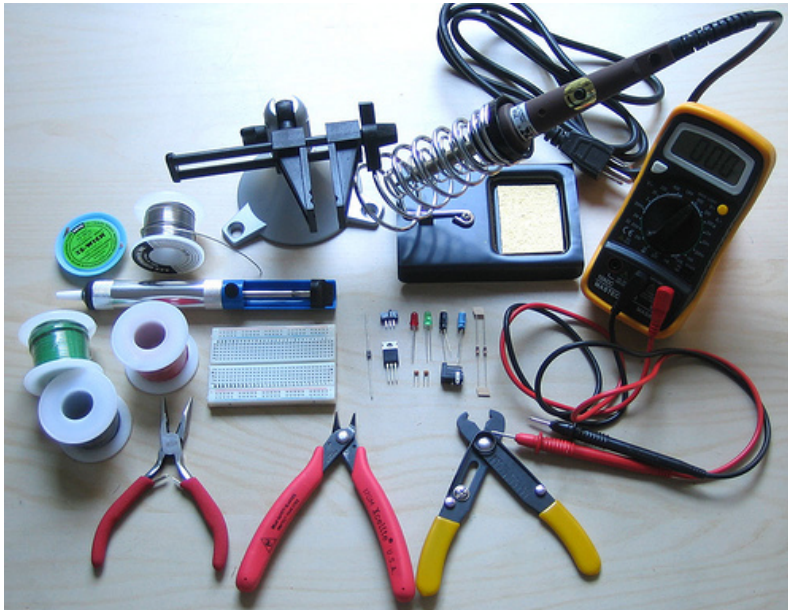
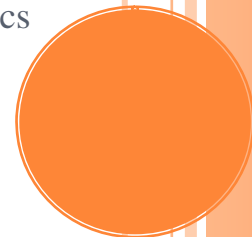


BABA FARID GROUP OF INSTITUTIONS



“Electronics is one of the largest and fastest growing field. It covers a wide range of applications which make our life easier and enjoyable such as Television, Radio, Computers, Telecommunication etc. They help us to see, hear and communicate over vast distances and do things faster. Electronics has a major role in improving productivity in industries like oil, energy, agriculture and so many other important sectors of economy. In steel, petroleum and chemical industries it is the electronic devices that direct, control and test production processes. Health care industry depend on electronic instruments to perform chemical tests and to check body functions. The safety in transportation, factories and mines and in homes relies heavily on electronics. The uses are endless. You must find new solutions to the practical problems affecting our daily lives. You may team with other specialists to design, fabricate, produce, test and supervise the manufacture of complex products and systems i.e electronic equipments and components for a number of industries including hospitals, computer industry, electronic data processing systems for communication and in defense etc after completion of course. Electronics is a constantly changing and widening branch among profession courses.”

--Dr. Subhash Pokhriyal
In-Charge
Department of Electronics



ENGLISH AND COMMUNICATION SKILLS - I

L T P
3 - 2

RATIONALE

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this course is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the course, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a **communication skill laboratory** for conducting practicals mentioned in the curriculum.

DETAILED CONTENTS

1. Facets of Literature (14 hrs)
 - 1.1 Short Stories
 - 1.1.1 Homecoming – R.N. Tagore
 - 1.1.2 The Selfish Giant - Oscar Wilde
 - 1.1.3 The Diamond Necklace- Guy- De Maupassant
 - 1.2 Prose
 - 1.2.1 I Have A Dream – Martin Luther King
 - 1.2.2 On Habits – A. G. Gardiner
 - 1.2.3 On Seeing People Off – Max Beerbohm
 - 1.3 Poems
 - 1.3.1 Ozymandias – P.B. Shelley
 - 1.3.2 Daffodils – William Wordsworth
 - 1.3.3 Stopping by Woods on a Snowy Evening – Robert Frost
2. Grammar and Usage (10 hrs)
 - 2.1 Parts of speech
 - 2.1.1 Nouns
 - 2.1.2 Pronouns
 - 2.1.3 Adjectives

- 2.1.4 Articles
 - 2.1.5 Verbs
 - 2.1.6 Adverbs
 - 2.1.7 Prepositions
 - 2.1.8 Conjunction
 - 2.1.9 Interjection
 - 2.1.10 Identifying parts of speech
 - 2.1.11 Structures: Verb patterns, Question tags,
 - 2.1.12 Subject – Verb agreement (concord)
- 2.2 Pair of words (Words commonly confused and misused)
- 2.2.1 Tenses
 - 2.2.2 Correction of incorrect sentences
 - 2.2.3 One word Substitution
3. Translation (04 hrs)
- 3.1 Glossary of Administrative Terms (English and Hindi)
 - 3.2 Translation from Hindi into English
4. Paragraph of 100-150 words from outlines (08 hrs)
5. Comprehension (04 hrs)
- Unseen passages of literacy, scientific, data/graph based for comprehension exercises
6. Communication (08 hrs)
- 6.1 Definition, Introduction and Process of Communication
 - 6.2 Objectives of Communication
 - 6.3 Notices

LIST OF PRACTICALS

1. Locating a Book in Library
2. How to look up words in a Dictionary: meaning and pronunciation of words as given in the standard dictionary using symbols of phonetics,
3. How to Seek Information from an Encyclopedia
4. Listening pre-recorded English language learning programme
5. Paper Reading before an audience (reading unseen passages)
6. Study of spelling Rules
7. Study of essentials of a Good Speech to respond and comprehend visual, oral themes, situations or stimulus and practice before select gathering
8. Exercises on use of different abbreviations
9. Greetings for different occasions
10. Introducing oneself, others and leave taking
11. Exercises on writing sentences on a topic

Note:

1. The Text Book on “English and Communication Skills, Book-I By Kuldip Jaidka et. al. developed by NITTTR, Chandigarh is recommended to be used for teaching & setting-up the question papers.
2. A communication laboratory may be set up consisting of appropriate audio-video system with facility of playing CDs/DVDs and a video camera for recording the performance of each student with play back facility. A set of CDs from any language training organization e.g. British Council etc. may be procured for use of students.
3. Elements of body language will be incorporated in all practicals
4. The practical exercises involving writing may also be included in Theory Examination.

RECOMMENDED BOOKS

1. English and Communication Skills, Book-I By Kuldip Jaidka, Alwainder Dhillon and Parmod Kumar Singla, Prescribed by NITTTR, Chandigarh Published By Abhishek Publication, 57-59, Sector-17, Chandigarh
2. Essentials of Business Communication by Pal and Rorualling; Sultan Chand and Sons
3. The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India
4. New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
5. New Design English Reading and Advanced Writing Skills for Class XI and XII by MK Kohli and AL Kohli; Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
6. A Practical English Grammar by Thomson and Marlinet
7. Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill
8. English Conversation Practice by Grount Taylor; Tata McGraw Hill
9. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
10. Business Correspondence and Report Writing by RC Sharma and Krishna Mohan; Tata McGraw Hill Publishing Company Ltd. New Delhi
11. Communication Skills by Ms R Datta Roy and KK Dhir; Vishal Publication, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	30
2	10	20
3	4	10
4	8	15
5	4	10
6	8	15
Total	48	100

APPLIED MATHEMATICS – I

L T P
5 - -

RATIONALE

Engineering Mathematics forms the backbone of engineering studies. Basic elements of Algebra, Trigonometry, Coordinate geometry have been included in the curriculum as foundation course to be followed by differential and integral calculus. This course will develop analytical abilities to make precise judgements and will provide base for continuing educational base to the students.

