.6 Estimation.

- 5.2 Practice
 - 5.2.1 Practices for Basic Carpentry Work
 - 5.2.2 Sawing practice using different types of saws
 - 5.2.3 Assembling jack plane — Planning practice including sharpening of jack plane cutter
 - 5.2.4 Chiselling practice using different types of chisels including sharpening of chisel
 - 5.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.
- 5.3 Job Practice
 - Job I Marking, sawing, planning and chiselling and their practice
 - Job II Half Lap Joint (cross, L or T – any one)
 - Job III Mortise and Tenon joint (T-Joint)
 - Job IV Dove tail Joint (Lap or Bridle Joint)

6. SMITHY SHOP - I

- 6.1 General Shop Talk
 - 6.1.1 Purpose of Smithy shop
 - 6.1.2 Different types of Hearths used in Smithy shop
 - 6.1.3 Purpose, specifications, uses, care and maintenance of various tools and equipments used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.
 - 6.1.4 Types of fuel used and maximum temperature obtained
 - 6.1.5 Types of raw materials used in Smithy shop
 - 6.1.6 Uses of Fire Bricks & Clays in Forging workshop.
- 6.2 Practice
 - 6.2.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.
 - 6.2.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting
 - a) Demonstration — Making cube, hexagonal cube, hexagonal bar from round bar
 - 6.2.3 Practice of Simple Heat treatment processes like Tempering, Normalizing Hardening etc
- Job Practice: Job Preparation
 - Job I Making a cold / hot, hexagonal / octagonal flat chisel including tempering of edges.
 - Job II Production of utility goods e.g. hexagonal bolt / square shank boring tool, fan hook (long S-type) [Two jobs are to be done by the students].
 - Job III To prepare a cube from a M.S. round by forging method.

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

TRAFFIC AWARENESS & ROAD SAFETY CAMP (I)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety. By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Road safety Scenario

2. School bus and traffic management

3. Awareness of Traffic Signs

4. Speeding Limit

5. Always Wear your Shields

6. Overtaking

7. Awareness through Hoardings

8. Walking & Safe cycling

2.1 ENGLISH AND COMMUNICATION SKILLS - II

L T P
3 - 2

RATIONALE

Communication skills play an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills.

LEARNING OUTCOME

After undergoing the subject, the students will be able to:

- Make proper oral presentations.
- Speak confidently.
- Debate properly.
- Write accurate official/business letters.
- Respond to telephone calls effectively.
- Overcome communication barriers.

DETAILED CONTENTS

1. Functional Grammar and Vocabulary (12 hrs)

Theory and Practical exercises on following:

- 1.1 One word substitution
- 1.2 List of words misspelt
- 1.3 Prefixes and Suffixes
- 1.4 Punctuation
- 1.5 Narration
- 1.6 Idioms and Phrases

2. Reading (12 hrs)

Comprehension, Vocabulary enrichment and grammar exercises based on the following readings:

Section-I

- The Refund - Priotz Karinthy
- Riders to the Sea - J.M. Synge

Section-II

- Night of the Scorpion - Nissim Ezekiel
- Palanquin Bearers - Sarojini Naidu
- Ode on a Grecian Urn – John Keats

3. Writing (24 hrs)

- 3.1 Precise Writing
- 3.2 Correspondence: Business and Official
- 3.3 Report Writing: Project report
- 3.4 Press Release
- 3.5 Memos and Circulars
- 3.6 Notices, Agenda and Minutes of Meetings
- 3.7 Filling-up different forms such as bank form and on-line form for placement etc.

LIST OF PRACTICALS

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Seminar
4. Debate
5. Use of recorded CDs of speeches for comprehension.
6. Manners and etiquettes
7. Paper presentation
8. Telephonic conversation: General etiquette for making and receiving calls.

INSTRUCTIONAL STRATEGY

Use of pre-recorded CDs/DVDs should be made to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Professional Communication by Kavita Tyagi & Padma Misra; Published by PHI Learning Pvt. Ltd; New Delhi.
3. Developing Communication Skills (2nd Edition) by Krishna Mohan & Meera Banerji; Published by Macmillan Publishers India Ltd; New Delhi.
4. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.

5. Business correspondence and report writing by RC Sharma and Krishna Mohan; Tata McGraw Hill, New Delhi.
6. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
7. Communication Skills by Sanjay Kumar & Pushp Lata; Oxford University Press, New Delhi

Websites for Reference:

1. [http://www.mindtools.com/](http://www.mindtools.com/page 8.html) page 8.html – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	12	25
3	24	50
Total	48	100

2.2 APPLIED MATHEMATICS – II

L T P
5 - -

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus and Integral calculus and Operations Research have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Calculate the effect of one variable with respect to another variable and write the equation of tangent and normal to a curve at a point by understanding and application of basics concepts of derivatives. After understanding the concept of derivatives they will be able to calculate the maximum and minimum values of a function.
- Calculate the area of a curve bounded by axes, by understanding the applications of basic concepts of integration. They will also be able to find the velocity from acceleration and displacement from velocity.
- Evaluate complex integrals in a simpler way by applying definite integral.
- Calculate the approximate area under a curve by applying Numerical Integration by using Trapezoidal and Simpson's Rules.
- Optimize the utilization of limited resources by applying basics concepts of Linear Programming.
- Solve Engineering and Industrial Problems by understanding and applying the solution of differential equations.
- Apply differential Equations and Numerical methods for higher learning of Mathematics and Engineering Applications.

DETAILED CONTENTS

1. Differential Calculus (26 hrs)
 - 1.1 Definition of function; Concept of limits (Introduction only).
 - 1.2 Standard Differentiation of x^n , $\sin x$, $\cos x$, $\tan x$, e^x , $\log_a x$ and related formule.

- 1.3 Differentiation of sum, product and quotient of functions, differentiation of implicit functions, differentiation of parametric functions. Differentiation of function of a function.
- 1.4 Differentiation of trigonometric, inverse trigonometric functions. Logarithmic differentiation. Exponential differentiation, Successive differentiation (excluding nth order).
- 1.5 Application of differential calculus in:
 - (a) Rate Measures
 - (b) Maxima and minima
 - (c) Equation of tangent and normal to a curve (for explicit functions only)
2. Integral Calculus (30 hrs)
 - 2.1 Integration as inverse operation of differentiation with simple examples.
 - 2.2 Standard integrals and related simple problems
 - 2.3 Simple integration by substitution, by parts and by partial fractions (for linear factors only)
 - 2.4 Evaluation of definite integrals (simple problems)
 Evaluation of $\int_0^{\pi/2} \sin^n x \cdot dx$, $\int_0^{\pi/2} \cos^n x \cdot dx$, $\int_0^{\pi/2} \sin^m x \cos^n x \cdot dx$
 using formulae without proof (m and n being positive integers only).
 - 2.5 Applications of integration for evaluation of area bounded by a curve and axes (Simple problem).
 - 2.6 Numerical integration by Trapezoidal Rule and Simpson's 1/3rd Rule and 3/8th Rule.
3. Operations Research (12 hrs)
 - 3.1 Linear Programming Problems formulations.
 - 3.2 Graphical Method
4. Differential Equations (12 hrs)
 - 4.1 Definition, order, degree of ordinary differential equations.

- 4.2 Formation of differential equation (upto 2nd order). Solution of Differential equations with Variable separation and Linear Differential equations.

INSTRUCTIONAL STATREGY

Basic elements of Differential Calculus, Integral Calculus, Operations research and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students.

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Applied Mathematics, Vol. I & II by SS Sabharwal & Dr Sunita Jain, Eagle Parkashan, Jalandhar
4. Engineering Mathematics, Vol I, II & III by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi
5. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd., Delhi
6. Applied Mathematics I, Archana Sharma, Lords Publications, Jalandhar.
7. Engineering Mathematics by Srimanta Pal and Subodh C. Bhunia; Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	26	34
2	30	38
3	12	16
4	12	12
Total	80	100

2.3 APPLIED PHYSICS – II

L T P
4 - 2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology

LEARNING OUTCOME

After undergoing this subject, the student will be able to;

- a) Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- b) Define the terms: frequency, amplitude, wavelength, velocity of a wave. They will be able to explain diffraction, interference, polarization.
- c) Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- d) Apply acoustics principles to various types of buildings to get best sound effect.
- e) State the laws of reflection and refraction of light, calculate the location of the final image for a concave mirror single thin converging lens, design and assemble a microscope using 2 lenses
- f) Measure the refractive index of a liquid or a solid. They will be able to explain total internal reflection as applied to optical fibers.
- g) Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using $C=Q/V$
- h) Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- i) Explain electric current as flow of charge, the concept of resistance, measure correctly, using a multimeter, the following: electric current, potential difference, resistance.
- j) List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity
- k) State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- l) Explain how the following operate: moving coil galvanometer, simple DC motor
- m) Apply the knowledge of diodes in rectifiers, adapters IC's and various electronic circuits. Use the knowledge of semiconductors in various

technical gadgets like mobile phones, computers, LED, LCD, solar lights etc.

- n) Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- o) Apply the use of optical fibre in Medical field and optical fibre Communication.

DETAILED CONTENTS

1. Wave motion and its applications (08 hrs)
 - 1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application
 - 1.2 Wave equation $y = r \sin wt$, phase, phase difference, principle of superposition of waves
 - 1.3 Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M. concept of simple harmonic progressive wave
 - 1.4 Study of vibration of Cantilever and determination of its time period
 - 1.5 Free, forced and resonant vibrations with examples
 - 1.6 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications
 - 1.7 Ultrasonics – Introduction and their engineering and medical applications.

2. Optics (10 hrs)
 - 2.1 Laws of reflection and refraction, refractive index, lens for thin lenses, power of lens, magnification
 - 2.2 Total internal reflection and its applications, Critical angle and conditions for total internal reflection
 - 2.3 Simple and compound microscope, astronomical telescope in normal adjustment, magnifying power.
 - 2.4 Applications of Total Internal Reflection in optical fiber, uses of microscope and telescope.

3. Electrostatics (12 hrs)
 - 3.1 Coulombs law, unit of charge,
 - 3.2 Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.
 - 3.3 Gauss law: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.

- 3.4 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numericals)
- 3.5 Dielectric and its effect on capacitance, dielectric break down
- 3.6 Application of electrostatics in electrostatic precipitation of microbes and moisture separation from air and gases in industry for pollution control (Brief explanation only)

- 4. Current Electricity (12 hrs)
 - 4.1 Electric Current and its Unit, Direct and alternating current,
 - 4.2 Resistance and its Units, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Colour coding of carbon Resistances
 - 4.3 Ohm's law and its verification, superconductivity
 - 4.4 Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only)
 - 4.5 Concept of terminal potential difference and Electro motive force (EMF)
 - 4.6 Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy
 - 4.7 Examples of application of DC circuits in various electrical and electronics equipment such as C.R.O, T.V., Audio-Video System, Computers etc.

- 5. Electromagnetism (10 hrs)
 - 5.1 Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,
 - 5.2 Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and their units
 - 5.3 Concept of electromagnetic induction, Faraday's Laws
 - 5.4 Lorentz force (force on moving charge in magnetic field). Force on current carrying conductor, force on rectangular coil placed in magnetic field
 - 5.5 Moving coil galvanometer its principle, construction and working. Conversion of a galvanometer into ammeter and voltmeter
 - 5.6 Application of electromagnetism in ac/dc motors and generators.

- 6. Semiconductor physics (06 hrs)
 - 6.1 Energy bands, Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics
 - 6.2 Diode as rectifier – half wave and full wave rectifier (centre taped), semiconductor transistor; pnp and npn (concept only)
 - 6.3 Application of semiconductor diodes (Zenor, LED) and that of transistor as amplifier and oscillator.

7. Modern Physics (06 hrs)

- 7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; laser and its characteristics, population inversion, Types of lasers; Ruby and He-Ne lasers, engineering and medical applications of lasers.
- 7.2 Fibre optics: introduction to optical fibers, light propagation, types, acceptance angle and numerical aperture and applications in communication.
- 7.3 Introduction to nanotechnology, nanoparticles and nano materials.

LIST OF PRACTICALS (To perform minimum Eight experiments)

1. To find the time period of a simple pendulum
2. To determine and verify the time period of Cantilever
3. To find the focal length of convex lens by displacement method.
4. To determine the magnifying power of an astronomical telescope
5. To verify ohm's laws by drawing a graph between voltage and current.
6. To verify laws of resistances in series and parallel combination.
7. To find resistance of galvanometer by half deflection method
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To measure very low resistance and very high resistances using Slide Wire bridge
10. To draw characteristics of a pn junction diode and determine knee and break down voltages
11. Use of CRO in plotting AC and DC waveforms.
12. To find wave length of the laser beam.
13. To find numerical aperture of a plastic optical fiber.

INSTRUCTIONAL STATREGY

Teacher may use various instructional media like models, charts and graphs while imparting instructions. The field application should be made clear before teaching the basics of waves, sound, light, electrostatics, dc circuits, electromagnetism, and semiconductor physics etc to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

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

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (hrs)	Marks Allotted (%)
1	08	12
2	10	16
3	12	18
4	12	18
5	10	16
6	06	10
7	06	10
Total	64	100

2.4 APPLIED CHEMISTRY – II

L T P
4 - 2

RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- a) explain chemistry and technology of industrial metal extraction processes.
- b) explain chemical nature and causes of corrosion
- c) apply correct and efficient methods of corrosion prevention.
- d) explain chemistry of fuels and their relative advantages.
- e) select most efficient fuel for the engine and engineering applications.
- f) suggest how to subside air pollution caused by the use of fossil fuels
- g) adapt energy conservation techniques
- h) explain chemical mechanism of lubrication and their relative advantages.
- i) select most efficient lubricant and lubrication technique required for various engineering applications.
- j) explain chemistry of engineering materials
- k) verify suitability of materials and select suitable material for engineering applications.
- l) explain the chemistry of various polymers and plastics
- m) verify suitability and select polymer/rubber/plastic materials for engineering applications.