DETAILED CONTENTS

1. Algebra (20 hrs)
 - 1.1 Partial fractions: linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors
 - 1.2 Series: Arithmetic and geometric progression, its n^{th} term, sum of n^{th} term, sum of n terms, mean, with their applications to engineering problems.
 - 1.3 Permutations and Combinations: Value of ${}^n P_r$ ${}^n C_r$, Simple problems
 - 1.4 Binomial theorem: Binomial theorem for positive integral index, any index, first and second binomial approximation with applications to Engineering problems
 - 1.5 Logarithm and Exponential series: Logarithmic and exponential series and use in calculations of engineering problems

2. Trigonometry (10 hrs)
 - 2.1 Relation between sides and angle of a triangle. Statements of various formula showing relationship between sides and angles of a triangle
 - 2.2 Complex Numbers: Complex number, representation moduls and amplitude, De-movier's theorem, its application in solving algebraic equations, modulus function and its properties
 - 2.3 Height and distance: Simple problems on height and distance
 - 2.4 Graphs: Graphs of $\text{Sin}x$, $\text{Cos}x$, $\text{tan}x$, e^x , $\text{log}x$

3. Co-Ordinate Geometry (16 hrs)
 - 3.1 Straight Line: Equation of straight line in various standard forms
 - 3.2 Conic Section: Circle, Parabola, Ellipse, Hyperbola. Standard forms, their properties, tangents and normals

4. Differential Calculus (16 hrs)
 - 4.1 Functions, limits and continuity

- 4.2 Derivative of function of function, logarithmic differentiation of implicit function. Exponential and logarithmic function
- 4.3 Applications: Tangent and normal, maxima and minima rate measure, error and approximation
5. Integral Calculus (18 hrs)
- 5.1 Infinite Integration: by substitution, partial fraction and by parts, integration of specific function
- 5.2 Definite integral: Meaning and properties of definite integral, evaluation of definite integral
- 5.3 Applications: Finding areas, bounded by simple curves, length of Arc, volume and surface of solids of revolutions, centre of mean of plane curve
- 5.4 Simpson's and Trapezoidal rules and their applications in simple cases

RECOMMENDED BOOKS

- Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
- Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
- Applied Mathematics by Dr. RD Sharma
- Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar
- Comprehensive Mathematics, Vol. I & II by Laxmi Publications
- Engineering Mathematics by Dass Gupta
- Engineering Mathematics by C Dass Chawla, Asian Publishers, New Delhi
- Comprehensive Mathematics, Vol. I & II by Laxmi Publications
- Engineering Mathematics, Vol I, II & III by V Sundaram et.al, Vikas Publishing House (P) Ltd., New Delhi
- Engineering Mathematics by N.Ch.S.N Iyengar et.al, Vikas Publishing House (P) Ltd., New Delhi
- Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
- Engineering Mathematics, Vol I & II by AK Gupta, MacMillan India Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	20	25
2	10	15
3	16	20
4	16	20
5	18	20
Total	80	100

APPLIED PHYSICS – I

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 at giving an understanding of this world both by observation and prediction in which objects will behave. Concrete uses of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

DETAILED CONTENTS

1. Units and Dimensions (08 hrs)
 - 1.1 Physical quantities
 - 1.2 Fundamental and derived units
 - 1.3 Systems of units (FPS, CGS, MKS and SI units)
 - 1.4 Dimensions and dimensional formulae of physical quantities (area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, surface tension, gravitational constant, density). Coefficient of viscosity, stress, strain and elasticity)
 - 1.5 Principle of homogeneity
 - 1.6 Uses of Units and Dimensions
 - a) Conversion of one system of unit into another
 - b) Determination of formula of a physical quantity such as time period of simple pendulum and determination of formula for centripetal force by the method of units and dimensions
 - c) Knowing the correctness of a physical equation
 - 1.7 Limitations of dimensional analysis

2. Force and Motion (10 hrs)
 - 2.1 Scalar and vector quantities – definitions with examples, simple addition and multiplication of scalar and vector quantities
 - 2.2 Force - resolution and composition of forces, Parallelogram Law of forces with the derivation for the resultant force and direction of the resultant force.
 - 2.3 Introduction of forces in nature – Gravitational, electromagnetic, nuclear weak and strong
 - 2.4 Projectile motion - horizontal and oblique and their equation
 - 2.5 Derivation and definitions of
 - a) Time of flight
 - b) Maximum height
 - c) Horizontal range and the condition for the maximum range
 - 2.6 Conservative and non-conservative forces
 - 2.7 Work done by force on bodies

- 2.8 Concept of power and its unit
- 2.9 Kinetic energy, potential energy, concept of energy conservation, various forms of energy
- 3. Dynamics of rigid body (rotational motion) (10 hrs)
 - 3.1 Circular motion, regular velocity, angular acceleration
 - 3.2 Centripetal force, centrifugal forces and its applications
 - 3.3 Rigid bodies, definition of torque, moment of inertia
 - 3.4 Theorems of parallel and perpendicular axis (statements)
 - 3.5 Radius of gyration, expression of M.I. of regular bodies
 - 3.6 Conservation of angular momentum, rotational kinetic energy
- 4. Gravitation and Satellites (4 hrs)
 - 4.1 Kepler's law of planetary motion
 - 4.2 Newton's law of gravitation
 - 4.3 Escape velocities, satellites, geostationary satellite
- 5. Properties of Matter (12 hrs)
 - 5.1 Elasticity, definition of stress and strain, different types of modulus of elasticity stress – strain diagram, Hook's law, poisson ratio
 - 5.2 Surface tension – its units, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension
 - 5.3 Fluid motion, stream line and turbulent flow
 - 5.4 Viscosity and coefficient of viscosity, Stock's law, effect of temperature on viscosity
- 6. Transfer of Heat (08 hrs)
 - 6.1 Modes of transfer of heat (conduction, convection and radiation with examples)
 - 6.2 Coefficient of thermal conductivity. Isothermal surface, temperature gradient, steady state
 - 6.3 Properties of heat radiation
 - 6.4 Black body radiation - Stefan's law, Kirchoff's law, Wien's law, in case of black body radiations
 - 6.5 Conduction of heat through compound media
 - 6.6 Principle of measurement of temperature, different scales of temperature
 - 6.7 Platinum resistance thermometer, thermocouple thermometer
 - 6.8 Difference between heat and temperature
- 7. Simple Harmonic Motion (04 hrs)

- 7.1 Definition of simple harmonic motion relation for the displacement, velocity, acceleration, and time period of a body executing simple harmonic motion
 - 7.2 Free, forced and resonant vibrations with examples, Q factor (qualitative)
 - 7.3 Simple pendulum, derivation of its periodic time
 - 7.4 Energy conservation in simple harmonic motion
8. Application of Sound Waves (8 hrs)
- 8.1 Standing wave
 - 8.2 Close and open organ pipe, resonance, end correction
 - 8.3 Definition of pitch, loudness, quality and intensity of sound waves
 - 8.4 Echo and reverberation time, control of reverberation time
 - 8.5 Acoustic of building-defects and remedy (qualitative)
 - 8.6 Ultrasonic wave, its applications, production of ultrasonic wave by magneto and piezoelectric effects and its properties

LIST OF PRACTICALS

1. Determination of 'Y' (Young's Modulus) by Searle's Method.
2. Determination of 'g' by plotting a graph T^2 versus l and using the formula $g=4\pi^2 / \text{Slope of the graph line}$.
3. Determination of Spring Constant.
4. Measurement of instantaneous and average wind velocity by indicating cup type anemometer/ hand held anemometer.
5. Verification of Law of Parallelogram of forces.
6. Determination of velocity of sound by resonance tube.
7. Determination of Frequency of a tuning fork by a Sonometer.
8. Measurement solar intensity (determine solar constant) with the help of Insulation meter (Suryaamapi).
9. Determination of Viscosity Coefficient of liquid by Stoke's law.
10. Determination of the thickness of glass strip and radius of curvature of a concave surface using a spherometer.
11. Determination of & verification of time period of cantilever by drawing graph between load (w) and depression (D).
12. Determination of coefficient of Friction between two surfaces

RECOMMENDED BOOKS

1. Applied Physics Vol. I, TTTI Publication Tata McGraw Hill, Delhi
2. Basic Applied Physics by RK Gaur; Dhanpat Rai Publications
3. Comprehensive Practical Physics - Volume I and II by JN Jaiswal; Laxmi Publishers
4. Numerical Problems in Physics - Volume I and II by RS Bharaj; Tata McGraw Hill
5. Simple Course in Electricity and Magnetism by CL Arora; S Chand and Co, New Delhi
6. Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar
7. A Text Book of Optics by Subramanian and Brij Lal
8. Physics Laboratory Manual by PK Palanisamy, Scitech Publications
9. Fundamentals of Physics by Resnick and Halliday, Asian Books Pvt. Ltd., New Delhi
10. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

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

APPLIED CHEMISTRY - I

L T P
2 - 2

RATIONALE

The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a days various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behaviour when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS

1. Basics Concepts (04 hrs)
 - 1.1 Definition of matter, element, compound and mixtures, atom, molecule, ion, symbol, formula, valency and chemical equation.
 - 1.2 Writing of the chemical formula of a simple chemical compound. Calculation of percentage composition of a chemical compound and form the empirical and molecular formula of the compound
 - 1.3 Essentials of a chemical equation, balancing of a chemical equation by hit and trial method
2. Atomic Structure and Chemical Bonding (04 hrs)
 - 2.1 Fundamental particles i.e. electron, proton and neutron, their characteristics (discovery is not included)
 - 2.2 Modern periodic law, introduction of periodic table, periods and groups
 - 2.3 Electronic concept of valency
 - 2.4 Elementary account of electrovalent, covalent and coordinate bond formation on the basis of the electronic concept of valency giving suitable examples to each
 - 2.5 Hydrogen bonding and its effect on physical properties of the compounds
3. Water (08 hrs)
 - 3.1 Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) in industrial use (ii) in boilers for steam generation with special reference to sludge and scale formation; foaming in boilers

- 3.2 Methods to remove hardness of water (i) Clark's Process (ii) Permutit Process (iii) Soda Lime process (iv) Ion-Exchange resin process. Simple numerical problems related to soda lime process.
- 3.3 Definition of degree of hardness of water and the systems to express the degree of hardness of water. Simple numerical problems related to finding the degree of hardness on different scales. Estimation of hardness of water sample by O'Hehner's Method and E.D.T.A. Method
- 3.4 Qualities of water used for drinking purposes, treatment of river water to make it fit for town supply
- 3.5 Disinfection of water by chlorination process
- 4. Solutions (06 hrs)
 - 4.1 Concept of homogenous solution, brief introduction of the terms (i) Ionization (ii) Acidity (iii) Basicity (iv) equivalent weight and gram equivalent weight with suitable examples
 - 4.2 Strength of a solution (i) Normality (ii) Molarity (iii) Molality as applied in relation to a solution with simple numerical problems related to these terms
 - 4.3 Definition of pH, and different industrial applications of pH, determination of pH of a solution with the help of pH meter
- 5. Electrolysis (06 hrs)
 - 5.1 Definition of the terms: Electrolytes, Non-electrolytes conductors and non-conductors with suitable examples
 - 5.2 Faraday's Laws of Electrolysis with simple numerical problems
 - 5.3 Different industrial applications of 'Electrolysis' with special reference to electroplating and electrorefining of metals
 - 5.4 Basic concept of Buffer solutions, indicators and solubility product.
- 6. Environmental Chemistry (04 hrs)
 - 6.1 Scope and significance of Environmental Science
 - 6.2 Decomposition of organic compounds and biodegradability

LIST OF PRACTICALS

1. Volumetric analysis and study of apparatus used therein. Simple problems on volumetric analysis equation
2. Preparation of standard solution of oxalic acid or potassium dichromate
3. To analyse the inorganic mixture for two acidic and two basic radicals from the following radicals
 - a) Acidic Radicals CO_3^{2-} , S^{2-} , SO_3^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , CH_3COO^- , Cl^- , Br^- , I^-
 - b) Basic Radicals NH_4^{++} , Pb^+ , Cu^{++} , Cd^{++} , As^{+++} , Sb^{+++} , Sn^{++} , Al^{+++} , Fe^{+++} , Cr^{+++} , Mn^{++} , Ni^{++} , Co^{++} , Zn^{++} , Ba^{++} , Sn^{++} , Ca^{++} and Mg^{++} ,
4. Find the amount of chlorides in mg per litre in a sample of H_2O with the help of a solution of AgNO_3
5. Determine the degree of temporary hardness of water by O'Heher's method
6. Estimation of total alkalinity of water volumetrically
7. Determine pH of a given sample by using pH meter
8. Determination of solubility of a solid at room temperature
9. Demonstration – Application of FeCl_3 in etching process for designing circuits on PCB (Printed Circuit Board)

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuriacose and J. Rajaram; Tata McGraw-Hill Publishing Company Limited, New Delhi
2. Engineering Chemistry by Dr. S. Rabindra and Prof. B.K. Mishra ; Kumar and Kumar Publishers (P) Ltd. Bangalore-40
3. A Text Book of Applied Chemistry-I by SS Kumar; Tata McGraw Hill, Delhi
4. A Text Book of Applied Chemistry-I by Sharma and Others; Technical Bureau of India, Jalandhar
5. Engineering Chemistry by Jain PC and Jain M,
6. Chemistry of Engineering by Aggarwal CV,
7. Chemistry for Environmental Engineers by Swayer and McCarty, McGraw Hill, Delhi
8. Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	15
2	4	20
3	8	20
4	6	15
5	6	15
6	4	15
Total	32	100

BASICS OF INFORMATION TECHNOLOGY

L T P
- - 4

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. 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 of MS 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:

Group instructions should be dovetailed with practical work in the laboratory for development of appropriate knowledge and skill in the area of information technology

DETAILED CONTENTS FOR GROUP INSTRUCTION

1. Information Technology – its concept and scope
2. Elements of a computer system, its usefulness and applications, block diagram of a computer, CPU, memory, data – numeric data, alpha numeric data; contents of a program, processing of data
3. Computer organization, computer hardware and software; primary and secondary memory: RAM, ROM, PROM etc.
4. Input devices; keyboard, scanner, mouse etc ; output devices ; VDU and Printer, Plotter
5. Primary and Secondary Storage (Auxiliary Storage), Secondary storage; magnetic disks – tracks and sectors, optical disk (CD, CD-RW and DVD Memory)
6. Introduction to Operating Systems such as MS-DOS and Windows
7. Introduction to internet, browsing using search engine (like google etc.)
8. Basics of Networking – LAN, WAN, Topologies

LIST OF PRACTICALS

1. Given a PC, name its various components and list their functions
2. Identification of various parts of a computer and peripherals
3. Practice in installing a computer system by giving connection
4. DOS Commands (internal / external) e.g. TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP

5. Exercises on entering text and data (Typing Practice using any tutor)
6. Features of Windows as an operating system
 - Start
 - Shutdown and restore
 - Creating and operating on the icons
 - Opening closing and sizing the windows
 - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
 - Creating and operating on a folder
 - Changing setting like, date, time color (back ground and fore ground)
 - Using short cuts
 - Using on line help
7. MS-Word
 - 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
 - Page Set up:
Setting margins, tab setting, ruler, indenting
 - Editing a document:
Entering text, Cut, copy, paste using tool- bars
 - 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
 - Inserting date, time, special symbols, importing graphic images, drawing tools
 - 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
 - Using Tools like:
Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels
 - Using shapes and drawing toolbar,
 - Working with more than one window in MS Word,
 - How to change the version of the document from one window OS to another
 - Conversion between different text editors, software and MS word

8. MS-Excel

- Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, create chart, printing chart, save worksheet, switching between different spread sheets
- Menu commands:
Create, format charts, organize, manage data, solving problem by analyzing data, exchange with other applications. Programming with MS-Excel, getting information while working
- 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, working with arrays
- Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet
- 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

9. MS PowerPoint

- a) Introduction to PowerPoint
 - How to start PowerPoint
 - Working environment: concept of toolbars, slide layout, templates etc.
 - Opening a new/existing presentation
 - Different views for viewing slides in a presentation: normal, slide sorter etc.
- b) Addition, deletion and saving of slides
- e) How to view the slide show?
 - Viewing the presentation using slide navigator
 - Slide transition
 - Animation effects etc.

10. Internet and its Applications

- a) Log-in to internet
- b) Navigation for information seeking on internet
- c) Browsing and down loading of information from internet
- d) 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

RECOMMENDED BOOKS

1. Fundamentals of Computer by V . Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Computers Today by SK Basandara, Galgotia Publication Pvt Ltd. Daryaganj, New Delhi.
3. MS-Office 2000 for Everyone by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., New Delhi
4. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
6. Mastering Windows 95, BPB Publication, 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. Learning MS Office XP by Ramesh Bangia, Khanna Book Publishing Co. (P) Ltd., New Delhi.
11. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

ENGINEERING DRAWING – I

(Common with Civil, Electrical, Mechanical, Computer Engineering and IT)

L T P
- - 6

RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation

- Note:
1. First angle projection is to be followed
 2. Minimum of 15 sheets to be prepared by each student
 3. SP 46 – 1988 should be followed
 4. Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students

DETAILED CONTENTS

1. Drawing Office Practice
 - 1.1 Drawing instruments
 - 1.2 Sizes and layout of standard drawing sheets
 - 1.3 Sizes of drawing boards
 - 1.4 Drafting table/board
2. Lines, Lettering and Dimensioning (4 sheets)
 - 2.1 Different types of lines in engineering drawing as per BIS specifications
 - 2.2 Instrumental single stroke (vertical and inclined gothic) lettering of 35 mm height in the ratios of 7:4
 - 2.3 Instrumental double stroke lettering of 35 mm height in the ratio of 7:4, vertical
 - 2.4 Free hand lettering (alphabet and numerals) lower case and upper case, single stroke vertical and inclined at 75 degree in different standard series of 2.5, 3, 5, 7, 10, and 15 mm heights in the ratio of 7:4
 - 2.5 Necessity of dimensioning - methods and principles
 - 2.6 Dimensioning of overall sizes, circles, thread holes, chamfered surfaces, angles, tapered surface holes equally spaced on PCD, counter sunk hole counter bored holes, cylindrical parts, narrow space and gaps, radii, curves and arches – chain and parallel dimensioning
3. Simple Geometrical Constructions used in Engineering Practice (2 Sheets)

- 3.1 Construction of regular polygons (triangle, square, pentagon, hexagon) and circles
- 3.2 Ellipses (concentric circle method and oblong method)
- 3.3 Parabola (rectangle and tangent method)
- 3.4 Curves (cycloid and helix)
4. Scale (2 sheets)
 - 4.1 Scales – their need and importance, Definition of representative fraction (RF); Find RF of a given scale
 - 4.2 Types of scales
 - 4.3 Construction of plain and diagonal scales, chord scale
5. Principle of Projections (6 sheets)
 - 5.1 Principle of orthographic projection
 - 5.2 Planes of projection, four quadrants, first angle projection and third angle projection
 - 5.3 Projection of points situated in different quadrants
 - 5.4 Projection of lines, Lines inclined to one plane and parallel to the other and vice versa
 - 5.5 Projection of Planes: Planes perpendicular and parallel to either of the planes; planes perpendicular to one plane and parallel to the other or vice versa
 - 5.6 Projection of solids, such as Prism, Cube, Cylinder and Cones with axis perpendicular to horizontal plane or parallel to horizontal plane/vertical plane or both
 - 5.7 Drawing 3 orthographic views of given objects (at least five objects)
 - 5.8 Identification of surfaces on drawn orthographic views from isometric object drawn
 - 5.9 Exercises on missing lines, surfaces and views
6. Sectional Views (1 sheet)
 - 6.1 Need for sectional views – conventional sections of various materials
 - 6.2 Drawing of different conventions for materials in sections, conventional breaks for shafts, pipes, rectangular, square, angle, channel and rolled sections
7. Isometric Views (2 sheets)
 - 7.1 Fundamentals of isometric projections (theoretical instructions) and isometric scales
 - 7.2 Isometric views from 2 or 3 given orthographic views
8. Symbols and Conventions (2 sheets)
 - 8.1 Civil engineering sanitary fitting symbols

- 8.2 Electrical fitting symbols for domestic interior installations and electronics symbols
 - 8.3 Building plan drawing with electrical and civil engineering symbols
9. AUTO CAD (for practical and viva-voce only)
- 9.1 Concept of AutoCAD, Tool bars in AutoCAD, coordinate system, snap, grid, and ortho mode
 - 9.2 Drawing commands – point, line, arc, circle, ellipse
 - 9.3 Editing commands – scale, erase, copy, stretch, lengthen and explode
 - 9.4 Dimensioning and placing text in drawing area
 - 9.5 Sectioning and hatching
 - 9.6 Inquiry for different parameters of drawing entity

RECOMMENDED BOOKS

1. Elementary Engineering Drawing by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh, Dhanpat Rai and Co., Delhi
3. Engineering Drawing by PS Gill, SK Kataria and sons, Delhi

Note:

1. Minimum 15 drawing sheets will be prepared by the students
2. No table is suggested for distribution of marks, instead it is emphasized that the examination paper should contain exercises for evaluation of all necessary skills envisaged in the curriculum.
3. It is also suggested that a comprehensive viva of each student should be conducted by an external examiner during or just after the examinations to ascertain understanding of the subject e.g. reading and interpreting drawings and development of necessary skills etc.

GENERAL WORKSHOP PRACTICE - I

(Common with Electrical, Mechanical, Computer Engineering and IT)

L T P
- - 6

RATIONALE

Manual abilities to handle engineering materials with hand tools need to be developed in the students. This course aims at developing generic manual and machining skills in the students. They will be using different types of tools/equipment in different shops for fabrication purposes. Besides above, the development of dignity of labour, precision, safety at work places, team working and development of right attitude are other objectives.

DETAILED CONTENTS

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.

PRACTICAL EXERCISES

The following shops are included in the syllabus :

1. Carpentry and Painting shop - I
2. Fitting and Plumbing shop – I
3. Welding shop – I
4. Electric shop – I
5. Sheet Metal Shop
6. Electronics shop

1. Carpentry and Painting Shop – I

- 1.1 Introduction to various types of wood by demonstration and their identification.
- 1.2 Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to be observed.
 - Job I Marking, Sawing and planning practice
 - Job II Extensive planning practice
 - Job III Chiseling practice
- 1.3 Introduction to joints, their relative advantages and uses.
 - Job IV Preparation of half lap joint
 - Job V Preparation of Mortise and Tenon Joint

- 1.4 Demonstration of various methods of painting wooden items.
Job VI Preparation of surface before painting.
Job VII Application of primer coat
Job VIII Painting wooden items by brush/roller/spray
- 1.5 Demonstration of various methods adopted for painting steel items.
Job IX Painting steel items by brush/roller/ spray

2. Fitting and Plumbing Shop – I

- 2.1 Introduction to fitting shop, Common materials used in fitting shop, Identification of materials.
- 2.2 Description and demonstration of various types of tools and work benches.
Holding devices and files, Precautions while filing
Job I Filing practice (Production of flat surfaces) Checking by straight edge.
Job II Marking of jobs, use of marking and measuring tools.
Job III Filing a dimensioned rectangular or Square piece of an accuracy of +0.25mm.
- 2.3 Introduction to chipping, Demonstration on chipping and its applications.
Demonstration and function of chipping tools.
Job IV Chipping practice
- 2.4 Description & demonstration of simple operation of hacksawing, demonstration and description of various types of blades, their uses and method of fitting the blade.
Job V Making a cutout from a square piece of iron block using hacksaw.
- 2.5 Introduction and demonstration of plumbing tools and different connectors and plumbing operations
Job VI Preparation of job involving threads on GI pipe and fixing of different types of elbow, T-unions, sockets, stopcocks, taps etc.