DETAILED CONTENTS

1. Metallurgy (08 hrs)
 - 1.1 General metallurgical terms and operations with reference to iron, copper and aluminium (excluding extraction details)
 - 1.2 Manufacture of steel- Open hearth process.

- 1.3 Alloys- definition and purpose of alloying, Type of alloys – ferrous and non-ferrous alloys, properties and applications of ferrous alloys- invar, nichrome, stainless steel, alnico and non-ferrous alloys – brass, bronze, german silver, gun metal, duralumin, maganalumin and solder.
2. Corrosion and its Control (12 hrs)
 - 2.1 Definition of corrosion and factors affecting corrosion rate.
 - 2.2 Theories of
 - a) Dry (chemical) corrosion- Pilling Bedworth rule
 - b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism
 - 2.3 Definition of passivity and galvanic series
 - 2.4 Corrosion control:
 - a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel –Application of Metal Zn (Sheradizing), Cr (Chromozing) and Al (Calorizing), Sacrificial protection and impressed current voltage
 - b) Inorganic coatings – Anodizing and phosphating,
 - c) Organic coatings - use of paints varnishes and enamels
 - d) Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)
 - 2.5 Corrosion can be disastrous (catastrophic) but is not necessarily a curse- illustration with help of historic examples.
3. Fuels (12 hrs)
 - 3.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels
 - 3.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.
 - 3.3 Coal - types of coal and proximate analysis of coal
 - 3.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers
 - 3.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.
 - 3.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.
4. Lubricants (12 hrs)
 - 4.1 Definition of Lubricant and lubrication, type of lubrications – hydrodynamic, boundary lubrication with illustrative diagrams
 - 4.2 Classification of lubricants –liquid lubricants, solid lubricants, semi-solid lubricants and synthetic lubricants with examples

- 4.3 Properties of lubricant
 - a. Physical properties –viscosity and viscosity index, determination of viscosity of lubricant using Redwood viscometer, cloud point and pour point, flash point and fire point, oiliness.
 - b. Chemical properties- total acid value or number (TAV or TAN), carbon residue, emulsification factor and iodine value
- 4.4 Designation of lubricating oils according to Society of Automotive Engineers (SAE)
- 4.5 Cutting fluids – applications of cutting fluids, types and the factors that govern the selection of cutting fluids
5. Engineering Materials and Refractories (14 hrs)
 - 5.1 Definition and types with suitable examples and applications of- Ceramics, Refractory and Composite materials
 - 5.2 Glass-chemical composition and application of Soda, Borosilicate and lead glasses only
 - 5.3 Paint, varnish and enamels- definition, constituents and advantages of these organic coatings
6. Polymers and Plastics (06 hrs)
 - 6.1 Definition of polymer, monomer and degree of polymerization
 - 6.2 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)
 - 6.3 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics
 - 6.4 Applications of polymers in industry and daily life

Note: Hand written report need to be submitted on any three topics of the following:

- i) List of iron, aluminium and copper metal ores and place of occurrences in India
- ii) Names of steel plants situated in India.
- iii) Enlist hydro power plants and nuclear power plants in India.

LIST OF PRACTICALS

1. Gravimetric analysis and apparatus used in gravimetric analysis
2. Estimation of copper in the given copper ore solution volumetrically or using spectrophotometer.
3. Gravimetric estimation of moisture in the given coal sample (proximate analysis)
4. Gravimetric estimation of ash content in the given coal sample (proximate analysis)

5. Determination of viscosity of given liquid using Redwood viscometers
6. Determination of flash and fire point of given lubricating oil using Able's flash point apparatus
7. To study the effect of metal coupling on corrosion of iron
8. Volumetric estimation of total acid number (or total acid value) of given lubricating oil
9. Study of effect of acids and bases on tensile strength of natural and synthetic polymer fibres
10. To construct simple Daniel cell and measure its e.m.f. using voltmeter

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - II by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - II by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	08	12
2	12	18
3	12	18
4	12	18
5	14	24
6	06	10
Total	64	100

2.5 ENVIRONMENTAL STUDIES

L T P
3 - -

RATIONALE

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 eco system 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.

LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and sustainable
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of pollution.
- Explain environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment

DETAILED CONTENTS

1. Basics of ecology, eco system and sustainable development (03 hrs)
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table, rain water harvesting, maintenance of ground water, deforestation – its effects and control measures (04 hrs)
3. Pollution: Sources of pollution - natural and man made, causes, effects and control measures of pollution (air, water, noise, soil, radioactive and nuclear) and their units of measurement. Prevention of Pollution :Introduction to Cleaner Production Technologies, , Waste Minimization Techniques, Concept of Zero Discharge (12 hrs)
4. Solid waste management, classification of refuse material, sources, effects and control measures.Introduction to E-waste Management (06 hrs)

5. Environmental Legislation - Water (prevention and control of pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board, Environmental Impact Assessment (EIA) (08 hrs)
6. Energy Conservation: Introduction to Energy Management, Energy Conservation, Energy efficiency & its need. Introduction to Energy Conservation Act 2001 and Energy Conservation (Amendment) Act 2010 & its importance. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio Energy, Hydro Energy) in environmental protection. (10 hrs)
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, (05 hrs)

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits etc. may also be organized.

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 Deep Publications, 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.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	05
2	04	08
3	12	25
4	06	12
5	08	18
6	10	22
7	05	10
Total	48	100

2.6 ENGINEERING DRAWING - II

L T P
- - 6

RATIONALE

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.

Note:

- 1) First angle projection is to be followed.
- 2) Minimum 16 sheets to be prepared. At least 2 sheets in AutoCAD.
- 3) Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students.
- 4) Continuous evaluation be done by the teachers for exercises/work done on CAD software. For this proper record may be maintained for its inclusion in the internal assessment.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Draw and learn different types of wooden joints used in furniture.
- Draw the assembly from part details of objects
- Identify and draw different types of screw threads used in various machines and assemblies as per domestic and international standards
- Draw different types of nuts, bolts and washers
- Draw various locking devices and foundation bolts
- Draw different section of various types of keys and cotter joints
- Draw various riveted joints
- Draw various types of couplings used in power transmission.
- Prepare drawing of given joints/couplings using AutoCAD

DETAILED CONTENTS

1. Detail and Assembly Drawing (02 sheets)
 - 1.1 Principle and utility of detail and assembly drawings
 - 1.2 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortice and Tenon joint, furniture drawing - freehand and with the help of drawing instruments.

2. Screw Threads (03 sheets)
 - 2.1 Thread Terms and Nomenclature
 - 2.1.1 Types of threads-External and Internal threads, Right and Left hand threads (Actual and Conventional representation), single and multiple start threads.
 - 2.1.2 Different Forms of screw threads-V threads (B.S.W threads, B.A thread, American National and Metric thread), Square threads (square, Acme, Buttress and Knuckle thread)
3. Nuts and Bolts (02 sheets)
 - 3.1 Different views of hexagonal and square nuts. Square and hexagonal headed bolt
 - 3.2 Assembly of Hexagonal headed bolt and Hexagonal nut with washer.
 - 3.3 Assembly of square headed bolt with hexagonal and with washer.
4. Locking Devices (02 sheets)
 - 4.1 Different types of locking devices-Lock nut, castle nut, split pin nut, locking plate, slotted nut and spring washer.
 - 4.2 Foundations bolts-Rag bolt, Lewis bolt, curved bolt and eye bolt.
 - 4.3 Drawing of various types of studs
5. Keys and Cotters (03 sheets)
 - 5.1 Various types of keys and cotters - their practical application, drawings of various keys and cotters showing keys and cotters in position
 - 5.2 Various types of joints
 - Spigot and socket joint
 - Gib and cotter joint
 - Knuckle joint
6. Rivets and Riveted Joints (04 sheets)
 - 6.1 Types of general purpose-rivets heads
 - 6.2 Caulking and fullering of riveted joints
 - 6.3 Types of riveted joints
 - (i) Lap joint-Single riveted, double riveted (chain and zig-zag type)
 - (ii) Single riveted, Single cover plate butt joint
 - (iii) Single riveted, double cover plate butt joint
 - (iv) Double riveted, double cover plate butt joint(chain and zig-zag type)

7. Couplings (02 sheets)

- 7.1 Introduction to coupling, their use and types
- 7.2 Flange coupling (protected)
- 7.3 Flexible Coupling

*8. Use of CAD software (02 sheets)

Draw any two joints/coupling using CAD software from the following:

- i) Sleeve and cotter joint
- ii) Knuckle joint
- iii) Spigot and socket joint
- iv) Gib and cotter joint
- v) Flange coupling
- vi) Muff coupling

*** Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

INSTRUCTIONAL STRATEGY

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

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. AutoCAD 2010: For Engineers & Designers by Prof. Sham Tickoo & D. Sarvanan; Wiley India Pvt. Ltd., Delhi.

2.7 GENERAL WORKSHOP PRACTICE - II

(Common for Mechanical Engineering, Mechanical Engineering (RAC), Production and Industrial Engineering, Automobile Engineering and Civil Engineering)

L T P
- - 6

RATIONALE

Psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skills jobs. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met.

LEARNING OUTCOME

After completing the course the students will be able to:

- Select materials, sequence of operations, select tools to make a given job based on interpretation of drawing as per given specification with close tolerances using at least the resources of three shops.
- Prepare a job as per given specifications for a given shop.
- Specify and read/understand specifications of different types of tools, equipment and machines used in various shops.
- Inspect visually to identify various types of defects in different type of materials.
- Analyze a given job and identify various operations required to make it.
- Follow safety procedures and measures.
- Maintain good housekeeping practices.

DETAILED CONTENTS (PRACTICAL EXERCISES)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus.

- 1 Welding Shop – II
- 2 Fitting Shop – II
- 3 Sheet Metal Shop – II
- 4 Electric Shop -II
- 5 Carpentry Shop – II
- 6 Smithy Shop – II

1. WELDING SHOP - II

- 1.1 Introduction to gas welding, gas welding equipment, introduction to soldering and brazing, introduction to resistance welding, safety precautions.
- 1.2 Jobs to be prepared

Job I	Identification and adjustment of various types of gas flames.
Job II	Preparation of lap joint on 75 mm × 35 mm × 3mm M.S. plate using gas welding.
Job III	Preparation of butt joint on 75mm×35mm×3mm M.S.flat using gas welding process.
Job IV	Preparation of a small cot frame (M.S. steel bed frame) from M.S. conduit pipe using arc/gas welding process.
Job V	Preparation of a square pyramid from M.S. rod by welding (Arc or Gas welding).
Job VI	Practice of Spot/Seam welding.

2. FITTING SHOP - II

- 2.1 Care and maintenance of various measuring tools.
 - 2.2 Handling of measuring instruments, finding least count and checking of zero error.
 - 2.3 Description and demonstration of various types of drills, taps and dies.
 - 2.4 Selection of dies for threading, selection of drills and taps.
 - 2.5 Precautions while drilling soft metals (Aluminium, Copper, Brass etc.).
 - 2.6 Introduction to various types of threads (internal, external, single start, multi-start, left hand and right hand threads).
- | | |
|---------|--|
| Job I | Drilling practice on soft metals-Aluminium or Copper or Bronze. |
| Job II | Preparation of a job by filing on non ferrous metals upto an accuracy of $\pm .1$ mm. |
| Job III | Making internal and external threads on a job (GI Pipe, PVC pipe, Steel bars etc.) by tapping and dieing operations (manually) and fixing of different types of elbow, tee, union, socket. |

3. SHEET METAL SHOP - II

- 3.1 Introduction to various metal forming processes e.g. Spinning, Punching, Blanking, cup drawing
- 3.2 Introduction to soldering and brazing.

3.3 Introduction to metal spinning process.

- | | |
|---------|--|
| Job I | Preparation of job involving shearing, circular shearing, rolling, folding, beading and soldering process e.g. Funnel or any other job involving above operations. |
| Job II | Exercise on job involving brazing process |
| Job III | Spinning a bowl/cup/saucer |
| Job IV | Visit to a sheet metal industry e.g. coach builders etc. |

4. ELECTRIC SHOP - II

- 4.1 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply and wiring system.
- | | |
|-------|---|
| Job I | Laying 3 phase wiring for an electric motor or any three phase machine. |
|-------|---|
- 4.2 Estimating and costing of power consumption
- | | |
|---------|--|
| Job II | Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy. |
| Job III | Finding faults in electric circuits, machines, with series testing lamp and multimeter. |
- 4.3 Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.
- | | |
|--------|--|
| Job IV | Dismantling, servicing and reassembling of any of the above electrical appliances. |
|--------|--|
- 4.4 Testing and reversing direction of rotation of single phase and three phase motors.
- | | |
|--------|---|
| Job V | Testing single phase/three phase motors by using voltmeter, ammeter and tachometer. |
| Job VI | Reversing direction of rotation of single phase and three phase motors. |
- 4.5 Identification and familiarisation with the following tools:
Tweezers, Screw Drivers (Different sizes), Insulated pliers, Cutters, Sniper, Philips Screw driver (star screw driver), L-Keys, Soldering Iron and their demonstration and uses.
- | | |
|--------|--|
| Job VI | Practice on joining using soldering and removing components/wires by desoldering |
|--------|--|

5. CARPENTRY SHOP – II

- 5.1 Introduction to joints, their relative advantages and uses.
- | | |
|---------|------------------------------------|
| Job I | Preparation of glued joint. |
| Job II | Preparation of mitre joint |
| Job III | Preparation of a lengthening joint |
- 5.2 Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

- 5.3 Demonstration of job on Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.
- 5.4 Importance and need of polishing wooden items, Introduction to polishing materials.
- 5.5 Practice on Wood Working Lathe
 - a) Safety precaution on wood working machines
 - b) Study of wood working lathe
 - c) Sharpening of lathe tools
 - d) Setting of jobs and tools
 - e) Different type of wood turning practice
- Job IV
 - a) Making Handles of chisels/files/screw drivers etc.
 - b) Making legs of cabinets: Straight, Tapered and Ornamental

6. SMITHY SHOP – II

- 6.1 Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing etc.
- 6.2 Description of various types of power hammers and their usage (Demonstration only).
 - Job I To forge a ring to acquaint the students with forge welding.
 - Job II To forge a chisel and acquaint the students with simple idea of hardening and tempering.
 - Job III To forge squares on both ends of a circular rod.
 - Job IV To prepare a job involving drawing down process

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi

TRAFFIC AWARENESS & ROAD SAFETY CAMP (II)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety. By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

- 1. Time management**
- 2. Traffic light signals**
- 3. Speed limits of vehicles**
- 4. Schedule of offences**
- 5. Dividing lines**
- 6. Proper road Maintenance and Warnings**
- 7. Test yourself**

3.1 ENGINEERING MATERIALS

L T P
3 - 2

RATIONALE

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.

Learning Outcomes

After undergoing this course, the students will be able to:

- Distinguish between metals and non metals and ferrous and non ferrous materials.
- Analyze microstructure and changes in microstructure due to heat treatment.
- Carryout various heat treatment processes such as annealing, normalizing, tempering and hardening.
- Draw and interpret iron-carbon diagram.
- Classify various types of plastics and rubber.
- Explain properties and applications of composites, ceramics and smart materials.
- Select suitable material to be used for various engineering applications.

DETAILED CONTENTS

1. Introduction (07 hrs)

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.
2. Crystallography (07 hrs)

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 behaviour and its mechanisms, behaviour of material under load and stress-strain.

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

3. Metals And Alloys (14 hrs)

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 Aluminium, Copper and Zinc and their alloys
4. Heat Treatment (08 hrs)

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)
5. Plastics (03 hrs)

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
6. Advanced Materials (03 hrs)

Composites-Classification, properties, applications
 Ceramics-Classification, properties, applications
 Adhesives – Classification, properties and applications
 Smart materials - properties and applications.
7. Miscellaneous Materials (06 hrs)

Overview of -Tool and Die materials, Materials for bearing metals, Materials for Nuclear Energy, Refractory materials.

LIST OF PRACTICALS

1. Classification of about 25 specimens of materials/machine parts into
 - (i) Metals and non metals
 - (ii) Metals and alloys
 - (iii) Ferrous and non ferrous metals
 - (iv) Ferrous and non ferrous alloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate the various properties possessed by them.
3.
 - a) Study of heat treatment furnace.
 - b) Study of a thermocouple/pyrometer.
4. Study of a metallurgical microscope and a specimen polishing machine.
5. To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials:
i) Brass ii)Copper iii)Grey iv)Malleable v)Low carbon steel vi)High carbon steel vii) HSS
6. To anneal a given specimen and find out difference in hardness as a result of annealing.
7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
8. To harden and temper a specimen and to find out the difference in hardness due to tempering.

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	07	15
2.	07	15
3.	14	30
4.	08	16
5.	03	06
6.	03	06
7.	06	12
Total	48	100

3.2 APPLIED MECHANICS

L T P
3 - 2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

1. Introduction (04hrs)
 - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
 - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
 - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities
2. Laws of forces (9 hrs)
 - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force

- 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
- 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
- 2.4 Free body diagram
- 2.5 Equilibrant force and its determination
- 2.6 Lami's theorem (concept only)
[Simple problems on above topics]
- 3. Moment (9 hrs)
 - 3.1 Concept of moment
 - 3.2 Moment of a force and units of moment
 - 3.3 Varignon's theorem (definition only)
 - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
 - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
 - 3.6 Concept of couple, its properties and effects
 - 3.7 General conditions of equilibrium of bodies under coplanar forces
 - 3.8 Position of resultant force by moment
[Simple problems on the above topics]
- 4. Friction (9 hrs)
 - 4.1 Definition and concept of friction, types of friction, force of friction
 - 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
 - 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
 - 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
 - a) Acting along the inclined plane Horizontally
 - b) At some angle with the inclined plane

5. Centre of Gravity (8 hrs)
- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
 - 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
 - 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed
[Simple problems on the above topics]
6. Simple Machines (9 hrs)
- 6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of - a machine and their relationship, law of machines
 - 6.2. Simple and compound machine (Examples)
 - 6.3. Definition of ideal machine, reversible and self locking machine
 - 6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
 - 6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
 - 6.6. 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]

LIST OF PRACTICALS

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.

8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	8
2	9	20
3	9	20
4	9	18
5	8	16
6	9	18
Total	48	100

3.3 ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P
3	-	2

RATIONALE

The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, electromagnetic induction, batteries, transformers, motors, distribution system, domestic installation, electrical safety etc. The students will also learn basic electronics including diodes and transistors and their applications.

Learning Outcomes

After undergoing this course, the students will be able to:

- Measure basic electrical quantities.
- Measure and improve power factor in a given circuit.
- Explain the construction, working principle, performance and applications of transformers.
- Identify different wires of distribution system.
- Select and operate single phase and three phase motors.
- Follow electrical safety measures.
- Describe the characteristics and applications of diodes, transistors and thyristor.

DETAILED CONTENTS

1. Application and Advantage of Electricity (03 hrs)

Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy

2. Basic Electrical Quantities (04 hrs)

Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit

3. AC Fundamentals (08 hrs)

Electromagnetic induction-Faraday's Laws, Lenz's Law; Fleming's rules, Principles of a.c. Circuits; Alternating emf, Definition of cycle, frequency, amplitude and time period. Instantaneous, average, r.m.s and maximum value of sinusoidal wave; form factor and Peak Factor. Concept of phase and phase difference. Concept of resistance, inductance and capacitance in simple a.c. circuit. Power factor and improvement of power factor by use of capacitors. Concept of three phase system; star and delta connections; voltage and current relationship (no derivation)

4. Transformers (06 hrs)

Working principle and construction of single phase transformer, transformer ratio, emf equation, losses and efficiency, cooling of transformers, isolation transformer, CVT, auto transformer (brief idea), applications.

5. Distribution System (06 hrs)

Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply

6. Electric Motor (08 hrs)

Description and applications of single-phase and three-phase motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Motors used for driving pumps, compressors, centrifuge, dyers etc. Totally enclosed submersible and flame proof motors

7. Domestic Installation (04 hrs)

Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems. Common safety measures and earthing

8. Electrical Safety (04hrs)

Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs

9. Basic Electronics (05 hrs)

Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of stepper motors and servo motors in process control.

LIST OF PRACTICALS

1. Connection of a three-phase motor and starter with fuses and reversing of direction of rotation
2. Connection of a single-phase induction motor with supply and reversing of its direction of rotation
3. Troubleshooting in domestic wiring system, including distribution board
4. Connection and reading of an electric energy meter

5. Use of ammeter, voltmeter, wattmeter, and multi-meter
6. Measurement of power and power factor in a given single phase ac circuit
7. Study of different types of fuses, MCBs and ELCBs
8. Study of zener diode as a constant voltage source and to draw its V-I characteristics
9. Study of earthing practices
10. To draw V-I characteristics of a (i) NPN transistor (ii) thyristor (SCR)
11. Study of construction and working of a (i) stepper motor and (ii) servo motor

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhogal; Tata McGraw Hill Publishers, New Delhi
2. A Text Book of Electrical Technology, Vol. I and II by BL Thareja; S Chand and Co., New Delhi
3. Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
4. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi
6. Basic Electronics by VK Mehta; S Chand and Co., New Delhi
7. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
8. Basic electronics and Linear circuits by NN Bhargava and Kulshreshta, Tata Mc Graw Hill New Delhi.
9. Electronic principles by SK Sahdev, Dhanpat Rai and Sons, New Delhi.
10. Electronic Devices and circuits by Rama Raddy Narora Publishing House Pvt. Ltd. New Delhi.
11. Principles of electrical and electronics Engineering by VK Mehta; S Chand and Co. New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	04	08
3	08	16
4	06	12
5	06	12
6	08	16
7	04	10
8	04	10
9	05	10
Total	48	100

3.4 METROLOGY AND INSTRUMENTATION

L	T	P
4	-	2

RATIONALE

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

LEARNING OUTCOME

After undergoing the subject, students will be able to :

- Use vernier calliper, micrometer, Height gauge for linear internal and external measurement.
- Use bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.
- Use bevel protector, sine bar, slip gauge, dial indicator, angle deckor, poppy dial for angular measurements.
- Measure spur gear characteristics using gear tooth vernier, outside diameter over dovel pins.
- Use tool makers microscope
- Measure surface roughness parameters.
- Use profile projector, auto collimeter, angle deckor.
- Select and measure variables using electrical and electronics comparators and measuring instrument, sensors, transducers.
- Select and use non destructive testing methods.
- Explain the use of coordinate measuring machine.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Introduction | (06 hrs) |
| 1.1 | Definition of metrology | |
| 1.2 | Standard of measurement | |
| 1.3 | Types of Errors - Controllable and random errors | |
| 1.4 | Precision, accuracy, sensitivity, hysteresis, response time, repeatability, calibration, uncertainty of measurement, interchangeability. | |
| 1.5 | Standardization and standardizing organizations | |
| 2. | Linear and Angular Measurement | (18 hrs) |
| 2.1 | Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block. | |

- 2.2 Construction features and use of instruments for precision measurements : vernier calipers, vernier height and depth gauges, micrometers.
 - 2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.
 - 2.4 Cylinder bore gauges, feeler and wire gauges. Checking flatness, roundness and squareness
 - 2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic .
 - 2.6. Construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.
3. Measurement of Surface Finish (06 hrs)
- 3.1 Terminology of surface roughness.
 - 3.2 Concept of primary texture and secondary texture.
 - 3.3 Factors affecting surface finish.
 - 3.4 CLA, RMS and RA value.
 - 3.5 Principle and operation of stylus probe instruments. Tomlinson surface meter and Taylor surface talysurf.
4. Measurements of Screw threads and Gauges (08 hrs)
- 4.1 Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.
 - 4.2 Measurements of gears (spur) – Measurement of tooth thickness, pitch, Gear Ball tester, Lead and Profile Testers.
 - 4.3 Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.
5. Instrumentation (08 hrs)
- 5.1 Various types of instruments used for mechanical quantities such as displacement, velocity, acceleration, speed and torque. Use of transducers and electronic counters, stroboscope, vibrating reeds and tachometers.
 - 5.2 Strain gauge – use of strain gauge and load cells

Note: There should be a visit to established metrology lab to familiarize students with purpose and need of metrology.

LIST OF PRACTICALS

1. Internal and external measurements with vernier calliper and microscope
2. Measurement of linear dimensions with height gauge and depth gauge.
3. Measurement of flatness, concentricity with dial indicator
4. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
5. Use of plain plug and ring gauge, taper plug and ring gauge, thread plug and ring gauge and snap gauges.
6. Measurement of Angle using;
 - i) Cylindrical rollers and spherical balls and slip gauges
 - ii) Bevel protector
 - iii) Sine Bar/Sine Table , Slip Gauges, Height Gauge and dial indicator.
 - iv) Angle deckor.
7. Measurement of spur gear characteristics;
 - i) Measurement over teeth (M.O.T) by using flange/Disc micrometer.
 - ii) P.C.D run-out using bench centre, mandrel, cylindrical pin and dial indicator.
 - iii) Composite error using Gear Roller Tester and Master Gear.
8. Measurement of thread parameters by using tool maker's microscope.
9. Measurement of effective diameter of external threads by 2-wire and 3-wire method.
10. Measurement of cylindrical bore using cylinder bore gauge for bore diameter, ovality and taper.
11. Measurement of worn out IC engine piston clearance between cylinder and piston.
12. Measurement of surface roughness using surface roughness tester.
13. Measurement of co-ordinates of two or more than two holes using surface plate, angle plate, Height Gauge, dial indicator and slip gauges.
14. Measurement of a profile using profile projector.
15. Study and use of Auto-Collimator.

INSTRUCTIONAL STRATEGY

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Stress should be laid on correct use of various instruments.

RECOMMENDED BOOKS

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	18	26
3	06	10
4	08	12
5	08	12
6	18	30
Total	64	100

3.5 MECHANICAL ENGINEERING DRAWING-I

L T P
- - 7

RATIONALE

Diploma holders in Mechanical Engineering are required to interpret drawings and therefore it is essential that they have skills of preparing drawings and sketches of mechanical components. This subject aims at development of drawing skills in the students.

Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret different limits and fits of components
- Draw intersection of cylinders and their profile
- Draw different kind of machine components like bearings, brackets, pulleys, pipe joints and lathe tool holder.
- Draw electrical circuit diagram of simple household electrical circuits and home appliances
- Read and interpret drawings of mechanical components

DETAILED CONTENTS

1. Limits and fits (03 sheets)

Maximum limit of size, minimum limit of size, tolerance, allowance, deviation, upper deviation, lower deviation, fundamental deviation, clearance, maximum clearance, minimum clearance. Fits – clearance fit, interference fit, transition fit. Hole basis system, shaft basis system, tolerance grades, calculating values of clearance, interference, hole tolerance, shaft tolerance with given basic size for common assemblies like H₇/g₆, H₇/m₆, H₈/p₆. Basic terminology and symbols of geometrical dimensioning and tolerances.
2. Intersection of following solids:- (02 sheets)
 - (a) Cylinder with cylinder (equal and different diameters; axis at right angles)
 - (b) Cylinder with cylinder (axis inclined)
3. Drawing of the following with complete dimensions, tolerances, materials and surface finish marks.
 - 3.1 Universal coupling (Assembly) (01 Sheets)
 - 3.2 Bearings (05 sheets)
 - 3.2.1 Bushed Bearing (Assembled Drawing)
 - 3.2.2 Ball Bearing and Roller Bearing (Assembled Drawing)
 - 3.2.3 Plummer Block (Detailed Drawing)
 - 3.2.4 Plummer Block (Assembled Drawing)
 - 3.2.5 Foot step Bearing (Assembled Drawing)

- | | | |
|-------|---|-------------|
| 3.3 | Bracket | (01 sheets) |
| 3.3.1 | Wall bracket (orthographic views) | |
| 3.4 | Pulleys | (03 sheets) |
| 3.4.1 | Stepped Pulley | |
| 3.4.2 | V. Belt Pulley | |
| 3.4.3 | Fast and loose pulley (Assembled Drawing) | |
| 3.5 | Pipe Joints | (02 sheets) |
| 3.5.1 | Expansion pipe joint (Assembly drawing) | |
| 3.5.2 | Flanged pipe and right angled bend joint (Assembly Drawing) | |
| 3.6 | Lathe Tool Holder (Assembly Drawing) | (01 sheets) |
| 3.7 | Reading of mechanical component drawing | (01 sheets) |
| 3.8 | Sketching practice of bearings, bracket and pulleys. | (02 sheets) |
| 4. | Electrical Circuit Diagram | (01 sheet) |
| 4.1 | Electrical circuit diagrams for house hold appliances (bulb, fan, tube, provision for plug and switch with voltmeter and energy meter connected in the circuit. | |
| 4.2 | Electrical connections for lathe machine | |

- Note:-**
- (1) First angle projection should be followed, 20% of drawings may be prepared in third angle projection.
 - (2) SP-46-1988 should be followed
 - (3) The drawing should include discussion with tolerances, whenever necessary and material list as per BIS / ISO specifications.

INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the components/part whose drawing is to be made
2. Emphasis should be given to cleanliness, dimensioning, layout of sheet
3. Teachers should ensure use of IS codes related to drawing
4. Focus should be on the proper selection of drawing instrument and its proper use

LIST OF RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; S.K. Kataria and Sons; Ludhiana
2. A Text Book of Machine Drawing by R.K.Dhawan; S. Chand and Co. Ltd New Delhi.
3. Machine Drawing by N.D. Bhatt; Charotar Book Depot. Anand.

3.6 WORKSHOP TECHNOLOGY-1

L T P
3 - 7

RATIOANELE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of workshop technology.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Fabricate welding joints using gas welding arc welding, TIG, MIG/MAG welding of mild steel and stainless steel materials.
- Select suitable (most appropriate) process electrodes, various parameters of process for given job.
- Explain principle of operations of modern welding processes.
- Inspect various welding joints, castings, forgings.
- Prepare pattern for given job.
- Select material and type of patterns, cores.
- Prepare sand moulds manually and on machine.
- Select type of moulding sand, adhesives, compact, strength and parameters of sand for given job.
- Cast a mould.
- Identify a suitable furnace, alloying elements
- Carry out deburring of castings.
- Test the properties of moulding sand (permeability, Strength, refractoriness, adhesiveness, cohesiveness).
- Operate forging machine, press, spinning machine.
- Explain the principle of rolling, extrusion and drawing process.

DETAILED CONTENTS

1. Welding (18 hrs)

1.1 Welding Process

Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols. Safety precautions in welding.

1.2 Gas Welding

Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes

1.3 Arc Welding

Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification, B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece. Welding defects and their testing methods.

1.4 Other Welding Processes

Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding, Atomic hydrogen welding, Shielded metal arc welding, submerged arc welding, Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints. Welding defects and inspection.

1.5 Modern Welding Methods

Methods, Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, other welding process, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding, Robotic welding

2. Pattern Making (03 hrs)

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

3. Moulding and Casting (18 hrs)

3.1 Moulding Sand

Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand, Testing of moulding sand. Safety precautions in foundry.

3.2 Mould Making

Types of moulds, Step involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding, Molding machines squeeze machine, jolt squeeze machine and sand slinger.

3.3 Casting Processes

Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, Centrifugal casting

3.4 Gating and Riser System

Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification

3.5 Melting Furnaces

Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace

3.6 Casting Defects

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

4. Metal Forming Processes (6 hrs)

4.1 Press Working - Types of presses, type of dies, selection of press die, die material. Press Operations-Shearing, piercing, trimming, punching, notching, shaving, gearing, embossing, stamping

4.2 Forging - Open die forging, closed die forging, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging

4.3 Rolling - Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies

4.4 Extrusion and Drawing - Type of extrusion- Hot and Cold, Direct and indirect. Pipe drawing, tube drawing, wire drawing

5. Plastic Processing (3 hrs)

5.1 Industrial use of plastics, situation where used.

5.2 Injection moulding-principle, working of injection moulding machine.

- 5.3 Compression moulding-principle, and working of compression moulding machine.
- 5.4 Potential and limitations in the use of plastics

LIST OF PRACTICALS

General introduction to hand tools used in foundry, welding and pattern making and smithy shop.

Welding Shop

- Job 1. Preparing gas welding joint in vertical/Horizontal position joining M.S. Plates
- Job 2. Exercise on gas cutting of mild steel plate with oxy-acetylene gas torch.
- Job 3. Exercise on gas welding of cast iron and brass part or component.
- Job 4. Exercise on preparation of T Joint by arc welding
- Job 5. Exercise on spot welding/seam welding
- Job 6. Exercise on MIG and TIG welding
- Job 7. Exercise on arc welding pipe joint MS.

Pattern making

- Job 1. Preparation of solid/single piece pattern.
- Job 2. Preparation of two piece/split pattern
- Job 3. Preparation of a pattern on wooden lathe
- Job 4. Preparation of a self cored pattern
- Job 5. Preparation of a core box.

Foundry Shop

- Job 1. Preparation of mould with solid pattern on floor.
- Job 2. Preparation of floor mould of solid pattern using cope.
- Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.
- Job 4. Moulding and casting of a solid pattern of aluminum
- Job 5. Preparing a mould of step pulley and also preparing core for the same.
- Job 6. A visit to cast iron foundry should be arranged to have first hand knowledge of cast iron melting pouring and casting.
- Job 7. Testing of moisture contents and strength of moulding sand.

Forging Shop/Fitting Shop/Sheet Metal Shop

- Job 1. Preparation of single ended spanner by hand/machine forging.
- Job 2. Preparation of simple die
- Job 3. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine.
- Job 4. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
- Job 5. Preparation of utility item out of G.I. sheet.
- Job 6. Preparation of drilling Jig.

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

LIST OF RECOMMENDED BOOKS

1. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra : Asia Publishing House
3. Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
5. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishing House, Roorkee.
6. A Text Book of Manufacturing Science and Technology by A Manna, Prentice Hall of India, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	18	36
2	03	08
3	18	36
4	06	14
5	03	06
Total	48	100

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy
2. Introduction to energy management, energy conservation, energy efficiency and its need
3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance
4. Standards and Labeling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Punjab Energy Conservation Building Code (ECBC)
6. General Energy Saving Tips in:
 - Lighting System
 - Room Air Conditioners
 - Refrigerators
 - Water Heater
 - Computers
 - Fans, Heaters, Blowers and Washing Machines
 - Colour Television
 - Water Pumps
 - Kitchens
 - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

Unit 1 Drugs Use and Abuse in Society

- a. Concept and overview
- b. Extent of the problem
- c. Drug use as a social problem
- d. Causes of Drug Use: Biological, Socio-cultural, psychological

Unit 2 Types of Dugs and identification of Abuse

- a. Familiar drugs: Tabacco, Caffeine, over the counter drugs
- b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
- c. Reformance enhancing the drugs
- d. Uppers and Downers: Stimulants and Depressants

Unit 3 Impact of drug Abuse

- a. Individual level biological and psychological
- b. Family social, National

Unit 4 Management and prevention of Drug Abuse

- a. Medical and psychological
- b. Role of family School , Media and Legislation

4.1 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L T P
3 - -

RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma pass-outs for enhancing their employability and self confidence.

LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Explain the importance of generic skills
- Demonstrate self development
- Manage himself/herself physically, intellectually and psychologically
- Work effectively as a team member
- Manage tasks effectively
- Apply knowledge to solve problems
- Develop an entrepreneurial mindset.
- Identify entrepreneurial support system for new ventures and small businesses.
- Recognize a business opportunity.
- Prepare project report
- Demonstrate how to launch an individual's entrepreneurial career

DETAILED CONTENTS

1. Introduction to Generic Skills (04 hrs)
 - 1.1 Importance of Generic Skill Development
 - 1.2 Global and Local Scenario of Generic Skill Development
 - 1.3 Life Long Learning and associated importance of Generic Skill Development

2. Managing Self (08 hrs)
 - 2.1 Knowing Self for Self Development
 - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
 - 2.2 Managing Self - Physical
 - Personal grooming, Health, Hygiene, Time Management
 - 2.3 Managing Self – Intellectual development
 - Information Search: Sources of information
 - Writing Skills – Official & business correspondence, Job application covering letter and resume
 - Speaking Skills – Mock interview, Preparing for meeting, Group discussion
 - 2.4 Managing Self – Psychological
 - Stress, Emotions, Anxiety-concepts and significance
 - Techniques to manage stress
3. Managing in Team (06 hrs)
 - 3.1 Team - definition, team dynamics
 - 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
4. Task Management (03 hrs)
 - 4.1 Task Initiation, planning, execution, close out
 - 4.2 Exercises/case studies on task planning towards development of skills for task management
5. Problem Solving (05 hrs)
 - 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
 - 5.2 Different approaches for problem solving.
 - 5.3 Steps followed in problem solving.
 - 5.4 Exercises/case studies on problem solving.
6. Entrepreneurship (22 hrs)
 - 6.1 Introduction
 - Concept/Meaning and its need
 - Qualities of an entrepreneur
 - Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

- 6.2 Market Survey and Opportunity Identification (Business Planning)
 - How to start a small scale industry
 - Procedures for registration of small-scale industry
 - Assessment of demand and supply in potential areas of growth.
 - Understanding business opportunity
 - Considerations in product selection
- 6.3 Project Report Preparation
 - Preliminary Project Report
 - Techno-Economic Feasibility Report
 - Preparation of Detailed Project Report

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Soft Skills for Interpersonal Communication by S. Balasubramanian Published by Orient Black Swan, New Delhi.
2. Generic Skill Development Manual, MSBTE, Mumbai.
3. Lifelong learning, Policy Brief (www.oecd.org)
4. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
5. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	04	05
2.	08	15
3.	06	10
4.	03	10
5.	05	10
6.	22	50
Total	48	100

4.2 HYDRAULICS AND PNEUMATICS

L	T	P
4	-	2

RATIONALE

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.

Learning Outcomes

After undergoing this course, the students will be able to:

- Explain fluid properties, their units and conversion.
- Measure different types of pressures.
- Maintain different types of pressure gauges.
- Calculate flow and discharge of various liquids.
- Apply Bernoulli's theorem for calculating pipe diameter and height of pipe from ground.
- Calculate pipe friction and losses in pipelines.
- Specify hydraulic machines for different applications.
- Select maintain and resolve troubles in pumps.
- Apply Pascal's law in practical applications.
- Maintain hydraulic and pneumatic system.

DETAILED CONTENTS

1. Introduction (03 hrs)

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.
2. Pressure and its Measurement (06 hrs)
 - 2.1 Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure)
 - 2.2 Pressure measuring devices: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems
 - 2.3 Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge

3. Flow of Fluids (07 hrs)

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.

4. Flow through Pipes (10 hrs)

- 4.1 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, Nozzle - definition, velocity of liquid flowing through the nozzle, power developed. Water hammer, anchor block, syphon, surge tank (concept only).
- 4.2 Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof)

5. Hydraulic System (05 hrs)

Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press, selection of specification of above systems for different applications

6. Water Turbines and Pumps (14 hrs)

- 6.1 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, selection of turbines based on specific speed.
- 6.2 Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps.
- 6.3 Construction, working and operation of centrifugal pump. Performance, efficiencies and specifications of a centrifugal pump. Trouble shooting and problems in centrifugal pumps and remedial measures, pitting, cavitation, priming.

7. Introduction to Oil Power Hydraulics and Pneumatics (03 hrs)

- 7.1 Introduction to oil power hydraulics and pneumatic system
- 7.2 Statement of Pascal law and its applications
- 7.3 Industrial applications of oil power hydraulics and pneumatic system
- 7.4 Cavitation

8. Components of Hydraulic Systems (08 hrs)

- 8.1 Basic components of hydraulic system, function of each component in a hydraulic circuit.
- 8.2 Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,
- 8.3 Filters- definition and purpose, classification
- 8.4 Seals and packing- classification of seals, sealing materials.
- 9. Components of Pneumatic Systems (08 hrs)
 - 9.1 Basic components – function of each component
 - 9.2 Air compressors – type, working
 - 9.3 Air cylinder – types, function, single acting, double acting, rotating, non-rotating, piston type, diaphragm type, tandem cylinder, double ended cylinder, duplex cylinder.
 - 9.4 Air filter, regulator and lubricator – their necessity in pneumatic circuit.
 - 9.5 Installation, maintenance and application of air cylinders.