3. Welding Shop – I

- 3.1 Introduction to welding and its importance in engineering practice; types of welding; common materials that can be welded.
- 3.2 Electric arc welding, (AC and DC) precautions while using electric arc welding, Practice in setting current and voltage for striking proper arc.
Job I Practice of striking arc while using electric arc welding set.
Job II Welding practice job on arc welding for making uniform and straight weld beads.
- 3.3 Common welding defects and inspection.
- 3.4 Various types of joints and end preparation.
Job III Preparation of butt joint arc welding.
Job IV Preparation of lap joint by arc welding.
Job V Preparation of single V/double V butt joint by using electric arc welding.
Job VI Preparation of Tee joint by arc welding.
- 3.5 Introduction to gas welding and its demonstration

4. Electric Shop - I

- 5.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, ceiling roses, battens, cleats and allied items, tools and accessories.
- 5.2 Study of electrical safety measures and demonstration about use of protective devices.
 - Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin plugs.
 - Job II Laying out of complete wiring of a house (i) batten wiring (ii) plastic casing and capping.
- 5.3 Study of common electrical appliances such as electric irons, electric kettles, electric water heaters, table fans and electric mixer.
 - Job III Testing and rectification of simulated faults in above said electrical appliances.
- 5.4 Introduction to battery and its working.
 - Job IV Charging a battery and testing it with the help of hydrometers and cell testers.
 - Job V Battery connections in series and parallel

5. Sheet metal shop

Introduction to sheet metal process and tools

- Job I Making sheet metal joints
- Job II Making sheet metal tray or a funnel or a computer chassis
- Job III Preparation of sheet metal jobs involving rolling, shearing, creasing, bending and cornering
- Job IV Prepare a lap riveting joint of sheet metal pieces

6. Electronics Shop

- 6.1 Identification, familiarization, demonstration and use of the following electronic instruments:
 - a) Multi-meter digital
 - b) Single beam simple CRO , function of every knob on the front panel
 - c) Power supply , fixed voltage and variable voltage, single output as well as dual output.
- 6.2 Identification , familiarization and uses of commonly used tools; active and passive components; colour code and types of resistor and potentiometers
- 6.3 Cut, strip, join and insulate two lengths of wires/cables (repeat with different types of cables/ wires)
- 6.4 Demonstrate and practice the skill to remove components/wires by unsoldering
- 6.5 Cut, bend, tin component, leads, inserts. Solder components e.g. resistor, capacitor, diodes, transistors on a PCB
- 6.6 Wiring of a small circuit on a PCB/tag strip involving laying, sleeving and use of

identifier tags

- 6.7 Demonstrate the joining (or connecting) methods/mounting and dismantling method, as well as uses of the items mentioned below:
- a) Various types of plugs, sockets, connectors suitable for general-purpose audio video use. Some of such connectors e.g. 2 and 3 pin mains plug and sockets, Banana plugs, sockets and similar male and female connectors and terminal strips.
 - b) Various types of switches such as: normal/miniature toggle, slide, push button piano key, rotary, SPST, SPDT, DPST, DPDT, band selector, multi-way Master Mains Switch.
- 6.8 Exposure to modern soldering and de-soldering processes (Field visits)
- 6.9 De-solder pump, remove and clean all the components and wires from a given equipment, a PCB or a tag strip

RECOMMENDED BOOKS

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana and P Kaunaioh; MacMillan India Ltd., New Delhi
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

ENGLISH AND COMMUNICATION SKILLS - II

L T P
3 - 2

RATIONALE

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this course is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the course, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a **communication skill laboratory** for conducting practicals mentioned in the curriculum.

DETAILED CONTENTS

1. Facets of Literature (14 hrs)
 - 1.1 Short stories
 - 1.1.1 The Portrait of a Lady - Khushwant Singh
 - 1.1.2 The Doll's House – Katherine Mansfield
 - 1.1.3 The Refugees – Pearl S. Buck
 - 1.2 Prose
 - 1.2.1 Walking Tours – R.L. Stevenson
 - 1.2.2 A Dialogue on Civilization – C.E.M. Joad
 - 1.2.3 The Sign of Red Cross – Horace Shipp
 - 1.3 Poems
 - 1.3.1 All The World's A Stage – W. Shakespeare
 - 1.3.2 Say Not, The Struggle Nought Availeth – A.H. Clough
 - 1.3.3 Pipa's Song – Robert Browning
2. The Art of Précis Writing (04 hrs)
3. Grammar and Usage (08 hrs)
 - 3.1 Narration
 - 3.2 Voice
 - 3.3 Idioms and Phrases
4. Correspondence (04 hrs)

- 4.1 Business Letters
- 4.2 Personal letters

- 5. Drafting (06 hrs)
 - 5.1 Report Writing
 - 5.2 Inspection Notes
 - 5.3 Memos, Circulars and Notes
 - 5.4 Telegrams
 - 5.5 Press Release
 - 5.6 Agenda and Minutes of Meetings
 - 5.7 Applying for a Job

- 6. Glossary of Technical & Scientific Terms (04 hrs)

- 7. Communication (08 hrs)
 - 7.1 Media and Modes of Communication
 - 7.2 Channels of Communication
 - 7.3 Barriers to Communication
 - 7.4 Listening Skills
 - 7.5 Body language
 - 7.6 Humour in Communication

LIST OF PRACTICALS

1. Practice on browsing information from Internet
2. Group Discussions
3. Mock Interviews
4. Telephone Etiquette – demonstration and practice
5. Situational Conversation with feedback through video recording
6. Presentation on a given theme (using PowerPoint)
7. Exercises leading to personality development like mannerism, etiquettes, body language etc.
8. Reading unseen passages
9. Writing (developing) a paragraph
10. Exercises on writing notices and telephonic messages

Note:

1. The Text Book on “English and Communication Skills, Book-II By Kuldip Jaidka et. al. developed by NITTTR, Chandigarh is recommended to be used for teaching & setting-up the question papers.
2. A communication laboratory may be set up consisting of appropriate audio-video system with facility of playing CDs/DVDS and a video camera for recording the performance of each student with play back facility. A set of CDs from any language training organization e.g. British Council etc. may be procured for use of students.
3. Elements of body language will be incorporated in all practicals
4. The practical exercises involving writing may also be included in Theory Examination.

RECOMMENDED BOOKS

1. English and Communication Skills, Book-II By Kuldip Jaidka, Alwainder Dhillon and Parmod Kumar Singla, Prescribed by NITTTR, Chandigarh & Published By Abhishek Publication, 57-59, Sector-17, Chandigarh
2. Essentials of Business Communication by Pal and Rorualling; Sultan Chand and Sons
3. The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India
4. New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
5. New Design English Reading and Advanced Writing Skills for Class XI and XII by MK Kohli and AL Kohli; Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
6. A Practical English Grammar by Thomson and Marlinet
7. Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill
8. English Conversation Practice by Grount Taylor; Tata McGraw Hill
9. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
10. Business Correspondence and Report Writing by RC Sharma and Krishna Mohan; Tata McGraw Hill Publishing Company Ltd. New Delhi
11. Communication Skills by Ms R Datta Roy and KK Dhir; Vishal Publication, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	30
2	4	10
3	8	15
4	4	10
5	6	15
6	4	5
7	8	15
Total	48	100

APPLIED MATHEMATICS – II

L T P
5 - -

RATIONALE

Applied mathematics forms the backbone of engineering studies. In continuation to the basic elements of differential calculus and integral calculus taught in previous course and their applications, statistics and probability have been included in this course. This course will develop analytical abilities amongst the students and will provide base for continuing education base to the students.

DETAILED CONTENTS

1. Algebra (16 hrs)
 - 1.1 Matrix: Algebra of matrices, inverse, elementary row/column-transformation, linear dependence, rank of matrix, type of matrix, Eigen pairs, Cayley-Hamilton theorem
 - 1.2 Determinants: Elementary properties of determinants of second and third order, multiplication system of algebraic equation, consistency of equation, Cramme's rule
 - 1.3 Vector Algebra: Definition of vector and scalar quantities, addition and substration of rectors. Dot and cross product of two vectors. Angle between two vectors, applications of dot and cross product in Engineering problems.
2. Co-ordinate Geometry (16 hrs)
 - 2.1 Point in space. Distance between two points, ratio
 - 2.2 Straight line, finding the equation of straight line, shortest distance between two points
 - 2.3 Plane
 - 2.4 Sphere in space
3. Differential Calculus (16 hrs)
 - 3.1 Successive differentiation. Libnez's theorem

- 3.2 Partial differentiation: Partial derivatives, total differential co-efficient, chain rule. Euler's theorem of homogeneous function, Jacobians, curl, gradient and divergence and some identities among them
- 3.3 Differential equation: Order, degree and meaning of solution of differential equations. Linear, non-linear differential equation, first order equation (separable forms, linear and Bernoulli's form, exact equation and their solutions), second order linear equations (linear equations with constant co-efficients homogeneous and non-homogeneous equation, equations reducible to linear form with constant co-efficients)
4. Integral Calculus (18 hrs)
- 4.1 Laplace transform, solution of differential equation by Laplace transform
- 4.2 Beta and gamma function
- 4.3 Fourier series
5. Statistics and Probability (14 hrs)
- 10.1 Measure of central tendency: Mean, median, mode, mean deviation, standard deviation, rank and rank correlation
- 10.2 Probability: Law of probability and conditional probability
- 10.3 Binomial distribution and Poisson distribution
- 10.4 Continuous and normal distribution
- 10.5 Curve fitting by least square method