LIST OF PRACTICALS

- 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.

INSTRUCTIONAL STRATEGY

- 1. Use computer based learning aids for effective teaching-learning
- 2. Expose students to real life problems
- 3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

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
6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..
8. Pneumatic Controls by Festo Didactic; Bangalore.
9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel – Verlag.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	06	10
3	07	10
4	10	16
5	05	08
6	14	20
7	03	06
8	08	12
9	08	12
Total	64	100

4.3 STRENGTH OF MATERIALS

L T P
4 - 2

RATIONALE

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, columns and springs. 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.

Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret various concepts and terms related to strength of materials
- Calculate stresses in thin cylindrical shells.
- Calculate energy stored by materials subjected to axial loads.
- Calculate moment of inertia of different sections.
- Draw and calculate bending moment and shear force diagrams of beam under given loading
- Interpret the concept of bending and torsion and calculate stresses on different section of materials.
- Determine the diameter of a shaft under combined bending and torsion.
- Calculate critical axial loads on column under different end constraints.
- Determine the various parameters in closed coil helical and laminated springs
- Determine conformance of given materials sample to the prescribed Indian standards.

DETAILED CONTENTS

1. Stresses and Strains (08 hrs)
 - 1.1. Basic assumptions; Concept of load, stress and strain
 - 1.2. Tensile compressive and shear stresses and strains
 - 1.3. Concept of Elasticity, Elastic limit and limit of proportionality.
 - 1.3.1. Nominal and true stress-strain diagrams.
 - 1.3.2. Hook's Law
 - 1.3.3. Young Modulus of elasticity
 - 1.3.4. Nominal stress
 - 1.3.5. Yield point, plastic stage
 - 1.3.6. Ultimate strength and breaking stress

- 1.3.7. Percentage elongation
- 1.3.8. Proof stress and working stress
- 1.3.9. Factor of safety
- 1.3.10 Poisson's Ratio
- 1.3.11 Shear modulus
- 1.3.12 Deflection and stiffness
- 1.4. Concepts of fatigue, creep and stress concentration
- 1.5. Longitudinal and circumferential stresses in seamless thin walled cylindrical shells.

- 2. Resilience (04 hrs)
 - 2.1 Resilience, proof resilience and modulus of resilience
 - 2.2 Strain energy due to direct stresses
 - 2.3 Stresses due to gradual, sudden and falling load.

- 3. Moment of Inertia (10 hrs)
 - 3.1. Concept of moment of inertia and second moment of area
 - 3.2 Radius of gyration
 - 3.3 Theorem of perpendicular axis and parallel axis (without derivation)
 - 3.4 Second moment of area of common geometrical sections :Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section
 - 3.5 Section modulus

- 4. Bending Moment and Shearing Force (10 hrs)
 - 4.1 Concept of beam and form of loading
 - 4.2 Concept of end supports-Roller, hinged and fixed
 - 4.3 Concept of bending moment and shearing force
 - 4.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.

- 5. Bending stresses (06 hrs)
 - 5.1 Concept of Bending stresses
 - 5.2. Theory of simple bending
 - 5.3. Use of the equation $f/y = M/I = E/R$
 - 5.4. Concept of moment of resistance

- 5.5. Bending stress diagram
- 5.6. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
- 5.7 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

- 6 Columns (08 hrs)
 - 6.1. Concept of column, modes of failure
 - 6.2. Types of columns
 - 6.3. Buckling load, crushing load
 - 6.4. Slenderness ratio
 - 6.5. Factors effecting strength of a column
 - 6.6 End restraints
 - 6.7 Effective length
 - 6.8 Strength of column by Euler Formula without derivation
 - 6.9. Rankine Gourdan formula (without derivation)

- 7. Torsion (10 hrs)
 - 7.1. Concept of torsion- difference between torque and torsion.
 - 7.2. Use of torque equation for circular shaft
 - 7.3. Comparison between solid and hollow shaft with regard to their strength and weight.
 - 7.4. Power transmitted by shaft
 - 7.5 Concept of mean and maximum torque
 - 7.6 Concept of Principal stresses, principal planes and max. shear stress.
 - 7.7 Determination of shaft diameter under combined bending and torsion.

- 8. Springs (8 hrs)
 - 8.1. Closed coil helical springs subjected to axial load
 - 8.1.1. Stress deformation
 - 8.1.2 Stiffness and angle of twist and strain energy
 - 8.1.3 Proof resilience
 - 8.2 Determination of number of plates of laminated spring (semi elliptical type only)

LIST OF PRACTICALS

1. Tensile test on bars of Mild steel and Aluminium.
2. Bending tests on a steel bar or a wooden beam.
3. Impact test on metals
 - a) Izod test
 - b) Charpy test
4. Torsion test of solid specimen of circular section of different metals for determining modulus of rigidity.
5. To determine the stiffness of a helical spring and to plot a graph between load and extension.
6. Hardness test on different metals.

Note : All the tests need to be done as per prescribed Indian Standards.

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

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.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	12
2	04	06
3	10	16
4	10	16
5	06	10
6	08	12
7	10	16
8	08	12
Total	64	100

4.4 THERMODYNAMICS - I

L	T	P
4	-	2

RATIOANLE

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.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Apply thermodynamic laws.
- Solve basic problems of gas equation using perfect gas laws.
- Determine enthalpy, specific heat capacity and P-V-T surface of an ideal and real gas.
- Explain the working, construction and applications of steam boilers and steam generators
- Interpret different modes of heat transfer.

DETAILED CONTENTS

1. Fundamental Concepts (06 hrs)
 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.
2. Laws of Perfect Gases (05 hrs)
 Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants, derivation

 Specific heat at constant pressure, specific heat at constant volume of gas, derivation of an expression for specific heats with characteristics, simple problems on gas equation
3. Thermodynamic Processes on Gases (08 hrs)
 Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes

 Derivation of work done, change in internal energy, change in entropy, rate of heat transfer for the above processes

4. Laws of Thermodynamics (12 hrs)

Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Application of first law of thermodynamics to non-flow systems – Constant volume, constant pressure, Adiabatic and polytropic processes, steady flow energy equation, Application of steady flow energy to equation, turbines, pump, boilers, compressors, nozzles, evaporators, limitations.

Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy.

5. Ideal and Real Gases (06 hrs)

Concept of ideal gas, enthalpy and specific heat capacities of an ideal gas, $P - V - T$ surface of an ideal gas, determination of triple point, real gases, Vander-Wall's equation

6. Properties of Steam (05 hrs)

Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, entropy of water, entropy of steam, $T - S$ diagrams, Mollier diagram ($H - S$ Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes

Quality of steam (dryness fraction),

7. Steam Generators (05 hrs)

Uses of steam, classification of boilers, comparison of fire tube and water tube boilers. Construction features of Lancashire boiler, Nestler boiler, Babcock & Wilcox Boiler. Introduction to modern boilers.

8. Air Standard Cycles (06 hrs)

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

Comparison of Otto, Diesel cycles for same compression ratio or same peak pressure developed

Reasons for highest efficiency of Carnot cycle and all other cycles working between same temperature limits

9. Air Compressors (08 hrs)

Functions of air compressor – uses of compressed air, type of air compressors

Single stage reciprocating air compressor, its construction and working, representation of processes involved on P – V diagram, calculation of work done.

Multistage compressors – advantages over single stage compressors, use of air cooler – condition of minimum work in two stage compressor (without proof), simple problems

Rotary compressors – types, descriptive treatment of centrifugal compressor, axial flow compressor, vane type compressor

10. Introduction to Heat Transfer (03 hrs)

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

LIST OF PRACTICALS

1. Determination of temperature by
 - 1.1 Thermocouple
 - 1.2 Pyrometer
 - 1.3 Infrared thermometer
2. Demonstration of mountings and accessories on a boiler.
3. Study of boilers (through industrial visit)
4. Demonstrate the working of air compressor.
5. Demonstration of heat transfer through conduction, convection and Radiation
6. Study of working of high pressure boiler
7. Study the working of Lancashire boiler and Nestler boiler

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems.
2. Plan assignment so as to promote problem solving abilities.

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.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	05	08
3	08	12
4	12	20
5	06	10
6	05	08
7	05	08
8	06	10
9	08	10
10	03	04
Total	64	100

4.5 MECHANICAL ENGINEERING DRAWING-II

L T P
- - 7

RATIONALE

Diploma holders in Mechanical Engineering are required to interpret drawings and therefore it is essential that they have skills of preparing drawings and sketches of mechanical components. This subject aims at development of skills and understanding of mechanical engineering drawings.

Learning Outcomes

After undergoing this course, the students will be able to:

- Interpret and draw the drawings of mechanical machine parts like jig, vices and screw jack
- Interpret and prepare the drawings of boiler and I.C. engine parts.
- Interpret and draw different types of cams for different kinds of motions.
- Interpret gear terminology and draw spur gear teeth profile.

DETAILED CONTENTS

- | | | |
|-----|---|----------|
| 1. | Introduction to drawing office equipment, through a visit to modern drawing office of an industry | |
| 2. | Drilling Jig (Detail and Assembly) | 2 sheets |
| 3. | Vices | 3 sheets |
| 3.1 | Machine vice (Detailed and Assembly drawing) | |
| 4. | I.C. Engine Parts | 3 sheets |
| 4.1 | Piston | |
| 4.2 | Connecting rod (Assembly drawing) | |
| 4.3 | Crankshaft and flywheel assembly | |
| 5. | Boiler Parts | 2 sheets |
| 5.1 | Steam Stop Valve (Assembled drawing) | |
| 5.2 | Blow off cock. (Assembled drawing) | |
| 6. | Mechanical Screw Jack (Assembled Drawing) | 1 sheet |
| 7. | Cams | 4 sheets |
| 7.1 | Types of cams and followers (Theoretical) | |

- 7.2 Profile of cams for imparting following motions with knife edge, roller and flat followers :
- Uniform motion
 - Simple Harmonic Motion
 - Uniformity accelerated and retarded motion:
8. Gears 4 sheets
- 8.1 Nomenclature of gears and conventional representation
- 8.2 Drawing the actual profile of involute teeth of spur gear by different methods.
- Note: 1. 1st angle projection should be followed. 20% of the drawings may be made using 3rd angle projection.
2. SP- 46-1998 should be followed. The drawings should include dimensions with tolerance wherever necessary and material as per BIS/ISO specifications.
3. Uses, specifications, material and functions of above components should also be explained in the class..

RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; S.K. Kataria & Sons, Ludhiana
2. A Text Book of Machine Drawing by RK Dhawan; S.Chand & Co. Ltd., New Delhi.
3. Machine drawing by N.D Bhatt, Charotar Book Depot, Anand

4.6 WORKSHOP TECHNOLOGY-II

L T P
3 - 7

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes, modern machining methods, tools, jigs and fixtures is required to be imparted. Hence the subject of workshop technology.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Perform turning, step turning, taper turning, threading and knurling operation on lathe machine.
- Resharpen/grind single point tool.
- Select material and tool geometry for cutting tools on lathe.
- Perform drilling, reaming, counter boring, counter sinking and tapping operations on drilling machine.
- Explain the nomenclature of a drill
- Perform filing, cutting, Fitting and die tapping operations
- Perform keyway cutting and angular/step surface shaping on shaper.
- Explain geometry of single point tools, various types of lathe tools and tool materials.
- Explain uses of lathe accessories and different types of lathes.
- Explain boring operation, features of boring machine and boring tool.
- Explain the uses and features of jigs, fixtures, locating devices and clamping devices.
- Select cutting fluid for different materials and operations.
- Describe the features of various types of broaching machines.

DETAILED CONTENTS

1. Cutting Tools and Cutting Materials (06 hrs)
 - 1.1. Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect
 - 1.2 Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.
2. Lathe (10 hrs)
 - 2.1 Principle of turning
 - 2.2 Description and function of various parts of a lathe

- 2.3 Classification and specification of various types of lathe
 - 2.4 Drives and transmission
 - 2.5 Work holding devices
 - 2.6 Lathe tools: Parameters/Nomenclature and applications
 - 2.7 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.
 - 2.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
 - 2.9 Speed ratio, preferred numbers of speed selection.
 - 2.10 Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment, tool post grinder, milling attachment, Quick change device for tools.
 - 2.11 Brief description of capstan and turret lathe, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.
3. Drilling (06 hrs)
- 3.1 Principle of drilling.
 - 3.2 Classification of drilling machines and their description.
 - 3.3 Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
 - 3.4 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
 - 3.5 Types of drills and their features, nomenclature of a drill
 - 3.6 Drill holding devices.
 - 3.7 Types of reamers.
4. Boring (04 hrs)
- 4.1 Principle of boring
 - 4.2 Classification of boring machines and their brief description.
 - 4.3 Specification of boring machines.
 - 4.4 Boring tools, boring bars and boring heads.
 - 4.5 Description of jig boring machine.
5. Shaping and Planing (08 hrs)
- 5.1 Working principle of shaper and planer
 - 5.2 Type of shapers
 - 5.3 Type of planers
 - 5.4 Quick return mechanism applied to shaper and planer machine.
 - 5.5 Work holding devices used on shaper and planer
 - 5.6 Types of tools used and their geometry.
 - 5.7 Specification of shaper and planer .
 - 5.8 Speeds and feeds in above processes.

6. Broaching (04 hrs)
- 6.1 Introduction
 - 6.2 Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down.
 - 6.3 Elements of broach tool, broach tooth details – nomenclature, types, and tool material.
7. Jigs and Fixtures (06 hrs)
- 7.1 Importance and use of jigs and fixture
 - 7.2 Principle of location
 - 7.3 Locating devices
 - 7.4 Clamping devices
 - 7.5 Types of Jigs – Drilling jigs, bushes, template jig, plate jig, channel jig, leaf jig.
 - 7.6 Fixture for milling, turning, welding, grinding
 - 7.7 Advantages of jigs and fixtures
8. Cutting Fluids and Lubricants (04 hrs)
- 8.1 Function of cutting fluid
 - 8.2 Types of cutting fluids
 - 8.3 Difference between cutting fluid and lubricant
 - 8.4 Selection of cutting fluids for different materials and operations
 - 8.5 Common methods of lubrication of machine tools.

PRACTICAL EXERCISES

Turning Shop

- Job 1. Grinding of single point turning tool.
- Job 2. Exercise of simple turning and step turning.
- Job 3. A composite job involving, turning, taper turning, external thread cutting and knurling.

Advance Fitting Shop

- Job 1. Exercise on drilling, reaming, counter boring, counter sinking and tapping
- Job 2. Dove tail fitting in mild steel
- Job 3. Radius fitting in mild steel
- Job 4. Pipe threading with die

Machine Shop

- Job 1. Prepare a V-Block up to ± 0.5 mm accuracy on shaper machine
- Job 2. Exercise on key way cutting and spline cutting on shaper machine.

INSTRUCTIONAL STRATEGY

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.
2. Focus should be on preparing jobs using various machines in the workshop.
3. Foreman Instructor should conduct classes of each workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practicals.

RECOMMENDED BOOKS

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
3. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	12
2	10	22
3	06	14
4	04	08
5	08	16
6	04	08
7	06	12
8	04	08
Total	48	100

ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business

5.1 BASICS OF MANAGEMENT

L T P
3 -

RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Marketing management, Financial management, Customer Relationship Management (CRM) & Total Quality Management (TQM), etc. have been included in the subject to provide elementary knowledge about these management areas.. This course explores cyber-security measures and the different forms of cybercrime and emergent forms of cyber-warfare.

LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Explain the principles of management including its functions in an organisation.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organisation.
- Use marketing skills for the benefit of organization .
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, TPM and CRM.
- Distinguish and classify the forms of cybercriminal activity and the technological and 'social engineering' methods used to undertake such crimes.
- Analyse and assess the impact of cybercrime on government, businesses, individuals and society.

DETAILED CONTENTS

1. **Principles of Management** (06 hrs)
 - 1.1. Introduction, importance and general functions of management.
 - 1.2. Concept and Types of an organization - Sole trading ,partnership, companies, corporation, PSU's and cooperative societies.
 - 1.3. Structure of an organisation -
 - a) Line organization
 - b) Staff organisation
 - c) Functional organization
 - d) Line and staff organization
 - 1.4. Hierarchical Management Structure
 - Top, middle and lower level management

- 1.5. Departmentalization
 - Introduction and its advantages.

2. **Leadership and Motivation** (06 hrs)
 - 2.1 Leadership
 - 3.1.1. Definition and Need of Leadership
 - 3.1.2. Qualities of a good leader
 - 3.1.3. Manager vs. leader
 - 3.1.4. Theories of leadership –trait theory and Behaviour theory.
 - 2.2 Motivation
 - 3.1.5. Definition and characteristics of motivation
 - 3.1.6. Factors affecting motivation
 - 3.1.7. Maslow's Need Hierarchy Theory of Motivation and X&Y need Hierarchy theory of motivation.

3. **Work Culture** (06 hrs)
 - 3.1. Introduction and importance of Healthy Work Culture in organization
 - 3.2. Components of Culture
 - 3.3. Importance of attitude, values and behaviour
Behavioural Science – Individual and group behavior.
 - 3.4. Professional ethics – Concept and need of Professional Ethics and human values.

4. **HRM and its functions** (04 hrs)
 - 4.1 Human Resource Management
 - Manpower Planning, recruitment and selection
 - Training and development of work force at the shop-floor.
 - Performance appraisal
 - Wages, salary and incentive schemes

5. **Marketing and sales** (06 hrs)
 - 5.1 Marketing
 - Introduction, importance and its functions
 - Marketing mix for industries and service sector
 - Basic Marketing strategies
 - 5.2 Sales
 - Difference between marketing and selling
 - Advertisement- print media and electronic media
 - Market-Survey and Sales promotion.

6. **Basic of Accounting and Finance** (06 hrs)
 - 6.1 Basic of Accounting:
 - Meaning and definition of accounting
 - Double entry system of book keeping
 - Trading account, PLA account and balance sheet of a company

- 6.2 Objectives of Financial Management
 - Profit Maximization v/s Wealth Maximization
7. **Material and Stores Management** (04hrs)
 - Introduction, functions and objectives of material management
 - Purchasing: definition and procedure
 - Just in time (JIT)
8. **TQM , TPM** (02 hrs)
 Total Quality Management (TQM) and Total Preventive Maintenance (TPM) - Concepts and importance
9. **Customer Relationship management (CRM)** (02 hrs)
 Customer Relationship management - Concepts and importance
10. **Cyber Security** (06 hrs)
 -Introduction to Cyberspace and Cyber Law, Pros and Cons of social media.
 -Different Components of cyber Laws; Cyber Law and Netizens
 - Categories of Cyber Crime: Personal, Business, Financial, Office Security
 -Cyber Crime – Complete transparency, hacking/cracking, denial of service, IP piracy,
 phrasing, hetaerism etc. Cyber Attack – cyber attackers.
 -Introduction to IPR, copyright & patent

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.

3. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.
4. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
5. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
6. Intellectual Property Rights and the Law by Dr. GB Reddy.
7. Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.
8. Nandan Kamath, A Guide to Cyber Laws & IT Act 2000 with Rules & Notification
9. Keith Merill & Deepti Chopra (IK Inter.), Cyber Cops, Cyber Criminals & Internet

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	06	12
2.	06	12
3.	06	12
4.	04	9
5.	06	12
6.	06	12
7.	04	9
8.	02	05
9.	02	05
10.	06	12
Total	48	100

5.2. REFRIGERATION AND AIR CONDITIONING

L T P
4 - 2

RATIONALE

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.

Learning Outcomes

After undergoing this course, the students will be able to:

- Explain the working and construction features of refrigeration and air conditioning systems
- Draw and interpret various refrigeration cycles.
- Make basic calculation of psychometric properties and processes.
- Calculate heating and cooling load requirements of a room.
- Explain latest developments in the field of refrigeration and air conditioning.
- Calculate the properties of air by using psychometric chart.
- Detect faults in an air-conditioner/refrigerator.
- Carry out charging of air conditioner.

DETAILED CONTENTS

REFRIGERATION

1. Fundamentals of Refrigeration (02 hrs)

Introduction to refrigeration, and air conditioning, meaning of refrigerating effect, units of refrigeration, COP, difference between COP and efficiency, methods of refrigeration, Natural system and artificial system.

2. Vapour Compression System (12 hrs)

Introduction, principle, function, parts and necessity of vapour compression system, T- ϕ 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

3. Refrigerants (04 hrs)

Functions, classification of refrigerants, properties of R - 717, R – 22, R–134 (a), CO₂, R – 11, R – 12, R – 502, Properties of ideal refrigerant, selection of refrigerant

4. Air Refrigeration System (08 hrs)

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

5. Vapour Absorption System (06 hrs)

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.,

6. Refrigeration Equipment (12 hrs)

6.1 Compressors- Function, various types of compressors

6.2 Condensers - Function, various types of condensers

6.3 Evaporators- Function, types of evaporators

6.4 Expansion Valves - Function, various types such as capillary tube, thermostatic expansion valve, low side and high side float valves, application of various expansion valves

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

AIR CONDITIONING

7. Psychrometry (08 hrs)

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

8. Applied Psychrometry and Heat Load Estimation. (09 hrs)

Psychrometric chart, various lines, psychrometric process, by pass factor, room sensible heat factor, effective room sensible heat factor, grand sensible heat factor, ADP, room DPT.

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

9. Latest development in refrigeration and air conditioning:- (03 hrs)

Inverter technology, auto-defrosting, blast cooling, star rating.

LIST OF PRACTICALS

1. Identify various tools of refrigeration kit.
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

INSTRUCTIONAL STRATEGY

1. Teaches should take the students to industry and explain the details of refrigeration and air-conditioning systems and their components.
2. While imparting instructions, focus should be on conceptual understanding.
3. Training slides of “Carrier Fundamentals of Refrigeration Air Conditioning” to be shown to students.

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.
4. Refrigeration and Air Conditioning by Dr. Harjeev Khanna; Dhanpat Rai and Sons, Delhi.
5. Refrigeration and Air Conditioning by Dr. R.K Rajput; S.K. Kataria and Sons, Ludhiana.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	12	20
3	04	06
4	08	12
5	06	10
6	12	18
7	08	12
8	9	14
9	3	4
Total	64	100

5.3 THERMODYNAMICS-II

L T P
4 - 2

RATIOANLE

A diploma holder in this course is supposed to know about testing of IC Engines, fuel supply, ignition system, cooling and lubrication of engines and gas turbines. Hence this subject

Learning Outcomes

After undergoing this course, the students will be able to:

- Explain the working of IC engine.
- Diagnose and rectify simple problems in fuel supply and ignition system.
- Explain the functioning of different components of fuel supply of diesel engine.
- Explain the working of lubrication and cooling system in IC engine.
- Assist in testing an IC engine.
- Explain the functioning of steam turbine, gas turbine and jet propulsion.

DETAILED CONTENTS

1. IC Engines (09 hrs)
 - 1.1 Introduction
 - 1.2 Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle
 - 1.3 Location and functions of various parts of IC engines and materials used for them
2. Fuel Supply and Ignition System in Petrol Engine (08 hrs)
 - 2.1 Concept of carburetion
 - 2.2 Air fuel ratio
 - 2.3 Simple carburetor and its application, carburetor of two wheeler.
 - 2.4 Description of battery coil and electro ignition system, fault finding/ and remedial action in ignition system
 - 2.5 Description of petrol injection system
3. Fuel System of Diesel Engine (06 hrs)
 - 3.1 Components of fuel system
 - 3.2 Description and working of fuel feed pump
 - 3.3 Fuel injection pump, Common rail direct injection (CRDI)
 - 3.4 Injectors

4. Cooling and Lubrication (10 hrs)
 - 4.1 Function of cooling system in IC engine
 - 4.2 Air cooling and water cooling system, use of thermostat, radiator and forced circulation in water cooling (description with line diagram)
 - 4.3 Function of lubrication
 - 4.4 Types and properties of lubricant
 - 4.5 Lubrication system of engine
 - 4.6 Fault finding in cooling and lubrication and remedial action
5. Testing of IC Engines (09 hrs)
 - 5.1 Engine power - indicated and brake power
 - 5.2 Efficiency - mechanical, thermal, relative and volumetric
 - 5.3 Methods of finding indicated and brake power
 - 5.4 Morse test for petrol engine
 - 5.5 Heat balance sheet, simple numerical problems
 - 5.6 Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO - 2, Bharat methods of reducing pollution in IC engines, alternative fuels like CNG, LPG, Hydrogen
6. Steam Turbines and Steam Condensers (10 hrs)
 - 6.1 Function and use of steam turbine
 - 6.2 Steam nozzles - types and applications
 - 6.3 Steam turbines - impulse, reaction, simple and compound, construction and working principle
 - 6.4 Governing of steam turbines
 - 6.5 Function of a steam condenser, elements of condensing plant
 - 6.6 Classification - jet condenser, surface condenser
 - 6.7 Cooling pond and cooling towers
7. Gas Turbines and Jet Propulsion (12 hrs)
 - 7.1 Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine
 - 7.2 Open cycle constant pressure gas turbines - general layout, PV and TS diagram and working of gas turbine
 - 7.3 Closed cycle gas turbines, PV and TS diagram and working
 - 7.4 Principle of operation of ram-jet engine and turbo jet engine - application of jet engines
 - 7.5 Rocket engine - its principle of working and applications
 - 7.6 Fuels used in jet propulsion

LIST OF PRACTICALS

1. Dismantle an IC engine and note down the condition of various parts, removal and fitting of piston, rings, measuring of bore size, crank shaft ovality and assemble it.
2. Dismantle a carburetor
3. Servicing of petrol injection system
4. Valve servicing, grinding, lapping and fitting mechanism and tappet adjustment.
5. Inspection of ignition system of a multi-cylinder engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment, spark plug cleaning.
6. Service of cooling & lubrication system of IC engine and note down the functioning/testing of various components.
7. Determination of BHP by dynamometer.
8. Morse test on multi-cylinder petrol engine.
9. Draw layout of modern automobile workshop and note down the special tools and equipments in each shop.
10. Local visit to roadways or private automobile workshop.

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

RECOMMENDED BOOKS

1. Elements of Heat Engines by Pandey and Shah; Charotar Publishing House, Anand.
2. Thermal Engineering by PL. Ballaney; Khanna Publishers, New Delhi.
3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing Company, Delhi.
4. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
5. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	09	15
2	08	12
3	06	10
4	10	15
5	09	15
6	10	15
7	12	18
Total	64	100

5.4 THEORY OF MACHINES

L T P
4 - -

RATIONALE

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.