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 by Dr. RD Sharma, Dhanpat Rai and Sons, Delhi
4. Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar
5. Engineering Mathematics by Dass Gupta
6. Engineering Mathematics by C Dass Chawla, Asian Publishers, New Delhi
7. Comprehensive Mathematics, Vol. I & II by Laxmi Publications

8. Engineering Mathematics, Vol I, II & III by V Sundaram et.al, Vikas Publishing House (P) Ltd., New Delhi
10. Engineering Mathematics by N.Ch.S.N Iyengar et.al, Vikas Publishing House (P) Ltd., New Delhi
9. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
10. Engineering Mathematics, Vol I & II by AK Gupta, Macmillan India Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	16	20
2	16	20
3	16	20
4	18	25
5	14	15
Total	80	100

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 at giving an understanding of this world both by observation and prediction in which objects will behave. Concrete uses of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

DETAILED CONTENTS

1. Classification of materials (4 hrs)
Classification of materials into Conducting materials, Insulating materials, semiconducting materials with reference to their atomic structure, magnetic material (para, dia and ferro)
2. Fundamentals of D.C. and A.C. (8 hrs)
 - 2.1 D.C: Electric current, Ohm's Law, Series and parallel combination of resistances, Kirchoff's law and their simple applications. Principle of Wheatstone's bridge and its application in meter bridge and post office box
 - 2.2 A.C: Sinusoidal current and EMF. Peak, and r.m.s values, resistive, inductive, and capacitive circuits singularly and in combination, reactance, impedance
3. Moving Charge & Magnetic Field (10 hrs)
Magnetic behaviour of current carrying conductor; Magnetic behaviour of current Carrying solenoid; concept of Magnetic Field: Magnetic line of forces; force on a current -carrying conductor in a magnetic field ; fleming's Left hand rule ; force on a charge moving in a magnetic field; motion of charged particles in a magnetic field; Magnetic field due to a current carrying conductor(Biot- Savart law); Force between two parallel current carrying conductors .
4. Modern Physics (12 hrs)
Laser- Absorption and emission of energy by atom, spontaneous and stimulated emission, Population inversion, Main component of Laser and types of Laser: Ruby Laser, He,- Ne and semiconductor Laser and their applications. Super Conductivity- Phenomenon of super conductivity, effect of magnetic field, critical field, type I & type II super conductors and their applications. Radioactivity,

nuclear stability, radio active emission, radiation damage, concept of nuclear fission and fusion and their applications.

5. Application of Optics: (6 hrs)

- 5.1 Concept of interference and diffraction.
- 5.2 Optical slide film projector and OHP (principle and operation)
- 5.3 Introduction to fibre optics, optical fibre materials, types, light propagation. Critical angle, total internal reflection, optical sensor
- 5.4 Application of optical fibres in telecommunication

6. Semi Conductor Physics and its Application (12 hrs)

Energy band in solids, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semiconductors, Electrons and holes as charge carriers in semiconductors, effect of temperature in conduction in semiconductors, P-type and N-type semiconductors, PN junction formation, barrier voltage, forward and reverse biasing of a junction diode, PN junction device characteristics, formation of transistor, transistor action, base, emitter and collector currents and their relationship, LEDs, photoelectric effect, photo devices and their applications..

7. Non Conventional Energy Sources (12 hrs)

- 7.1 Wind Energy: Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill, India's wind energy programme.
- 7.2 Solar Energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, solar constant measurement of solar radiation by pyranometer. Uses of solar energy: solar cooker, solar water heater, solar photovoltaic cells, solar energy collector, solar by planets in India, Modern applications in technology (Qualitative only).

LIST OF PRACTICALS

1. To verify the Laws of Series and Parallel combination of resistances by P.O.Box
2. To verify the Laws of Series and Parallel combination of resistances by Meter Bridge.
3. Determination of wave length of He- Ne Laser
4. To draw the characteristics of a transistor
5. Verification of Ohm's law.
6. Verification of Kirchoff's laws.
7. Conversion of galvanometer into ammeter & voltmeter.
8. Calculation of peak and rms values of a given ac with the help of an oscilloscope.

9. To measure impedance of a given coil with the help of A-V method.
10. To Draw the characteristics of PN Junction Diode & Determination of Static & Dynamic Resistance.
11. Measurement of solar intensity with the help of pyranometer/ Lux meter
12. To measure thickness of paper by two optically plane glass plates using interference fringes.

RECOMMENDED BOOKS

1. Applied Physics Vol. II, TTTI Publication Tata McGraw Hill, Delhi
2. Basic Applied Physics by RK Gaur; Dhanpat Rai Publications
3. Comprehensive Practical Physics - Volume I and II by JN Jaiswal; Laxmi Publishers
4. Numerical Problems in Physics - Volume I and II by RS Bharaj; Tata McGraw Hill
5. Simple Course in Electricity and Magnetism by CL Arora; S Chand and Co, New Delhi
6. Fundamental Physics - Volume I and II by Gomber and Gogia; Pardeep Publications, Jalandhar
7. Physics Laboratory Manual by PK Palanisamy, Scitech Publications
8. Fundamentals of Physics by Resnick and Halliday, Asian Books Pvt. Ltd., New Delhi
9. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

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

APPLIED CHEMISTRY-II

L T P
2 - 2

RATIONALE

The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a days various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behaviour when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS

1. Metallurgy (06 hrs)
 - 1.1 A brief introduction of the terms: Metallurgy, mineral, ore, gangue or matrix, flux, slag, concentration (methods of concentrating the ores), roasting calcination and refining as applied in relation to various metallurgical operations
 - 1.2 Metallurgy of (i) Aluminium (ii) Iron with their physical and chemical properties and uses
 - 1.3 Definition of an alloy, purposes of alloying, composition and uses of alloys-brass, bronze, magnalium, duralumin, alnico, invar and stainless steel
2. Fuels (08 hrs)
 - 2.1 Definition of a 'Fuel', characteristics of a good fuel and classification of fuels with suitable examples
 - 2.2 Definition of Calorific value of a fuel and its determination for a solid fuel with the help of Bomb calorimeter.
 - 2.3 Merits of gaseous fuels over those of other varieties of fuels
 - 2.4 Manufacture, composition, properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas (iv) Compressed Natural gas (CNG)
 - 2.5 Octane Number and Cetane Number

- 3 Corrosion (04 hrs)
- 3.1 Meaning of the term 'corrosion' and its definition
 - 3.2 Theories of corrosion i.e. (i) direct chemical action theory and (ii) electro chemical theory
 - 3.3 Prevention of corrosion by
 - (a) Alloying
 - (b) Providing metallic coatings
 - (c). Sacrificial cathodic protections:
- 4 Lubricants (04 hrs)
- 4.1 Definition of (i) lubricant (ii) lubrication
 - 4.2 Classification of lubricants
 - 4.3 Principles of lubrication
 - (i) fluid film lubrication
 - (ii) boundary lubrication
 - 4.4 Characteristics of a lubricant such as viscosity, viscosity index, volatility, oxidation, oiliness, acidity, emulsification, flash point, fire point and pour point.
 - 4.5 Importance of additives in lubricants
- 5 Cement and Glass (02 hrs)
- 5.1 General introduction to cement and glass
 - 5.2 Manufacture of Portland Cement
 - 5.3 Manufacture of ordinary glass and lead glass
6. Classification and Nomenclature of Organic Compounds (08 hrs)
- Classification of Organic Compounds, functional group, Homologus Series, Nomenclature, Physical and Chemical properties, and industrial use of Organic Compounds, IUPAC system of nomenclature of Carboxylic acid, Alcohols, Phenols, Aldehydes, Ketones and Amines.