Learning Outcomes

After undergoing this course, the students will be able to:

- Explain working of different types of mechanisms and draw their inversion.
- Determine the horizontal force required to move a body on an inclined plane and calculate the efficiency of screw jack.
- Solve problems on power transmission.
- Determine ratio of driving tension for flat and V-belt drive.
- Identify various types of gears and their applications.
- Construct turning moment diagram of flywheel for different types of engine.
- Explain working of different types of governors.
- Calculate balancing of rotating mass and its position.
- Identify different type of vibrations, their causes, harmful effect and remedies.

DETAILED CONTENTS THEORY

1. Simple Mechanisms (06 hrs)
 - 1.1 Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversions.
 - 1.2 Different types of mechanisms (with examples)

2. Friction (10 hrs)
 - 2.1 Definition and its necessity
 - 2.2 Horizontal force required to move a body on an inclined plane both upward and downward
 - 2.3 Frictional torque in screws , both for square and V threads
 - 2.4 Screw jack (Derivation and Numericals)
 - 2.5 Different types of bearings and their application

3. Power Transmission (14 hrs)
 - 3.1 Introduction to Belt and Rope drives
 - 3.2 Types of belt drives and types of pulleys
 - 3.3 Concept of velocity ratio, slip and creep; crowning of pulleys (simple numericals)
 - 3.4 Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numericals)
 - 3.5 Different types of chains and their terminology
 - 3.6 Gear terminology, types of gears and their applications; simple and compound gear trains; power transmitted by simple spur gear
4. Flywheel (08 hrs)
 - 4.1 Principle and applications of flywheel
 - 4.2 Turning - moment diagram of flywheel for different engines
 - 4.3 Fluctuation of speed and fluctuation of energy - Concept only
 - 4.4 Coefficient of fluctuation of speed and coefficient of fluctuation of energy
5. Governor (10 hrs)
 - 5.1 Principle of governor
 - 5.2 Simple description and working of Watt, Porter and Hartnel governor (simple numerical based on watt and porter governor)
 - 5.3 Hunting, isochronisms, stability, sensitiveness of a governor
6. Balancing (06 hrs)
 - 6.1 Concept of balancing
 - 6.2 Introduction to balancing of rotating masses (simple numericals)
7. Vibrations (10 hrs)
 - 7.1 Types-longitudinal, transverse and torsional vibrations (simple numericals)
 - 7.2 Dampening of vibrations
 - 7.3 Causes of vibrations in machines, their harmful effects and remedies

INSTRUCTIONAL STRATEGY

1. Use teaching aids for classroom teaching
2. Give assignments for solving numerical problems
3. Arrange industry visits to augment explaining use of various machine components like belt, rope, chain, gear drives, action due to unbalanced masses, brake clutch, governors, fly wheels, cams and gear drives
4. Video films may be used to explain the working of mechanisms and machine components like clutch, governors, brake etc.

RECOMMENDED BOOKS

1. Theory of Machines by D.R. Malhotra; Satya Prakashan, New Delhi.
2. Theory of Machines by V.P Singh; Dhanpat Rai and sons, New Delhi.
3. Theory of Machines by Jagdish Lal; Metropolitan Publishers, New Delhi.
4. Theory of Machine by B.S Ubhi; S.K. Kataria and Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	10	15
3	14	22
4	08	12
5	10	16
6	06	10
7	10	15
Total	64	100

5.5 COMPUTER AIDED DRAFTING AND MODELING

L T P

- - 8

LEARNING OUTCOMES

- On completion of this course, students will be able to :
- know the advantages of using CAD in comparison with conventional method.
- draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
- create easy and complex solids and assemblies using various tools in Solidworks software.

DETAILED CONTENTS

1. Introduction to AutoCAD commands (6 drawing sheets)
 - 1.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar)
 - 1.2 Drawing commands – point, line, arc, circle, ellipse,
 - 1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
 - 1.4 Dimensioning and placing text in drawing area
 - 1.5 Sectioning and hatching
 - 1.6 Inquiry for different parameters of drawing entity
 - 1.7 Create layers within a drawing
 - 1.8 Specifying Geometrical Dimensioning & tolerancing (GD&T) parameters in drawing
2. Detail and assembly drawing of the following using AUTOCAD (4 sheets)
 - 2.1 Plummer Block
 - 2.2 Wall Bracket
 - 2.3 Stepped pulley, V-belt pulley
 - 2.4 Flanged coupling
 - 2.5 Machine tool Holder (Three views)
 - 2.6 Screw jack or knuckle joint
3. Isometric Drawing by CAD using Auto CAD (one sheet)

Drawings of following on computer:

 - Cone
 - Cylinder
 - Isometric view of objects

4. Introduction to Solidworks

Introduction to Sketcher: Sketch Entities, Sketch Tools, Blocks, Dimensioning

4.1 Part modeling (4 models)

Part Modeling Tools:-

- 4.1.1 Creating reference planes
- 4.1.2 Creating Extrude features Creating Revolve Creating Swept features-
- 4.1.3 Creating Loft features
- 4.1.4 Creating Reference - points, axis, coordinates
- 4.1.5 Creating curves
- 4.1.6 Creating Fillet features
- 4.1.7 Inserting Hole types
- 4.1.8 Creating Chamfer
- 4.1.9 Creating Shell
- 4.1.10 Creating Rib
- 4.1.11 Creating Pattern Advanced Modeling Tools
- 4.1.12 Inserting Fastening features,
- 4.1.13 Environment& Utilities - Working with views and manipulating views,

4.2 Assembly (2 models)

Assembly Modeling Tools:-

Introduction to Assembly Modeling & Approaches – Top down and Bottom up approach, Applying Standard Mates- Coincident, Parallel, Perpendicular, Tangent, Concentric, Lock, Distance, Angle. Applying Advanced Mates – Symmetric, Width, Path Mate, Linear/Linear Coupler, Limit Mate. Applying Mechanical Mates – Cam, Hinge, Gear, Rack Pinion, Screw, and Universal Joint. Manipulating Components - Replacing Components, Rotating Components, Move Components, Collision Detection, Physical Dynamics, Dynamic Clearance, Detecting Interference Creating Pattern - Assembly Pattern, Mirror, Creating Explode Views

INSTRUCTIONAL STRATEGY

1. Teachers should show model or realia of the component/part whose drawing is to be made.
2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.
3. Teachers should ensure use of IS codes related to drawing.

RECOMMENDED BOOKS

1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
2. AutoCAD for Engineering Drawing Made Easy by P. NageswaraRao; Tata McGraw Hill, New Delhi.
3. AutoCAD 2000 for you by UmeshShettigar and Abdul Khader; Janatha Publishers, Udupi.
4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
5. Designing with Pro Engineer, Sham Tickoo by Dream Tech Publications, New Delhi.
6. Designing with CATIA, by Sham Tickoo, Dream Tech. Publications, New Delhi

5.6 WORKSHOP TECHNOLOGY - III

L T P
4 - 7

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes and modern machining methods is required to be imparted. Hence the subject of workshop technology.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Perform boring, internal threading on lathe machine.
- Perform milling machine operations on vertical and horizontal milling machine.
- Operate tool and cutter grinder
- Operate cylindrical grinder, surface grinder, internal grinder.
- Use Milling machine accessories and attachments.
- Explain gear hobbing, gear shaping, gear shaving and gear finishing processes.
- Explain the working and use of modern machining practices.
- Explain the working principle of metallic coating processes.
- Explain the working principle of metal finishing processes.

DETAILED CONTENTS

- | | | |
|------|---|----------|
| 1. | Milling | (18 hrs) |
| 1.1 | Specification and working principle of milling machine | |
| 1.2 | Classification, brief description and applications of milling machines | |
| 1.3 | Details of column and knee type milling machine | |
| 1.4 | Milling machine accessories and attachment – Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment shover chuck and rotary table. | |
| 1.5 | Milling methods - up milling and down milling | |
| 1.6 | Identification of different milling cutters and work mandrels | |
| 1.7 | Work holding devices | |
| 1.8 | Milling operations – face milling, angular milling, form milling, straddle milling and gang milling. | |
| 1.9 | Cutting speed and feed, simple numerical problems. | |
| 1.10 | Thread milling | |
| 2 | Grinding | (14 hrs) |
| 2.1 | Purpose of grinding | |
| 2.2 | Various elements of grinding wheel – Abrasive, Grade, structure, Bond | |

- 2.3 Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels. Specification of grinding wheels as per BIS.
- 2.4 Truing, dressing, balancing and mounting of wheel.
- 2.5 Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
- 2.6 Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder.
- 2.7 Selection of grinding wheel
- 2.8 Thread grinding.

- 3. Gear Manufacturing and Finishing Processes (08 hrs)
 - 3.1 Gear hobbing
 - 3.2 Gear shaping
 - 3.3 Gear finishing processes

- 4. Modern Machining Processes (08 hrs)
 - 4.1 Mechanical Process - Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications
 - 4.2 Electro Chemical Processes - Electro chemical machining (ECM) – Fundamental principle, process, applications
 - 4.3 Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications
 - 4.4 Laser beam machining (LBM) – Introduction, machining process and applications
 - 4.5 Plasma arc machining (PAM) and welding – Introduction, principle process and applications

- 5. Metallic Coating Processes (08 hrs)
 - 5.1 Metal spraying – Wire process, powder process, applications
 - 5.2 Electro plating, anodizing and galvanizing
 - 5.3 Organic Coatings- oil base paint, rubber base coating

- 6. Metal Finishing Processes (08 hrs)
 - 6.1 Purpose of finishing surfaces.
 - 6.2 Surface roughness-Definition and units
 - 6.3 Honing Process, its applications
 - 6.4 Description of hones.
 - 6.5 Brief idea of honing machines.
 - 6.6 Lapping process, its applications.
 - 6.7 Description of lapping compounds and tools.
 - 6.8 Brief idea of lapping machines.
 - 6.9 Polishing
 - 6.10 Buffing.

PRACTICAL EXERCISES

Advance Turning Shop

1. Exercise of boring with the help of boring bar
2. Exercises on internal turning on lathe machine
3. Exercises on internal threading on lathe machine
4. Exercises on external turning on lathe machine
5. Resharpening of single point cutting tool with given geometry

Machine Shop

1. Produce a rectangular block by facing on a slotting machine
2. Produce a rectangular slot on one face with a slotting cutter
3. Produce a rectangular block using a milling machine with a side and face cutter
4. Prepare a slot on one face using milling machine
5. Job on grinding machine using a surface grinder
6. Prepare a job on cylindrical grinding machine.
7. Exercise on milling machine with the help of a form cutter
8. Exercise on milling machine to produce a spur gear
9. Grinding a drill-bit on tool and cutter grinder
10. Exercise on dressing a grinding wheel

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.
4. Foreman Instructor should conduct classes of each Workshop explaining use of tools, jobs to be made and safety precautions related to each workshop prior to students being exposed to actual practical's.

RECOMMENDED BOOKS

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi.
2. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
3. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
4. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
5. Workshop Technology Vol-III, by R.P. Dhiman, Ishan Publications Jalandhar
6. Production Technology by HMT; Tata McGraw Publishers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	18	32
2	14	20
3	08	12
4	08	12
5	08	12
6	08	12
Total	64	100

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene

6.1 PRODUCTION MANAGEMENT

L T P
4 - -

RATIONALE

Diploma holder is responsible for controlling production and quality of the product on the shop floor as well as for production planning and control. He is also required to supervise erection, installation and maintenance of equipment including material handling and undertake work-study for better utilization of resources. For this purpose, knowledge and skills about these topics need to be imparted to them. This subject aims at development of competencies to prepare material, equipment schedule and production control schedules and maintain required quality levels. In addition, it will also help in developing skills in erection, installation and testing of equipment.

Learning Outcomes

After undergoing this course, the students will be able to:

- Solve planning, scheduling and sequencing problems for shop floor
- Interpret different kinds of production systems
- Prepare break-even analysis and Gantt chart.
- Locate suitable plant location and draw plant layout for different production system.
- Handle different type of material and tools safely and effectively.
- Apply work study techniques for improving production
- Maintain inventory optimally and classify different types of inventory
- Use industrial engineering concepts to improve productivity
- Use resources optimally and economically.
- Carryout estimating and costing of production cost
- Apply different techniques to improve quality of products and processes.

DETAILED CONTENTS.

1. Production Planning and Control (PPC) (05 hrs)
 - 1.1 Introduction.
 - 1.2. Objectives and factors affecting PPC
 - 1.3. Functions(Elements) of PPC - Planning, Routing, Loading, scheduling, dispatching, progressing and inspection
 - 1.4. Types of production system - Flow or continuous production, Intermittent Production
 - 1.5. Production Control - Objectives and fields of production control, Production control system
 - 1.6 Break even analysis and Gantt chart.