LIST OF PRACTICALS

1. Gravimetric analysis and study of apparatus used there in
2. To determine the percentage composition of a mixture consisting of a volatile and a non-volatile substances
3. Estimate the amount of moisture in the given sample of coal
4. Estimate the amount of ash in the given sample of coal
5. Esterification and ceric ammonium tests of alcohol
6. Sodium carbonate and Ester test of carboxylic acids
7. To determine the amount of copper in the given sample of copper sulphate with the help of N/20 sodium thiosulphate solution.
8. Detection of metal iron in the rust (solution of rust in concentrated HCL may be given)
9. Demonstration – to determine calorific value of a solid fuel with the help of Bomb Calorimeter

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuriacose and J. Rajaram; Tata McGraw-Hill Publishing Company Limited, New Delhi
2. Engineering Chemistry by Dr. S. Rabindra and Prof. B.K. Mishra ; Kumar and Kumar Publishers (P) Ltd. Bangalore-40
3. A Text Book of Applied Chemistry-II by SS Kumar; Tata McGraw Hill, Delhi
4. A Text Book of Applied Chemistry-II by Sharma and Others; Technical Bureau of India, Jalandhar
5. Engineering Chemistry by Jain PC and Jain M,
6. Chemistry of Engineering by Aggarwal CV,
7. Chemistry for Environmental Engineers by Swayer and McCarty, McGraw Hill, Delhi
8. Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	15
2	8	25
3	4	20
4	4	20
5	2	10
6.	8	10
Total	32	100

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.

DETAILED CONTENTS

1. Introduction (06 hrs)
 - 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 (08 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 (08 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 (08 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, friction in simple screw jack
- 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 (06 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 (08 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, different pulley blocks, 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]

7. Moment of Inertia (04 hrs)

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (*without derivations*). Second moment of area for L, T and I sections, section modulus.

LIST OF PRACTICALS

1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
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. Applied Mechanics By, Col. Harbhajan Singh, TL Singha and Parmod Kumar Singla Published By Abhishek Publication, 57-59, Sector-17, Chandigarh
3. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
4. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
5. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	8	18
3	8	18
4	8	18
5	6	10
6	8	18
7	4	8
Total	48	100

ENGINEERING DRAWING – II

(Common with Electrical and Mechanical Engineering)

L T P
- - 6

RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation

- Note:
1. First angle projection is to be followed
 2. Minimum of 15 sheets to be prepared by each student
 3. SP 46 – 1988 should be followed
 4. Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students

DETAILED CONTENTS

1. Development of Surfaces (2 sheets)
Development of surfaces – cubes, prisms, (square, pentagonal and hexagonal), cylinders, pyramids (square, pentagonal, hexagonal) and cones
2. Detail and Assembly Drawing (2 sheets)
 - 2.1 Principle and utility of detail and assembly drawings
 - 2.2 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 Mortise and Tenon joint
3. Threads (2 sheets)
 - 3.1 Nomenclature of threads, types of threads (metric), single and multiple start threads
 - 3.2 Forms of various external thread sections such as V, square and acme threads, BA, BSW and Knuckle, Metric, Seller Thread, Buttress Threads
 - 3.3 Simplified conventions of left hand and right hand threads, both external and internal threads
4. Locking Devices (1 sheet)
Lock nut, castle nut, split pin nut, sawn nut, slotted nut
5. Nuts and Bolts (3 sheets)

Different views of hexagonal and square nuts; Assembly of hexagonal headed, square headed, square headed with square neck, bolts with hexagonal and square nuts and washers. Foundations bolts – Rag bolt and Lewis bolt

6. Screws, Studs and Washers (1 sheet)
 - 6.1 Drawing various types of machine screws
 - 6.2 Drawing various types of studs and set screws
7. Keys and Cotters (2 sheets)
 - 7.1 Various types of keys and cotters and their practical application and preparation of drawing of various keys and cotters showing keys and cotters in position
 - 7.2 Cotter joints (i) gib and cotter joint (ii) knuckle joint
8. Rivets and Riveted Joints (2 sheets)
 - 8.1 Types of structural and general purposes rivet heads
 - 8.2 Caulking and fullering of riveted joints
 - 8.3 Types of riveted joints – lap, butt (single riveted, double riveted lap joint, single cover plate and double cover plate), chain and zig – zag riveting
9. Welded Joints (1 sheet)
 - 9.1 Various conventions and symbols of welded joints (IS 696)
 - 9.2 Practical applications of welded joints say joints on steel frames, windows, doors and furniture
10. Couplings (2 sheets)
 - 10.1 Muff or Box coupling, half lap muff coupling
 - 10.2 Flange coupling (Protected and non-protected)
 - 10.3 Flexible coupling
11. AutoCAD (for practicals and viva only)
 - 11.1 Practice on drawing commands, editing commands
 - 11.2 Practice on sectioning and hatching
 - 11.3 Practice on preparing simple drawings

RECOMMENDED BOOKS

1. Elementary Engineering Drawing by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh, Dhanpat Rai and Co. Delhi
3. Engineering Drawing by PS Gill, SK Kataria and Sons, New Delhi
4. Machine Drawing by RB Gupta, Satya Prakashan, New Delhi.

Note:

1. A minimum of 15 sheets should be prepared by each student
2. No table is suggested for distribution of marks, instead it is emphasized that the examination paper should contain exercises for evaluation of all necessary skills envisaged in the curriculum.

3. It is also suggested that a comprehensive viva of each students should be conducted by an external examiner during or just after the examinations to ascertain understanding of the subject e.g. reading and interpreting drawings and development of necessary skills etc.

GENERAL WORKSHOP PRACTICE - II

(Common with Electrical and Mechanical Engineering)

L T P
- - 6

RATIONALE

Manual abilities to handle engineering materials with hand tools need to be developed in the students. This course aims at developing generic manual and machining skills in the students. They will be using different types of tools/equipment in different shops for fabrication purposes. Besides above, the development of dignity of labour, precision, safety at work places, team working and development of right attitude are other objectives.

DETAILED CONTENTS

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.

PRACTICAL EXERCISES

The following shops are included in the syllabus :

1. Carpentry and Painting shop – II
2. Fitting and Plumbing shop – II
3. Welding shop – II
4. Electric shop – II
5. Forging shop
6. Machine shop

1. Carpentry and Painting Shop – II

- 1.1 Introduction to joints, their relative advantages and uses.
Job I Preparation of Dovetail joint and glued joint.
Job II Preparation of Mitre Joint
Job III Preparation of a lengthening Joint
Job IV Preparation of atleast one utility job with and without lamination.
- 1.2 Demonstration of job showing use of Rip Saw, Bow saw and Trammel, method of sharpening various saws.
- 1.3 Demonstration of job on Band Saw and circular saw, universal wood working machine, saw resharpening machine, Saw Brazing unit.
- 1.4 Importance and need of polishing wooden items, Introduction to polishing materials.

- Job V Preparation of surface before polishing.
- Job VI Application of primer coat.
- Job VII Polishing on wooden items.

2. Fitting and Plumbing Shop – II

- 2.1 Description and demonstration of various types of drills, taps and dies
- 2.2 Selection of dies for tapping. Types of taps, tapping, dieing and drilling operations.
 - Job I Making internal and external threads on a job by tapping and dieing operations (manually)
- 2.3 Precautions while drilling soft metals, specially aluminum and lead.
 - Job II Drilling practice on soft metals (Aluminum, Brass and lead)
- 2.4 Care and maintenance of measuring tools like calipers, steel rule, try square, vernier, micrometer, height gauge, combination set, reading gauge. Handling of measuring instruments, checking of zero error, finding of least count.
 - Job III Preparation of a job by filing on non-ferrous metal.
 - Job IV Production of a utility job involving all the above operations.
 - Job V Preparation of job involving thread on GI pipe/ PVC pipe and fixing of different types of elbow T - Union, socket, stopcock, taps, etc
- 2.5 Description and demonstration of various types of drills, taps and dies; Selection of dies for tapping; Types of taps, Tapping and dieing operations.

3. Welding Shop – II

- 3.1 Introduction of the gas welding, gas welding equipment, adjustments of different types of flames, demonstration and precautions about handling welding equipment.
 - Job I Practice in handling gas welding equipment and welding practice.
- 3.2 Common welding joints generally made by gas welding.
 - Job II Preparation Butt joint by gas welding.
 - Job III Preparation of small cot conduit pipe frame by electric arc welding/gas welding.
 - Job IV Preparation of square pyramid from M.S rods by welding (type of welding to be decided by students themselves).
 - Job V Exercise job on spot/seam welding machine.