2. Plant Location, Layout and Material Handling (09 hrs)

- 2.1 Definition and Factors affecting the plant location, Rural versus Urban Plant sites.
- 2.2 Definition and importance of Plant layout, Factors affecting plant layout.
- 2.3 Types of Plant layout- Process, product, combination and fixed position layout..
- 2.4 Methods of plant layout - Process flow charts, layout analogues Travel chart, distance, volume matrix.,
- 2.5. Plant layout procedure and work station design.
- 2.6. Material Handling- Definition, Significance and objectives of material handling, Principles of economic material handling,. Types of material handling equipment - Characteristics and classification of material handling equipment, Hoisting and conveying equipment (different types), Safety requirements while using material handling equipment

3. Work Study (10 hrs)

- 3.1 Production System and Productivity(Introduction and definitions), Difference between Production and productivity, Measures to improve productivity
- 3.2 Definition, advantages and procedure of work study
- 3.3 Method study – Definition, Objectives and Procedures, Process chart symbols, outline process chart, Flow process charts, Two handed processes charts, Multiple activity chart(Man-Machine charts), Flow diagram, string diagram.
- 3.4 Principles of motion economy, Therblig symbols, SIMO chart.
- 3.5. Work Measurement :- Definition and objective, Work measurement technique, Time Study- Definition, objectives and procedure, Calculation of basic time, performance rating and its techniques, normal time, allowance and its types, standard time (simple numerical problems)

4. Inventory Control (8 hrs)

- 4.1 Definition and objectives of inventory control.
- 4.2 Inventory types
- 4.3 Procurement and carrying cost, EOQ, lead time, reorder point (simple numerical problems)
- 4.4 Inventory Classification - ABC Analysis, VED Analysis, FMS Analysis
- 4.5 Standardization and Codification - Objective and advantages of standardization, Levels and types of standards, .Objective and advantages of codes. Coding systems-. National and International Codes

- 4.6. Concept of Just-In-Time (JIT)
5. Inspection and Quality Control (08 hrs)
 - 5.1. Inspection – Introduction, Need and Importance
 - 5.1.1. Types of Inspection
 - 5.1.2. Role of operator and inspector in inspection
 - 5.2. Quality Control
 - 5.2.1. Introduction, Need and Importance
 - 5.2.2. Factors affecting product quality
 - 5.3. Quality Assurance
 - 5.4. Statistical Quality Control (SQC)
 - 5.4.1. Acceptance Sampling, Sampling Plan- Single and double sampling plan
 - 5.4.2. Operating Characteristics Curve
 - 5.4.3. Control Charts – Introduction, advantages, Types of control charts (X, R, p and c charts)
6. Repair and Maintenance (06 hrs)
 - 6.1. Objectives and importance of Maintenance
 - 6.2. Different types of maintenance- Corrective or Breakdown maintenance, Scheduled Maintenance, Preventive Maintenance, Predictive Maintenance
 - 6.3. Nature of maintenance problems
 - 6.4. Range of maintenance problems
7. Value Engineering (04 hrs)
 - 7.1. Introduction, Concept
 - 7.2. Objectives of value engineering
 - 7.3. Value Analysis Procedures
 - 7.4. Benefits of value analysis
 - 7.5. Technique of value engineering
8. Cost Estimation and Control: (14 hrs)
 - 8.1. Definition and functions of cost estimation
 - 8.2. Estimation procedure
 - 8.3. Elements of cost, ladder of costs (simple numericals)
 - 8.4. Overhead expenses and its distribution
 - 8.5. Depreciation - Concept and Definition, Methods of calculating depreciation- Straight line method, Diminishing Balance Method, Sinking fund method (Numerical problems).
 - 8.6. Cost control- definition and objectives, Capital cost control (planning and scheduling), operating cost control.

- 8.7 Cost estimation for machining processes like turning, drilling, and milling.
Cost estimation of forming processes like forging, pattern making, and casting .

INSTRUCTIONAL STRATEGY

1. Teacher should put emphasis on giving practical problems related to plant location and plant layout
2. Students should be taken to industrial units to give an exposure of production environment, plant layout and material handling
3. Live problems may be given to students to carry out case studies in teams under guidance of teacher

RECOMMENDED BOOKS

1. Industrial Engineering and Management by T.R. Banga and SC Sharma; Khanna Publishers, Delhi.
2. Industrial Engineering and Management by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
3. Production Management by C.L. Mahajan; Satya Parkashan Company Limited, New Delhi.
4. Mechanical Costing, Estimation and Project Planning by CK Singh; Standard Publishers, New Delhi.
5. A Text Book of Reliability and Maintenance Engineering by A Manna, Prentice Hall of India

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	10
2	9	15
3	10	15
4	8	12
5	8	12
6	6	10
7	4	6
8	14	20
Total	64	100

6.2 MACHINE DESIGN

L T P
4 - -

RATIONALE

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.

LEARNING OUTCOME

At the end of this course, students will be able to:

- Explain the terms related to design.
- Use codes and standards for designing a component.
- Select material for designing a component.
- Interpret the various causes of design failures.
- Design shaft on the basis of strength and rigidity.
- Design various machine elements (key, joint, flange coupling and screwed joints)

DETAILED CONTENTS

1. Introduction (08 hrs)
 - 1.1 Design – Definition, Type of design, necessity of design
 - 1.1.1 Comparison of designed and undesigned work
 - 1.1.2 Design procedure
 - 1.1.3 Characteristics of a good designer
 - 1.2 Design terminology: stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit.
 - 1.2.1 General design consideration
 - 1.2.2 Codes and Standards (BIS standards)
 - 1.3 Engineering materials and their mechanical properties :
 - 1.3.1 Properties of engineering materials: elasticity, plasticity, malleability, ductility, toughness, hardness and resilience. Fatigue, creep, tenacity, strength
 - 1.3.2 Selection of materials, criterion of material selection

2. Design Failure (04 hrs)

- 2.1 Various design failures-maximum stress theory, maximum strain theory
- 2.2 Classification of loads
- 2.3 Design under tensile, compressive and torsional loads.

3. Design of Shaft (10 hrs)

- 3.1 Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaft available
- 3.2 Shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of :
 - Strength criterion
 - Rigidity criterion
- 3.3 Determination of shaft diameter (hollow and solid shaft) subjected to bending
- 3.4 Determination of shaft diameter (hollow and solid shaft) subjected to combined torsion and bending .

4. Design of Key (06 hrs)

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

5. Design of Joints (20 hrs)

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

5.1 Temporary Joint:

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

5.2 Permanent Joint:

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

6. Design of Flange Coupling (08 hrs)

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).

7. Design of Screwed Joints (08 hrs)

7.1 Introduction, Advantages and Disadvantages of screw joints, location of screw joints.

7.2 Important terms used in screw threads, designation of screw threads

7.3 Initial stresses due to screw up forces, stresses due to combined forces

7.4 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 provide all the relevant data for the machine design numericals in the question paper.

INSTRUCTIONAL STRATEGY

1. Use moulds of various parts/components.
2. Presentation should be arranged for various topics.

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.
6. Design Data Handbook by D.P. Mandali, SK Kataria and Sons, Delhi.
7. Machine Design by A.P.Verma; SK Kataria and Sons, Delhi
8. Machine Design by AR Gupta and BK Gupta ; Satya Parkashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	12
2	04	06
3	10	16
4	06	10
5	20	32
6	08	12
7	08	12
Total	64	100

6.3 AUTOMOBILE ENGINEERING

L T P
4 - 3

RATIONALE

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.

LEARNING OUTCOMES

After undergoing this course, the students will be able to :

- identify and explain the function of different chassis components and drive types.
- maintain transmission system.
- carry out balancing of wheels to maintain steering geometry.
- carry out routine servicing of brake system and bleeding of hydraulic brakes
- carry out testing and charging of Lead-acid battery.
- interpret Bharat norms of exhaust emissions.

DETAILED CONTENTS

1. Introduction (06 hrs)
 - 1.1 Automobile and its development
 - 1.2 Various types of automobiles manufactured in India, their manufacturer and location of their manufacturing unit.
 - 1.3 Classification of automobiles
 - 1.4 Layout of chassis
 - 1.5 Types of drives-front wheel, rear wheel, four wheel.
 - 1.6 Introduction to electric and hybrid vehicles.
 - 1.7 Governing of fuel- carburettor, electronic control module (ECM i.e, 8 bit, 16 bit and 32 bit computers)
 - 1.8 Concept of double overhead cam, single overhead cam, Twin cam 16 valve technology in 4 cylinder engine.
2. Transmission System (12 hrs)
 - 2.1 Clutch - Function, Constructional details of single plate and multi plate friction clutches, Centrifugal and semi centrifugal clutch, Cone clutch, Hydraulic clutch

- 2.2 Gear Box - Function, Working of sliding mesh, constant mesh and synchromesh gear box, Torque converter and overdrive, Introduction to Automated Manual Transmission, Automatic transmission and Continuously Variable Transmission.
- 2.3 Propeller shaft and rear axle - Function, Universal joint, Differential, Different types of rear axles and rear axle drives.
- 2.4 Wheels and Tyres - Types of wheels, Types and specifications of tyres used in Indian vehicles, Toe in, toe out, camber, caster, kingpin inclination, Wheel balancing and alignment, Factors affecting tyre life.

3. Steering System (06 hrs)

Function and principle, Ackerman and Davis steering gears, Types of steering gears - worm and wheel, rack and pinion, Power steering-Hydraulic and Electrical.

4. Braking system (08 hrs)

Constructional details and working of mechanical, hydraulic, air and vacuum brake, Relative merits and demerits. Details of master cylinder, wheel cylinder, Concept of brake drum, brake lining/pad and Brake adjustment, Introduction to Anti-lock Brake System and its working.

5. Suspension System (08 hrs)

Function and types of Coil spring, leaf spring, Air suspension, Shock absorber –Function, construction and working of Telescopic type.

6. Battery (10 hrs)

Constructional details of lead acid cell battery, Specific gravity of electrolyte - effect of temperature on specific gravity, Specification of battery-capacity, rating , number of plates, selection of battery for particular use, Battery charging, chemical reactions during charge and discharge, Maintenance of batteries, Checking of batteries for voltage and specific gravity. Batteries for electric and hybrid vehicles.

7. Dynamo and Alternator (10 hrs)
 - 7.1 Dynamo - Function and details, Regulators - voltage current and compensated type, Cutout - construction, working and their adjustment,
 - 7.2 Alternator - Construction and working, Charging of battery by alternator. Introduction to Integrated starter-alternator.

8. Exhaust Emissions (04 hrs)

Types and use of catalytic converters, selective catalytic reduction methods for emission control, emission norm standards i.e. Bharat norms.

LIST OF PRACTICALS

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

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose the students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

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.
4. Automobile Engineering by G. S. Aulakh; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	12	20
3	6	10
4	8	12
5	8	12
6	10	16
7	10	14
8	04	06
Total	64	100

6.4 CNC MACHINES AND AUTOMATION

L T P
4 - 3

RATIONALE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

LEARNING OUTCOMES

After undergoing this course, the students will be able to :

- Explain the construction and tooling of CNC machine.
- Prepare simple part programme.
- Operate a CNC lathe.
- Operate a CNC milling machine.
- Diagnose common problems in CNC machines.
- Explain the trends in the field of automation.

DETAILED CONTENTS

1. Introduction (12 hrs)

Introduction to NC, CNC & DNC, their advantages, disadvantages and applications, Machine Control Unit, input devices, serial communication and Ethernet techniques, selection of components to be machined on CNC machines, Problems with conventional NC, New developments in NC, Axis identification, PLC Control and its components.
2. Construction and Tooling (10 Hrs)

Design features, specification Chart of CNC machines, use of slideways, balls, rollers and coatings, motor and leadscrew, swarf removal, safety and guarding devices, various cutting tools for CNC machines, overview of tool holder, different pallet systems and automatic tool changer system, management of a tool room.
3. Part Programming (16 Hrs)

Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rational components, part programming using canned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation.

4. System Devices (12 Hrs)
Actuators, Transducers and Sensors, Tachometer, LVDT, opto-interrupters, potentiometers for linear and angular position, encoder and decoder, axis drives, open loop system, close loop system.
5. Problems in CNC Machines (06 Hrs)
Common problems in mechanical, electrical, pneumatic, electronic and PC components of NC machines, diagnostic study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines.
6. Automation and NC system (08 Hrs)
Role of computer in automation, emerging trends in automation, automatic assembly, manufacture of magnetic tape, manufacture of printed circuit boards, manufacture of integrated Circuits, Overview of FMS, Group technology, CAD/CAM and CIM.

LIST OF PRACTICALS

- 1 Study the constructional details of CNC lathe.
2. Study the constructional details of CNC milling machine.
3. Study the constructional details and working of:
 - Automatic tool changer and tool setter
 - Multiple pallets
 - Swarf removal
 - Safety devices
4. Develop a part programme for following lathe operations and make the job on CNC lathe and CNC turning center.
 - Plain turning and facing operations
 - Taper turning operations
 - Operation along contour using circular interpolation.
5. Develop a part programme for the following milling operations and make the job on CNC milling
 - Plain milling
 - Slot milling
 - Contouring
 - Pocket milling

6. Preparation of work instruction for machine operator
7. Preparation of preventive maintenance schedule for CNC machine.
8. Demonstration through industrial visit for awareness of actual working of FMS in production.
9. Use of software for turning operations on CNC turning center.
10. Use of software for milling operations on machine centres.

INSTRUCTIONAL STRATEGY

This is highly practice-based course. Efforts should be made to develop programming skills amongst the students. During practice work, it should be ensured that students get opportunity to individually perform practical tasks.

RECOMMENDED BOOKS

1. CNC Machines – Programming and Applications by M Adithan and BS Pabla; New Age International (P) Ltd., Delhi.
2. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata McGraw Hill, New Delhi.
3. CNC Machine by Bharaj; Satya Publications, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	10	16
3	16	26
4	12	18
5	06	10
6	08	10
Total	64	100

6.5 PROJECT WORK

L T P
- - 15

RATIONALE

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 first hand 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 (say at the end of second year). 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 cum 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, polytechnics 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 some one 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.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance Criteria	Max.** Marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10%	10	8	6	4	2
2.	Planning and execution of considerations	10%	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
Total marks		100	100	80	60	40	20

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared “not eligible to receive diploma”. It is also important to note that the students must get more than six “goods” or above “good” grade in different performance criteria items in order to get “Overall Good” grade.

Range of maximum marks		Overall grade
i)	More than 80	Excellent
ii)	79 < > 65	Very good
iii)	64 < > 50	Good
iv)	49 < > 40	Fair
v)	Less than 40	Poor

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.**

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work