4. Electric Shop – II

- 4.1 Importance of three phase wiring and its effectiveness.
 - Job I Laying out 3 phase wiring for an electric motor or any other 3 phase machine.
- 4.2 Estimating and costing power consumption.
 - Job II Connecting single phase energy meter and testing it. Reading and working out the power consumption and the cost of energy.
 - Job III Checking continuity of connection (with tester and bulbs), location of faults with a multimeter and their rectification in simple machines and/or other electric circuits fitted with earthing.
- 4.3 Demonstration of dismantling, servicing and reassembling of a table fan/ceiling fan/air cooler/mixer/electric iron, Electric heater, geaser, electric oven etc.

Job IV Dismantling, serving and reassembling of any of the above electrical appliances.

Job V Demonstration of testing single phase/three phase electrical motor by using voltmeters ammeter clip on meter technometer etc.

Job VI Reversing the rotation of motor.

5. Forging Shop

Introduction to forging, forging tools, tongs, blowers/pressure blowers, hammers, chisels, punch, anvil, swage-block etc. Forging operations.

Job I Forge a L hook or ring from MS rod 6 mm ϕ

Job II Forge a chisel and give an idea of hardening and tempering

Job III Lap joint with forge welding

Job IV High Strength Steel tools – forging of lathe and shaper tools

6. Machine Shop

Introduction to various machines used in machine shop.

Job I Exercise on simple turning

Job II Exercise on taper turning

Job III Marking and drilling practice on mild steel piece

Job IV Marking and drilling practice on aluminium piece

Job V Demonstration of various functions of CNC Machine

RECOMMENDED BOOKS

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana and F Kaunaioh; MacMillan India Ltd., New Delhi
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

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 pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table
3. Sources of pollution - natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms
5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms
6. Sources of noise pollution and its effects
7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods
8. Mining, blasting, deforestation and their effects
9. Legislation to control environment
10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements
11. Current issues in environmental pollution and its control
12. Role of non-conventional sources of energy in environmental protection

ENGINEERING MATERIALS

L T P
3 - 2

RATIONALE

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Engineering Materials has been designed to cover the above aspects.

DETAILED CONTENTS

1. Importance of Materials

- 1.1 Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys
- 1.2 Names of common metals, their alloys and non-metals used in Industry
- 1.3 Properties of metals and alloys
- 1.4 Physical properties - Appearance, luster, colour, density and melting point
- 1.5 Thermal and electrical conductivity
- 1.6 Corrosion, causes, effects and prevention.

2. Ferrous Metals and Alloys

- 2.1 Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram.
- 2.2 Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades
- 2.3 Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous on steels.
- 2.4 Composition, properties, and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.
- 2.5 Heat Treatment: Iron-carbon diagram, objectives of heat treatment. Brief description and uses with examples of principal heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications, case hardening

3. Non-ferrous Metals and Alloys

- 3.1 Copper: Properties and uses
- 3.2 Composition, properties and uses of copper alloys.
- 3.3 Brasses: Cartridge brass, Nickel silver
- 3.4 Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.
- 3.5 Properties and uses of Aluminium.

- 3.6 Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium
- 3.7 Properties and uses of alloys of lead, tin and magnesium.
- 3.8 Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and tri-metallic bushes

4. Identification and Examination of Metals and Alloys

Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

5. Other Important Materials

- 5.1 Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses and grades.
- 5.2 Composite materials.
- 5.3 Heat insulating materials: Properties and uses of asbestos, glass wool, thermo Cole, cork, mica.
- 5.4 Electrical insulating materials. Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber, felt.
- 5.5 Sound insulating materials: Cork, fibre boards.
- 5.6 Fabrication materials: Wood, plywood, rubber – natural and synthetic, Glass – plate glass, toughened glass, safety glass.
- 5.7 Refractory materials: General characteristics and uses of dolomite, ceramics.
- 5.8 Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, Teflon coating.
- 5.9 Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.

6. Selection, specifications and commercial availability of materials

- 6.1 Practical considerations for selection of material for different purposes
- 6.2 ISO/Bureau of Indian standard specifications for metals, non-metals, various components and materials.

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 in the industry.

RECOMMENDED BOOKS

1. Material Science by R.K.Rajput; Laxmi Publications, Darya Ganj, New Delhi.
2. Advances in material Science by R.K.Dogra and Dr.A.K.Sharma;S.K.kataria & sons; New Delhi.
3. Material Science by GBS Narang; Khanna Publishers New Delhi
4. Material Science and Metallurgy by D.S. Nutt. SK Kataria and Sons, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	6	12
2.	12	26
3.	12	26
4.	2	4
5.	10	20
6.	6	12
Total	48	100

WORKSHOP TECHNOLOGY-I

L T P
4 - 6

RATIONALE

This subject provides knowledge about various welding processes and foundry work. Welding is very useful for fabrication work and foundry for production of castings used for manufacturing of machines which is included in this subject and it is very essential for diploma holders.

DETAILED CONTENTS

Section – A (Welding)

1. Welding Process

- 1.1 Principle of welding
- 1.2 Classification of welding processes
- 1.3 Advantages and limitations of welding
- 1.4 Industrial applications of welding
- 1.5 Welding positions and techniques, symbols.

2. Gas Welding

- 2.1 Principle of operation
- 2.2 Types of gas welding flames and their applications
- 2.3 Gas welding equipments
 - 2.3.1 Gas welding torch
 - 2.3.2 Oxy acetylene cutting torch
 - 2.3.3 Blow pipe
 - 2.3.4 Pressure regulators
 - 2.3.5 Filler rods and fluxes

3. Arc Welding

- 3.1 Principle of operation
- 3.2 Arc welding machines and equipment
- 3.3 A.C. and D.C. arc welding
- 3.4 Effect of polarity, current regulation and voltage regulation
- 3.5 Electrodes: Classification, B.I.S. specification and selection
- 3.6 Flux for arc welding

4. Other Welding Processes

- 4.1 Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding.
- 4.2 Shielded metal arc welding, submerged arc welding.

- 4.3 Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints. Non destructive & Destructive testing, Dye penetration test, Magnetic Flaw detection system, Ultrasonic test.

5. Modern Welding Methods

Principle of operation, advantages, disadvantages and applications of:

- 5.1 Tungsten inert gas (TIG) welding
- 5.2 Metal inert gas (MIG) welding
- 5.3 Thermit welding
- 5.4 Electro slag welding

Section – B (Foundry)

6. Pattern Making

- 6.1 Types of pattern
- 6.2 Pattern material
- 6.3 Pattern allowances
- 6.4 Pattern codes as per B.I.S.
- 6.5 Introduction to cores, core boxes and core materials
- 6.6 Core making procedure
- 6.7 Core prints, positioning of cores

7. Moulding Sand

- 7.1 Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility.
- 7.2 Various types of moulding sand
- 7.3 Testing of moulding sand.

8. Mould Making

- 8.1 Types of moulds
- 8.2 Step involved in making a mould
- 8.3 Molding boxes, hand tools used for mould making
- 8.4 Molding processes: Bench molding, floor molding, pit molding and machine molding.

9. Special Casting Processes

Principle, working and applications of

- 9.1 Die casting: hot chamber and cold chamber
- 9.2 Investment and lost wax process

- 9.3 Centrifugal casting
- 9.4 Continuous casting process

10. Gating and Riser System

- 10.1 Elements of gating system
- 10.2 Pouring basin, sprue, runner, gates
- 10.3 Types of risers, location of risers

11. Melting Furnaces

Construction and working of:

- 11.1 Pit furnace
- 11.2 Cupola furnace
- 11.3 Crucible furnace – tilting type

12. Casting Defects

- 12.1 Different types of casting defects and their reasons
- 12.2 Testing of defects: radiography, magnetic particle inspection, and ultrasonic inspection.

LIST OF PRACTICALS

1. Preliminary joining practice by gas welding
2. Exercises of gas welding on the following
 - 2.1 Aluminum
 - 2.2 Brass
 - 2.3 Copper
 - 2.4 C.I.
3. Gas cutting of the following types
 - 3.1 Preliminary gas cutting practice
 - 3.2 Stock cutting by oxy acetylene
4. Making following types of joints by arc welding:
 - 4.1 Preliminary joining practice by arc welding
 - 4.2 Butt and lap joint (in vertical position, travel up and down)
 - 4.3 Welding of outside corner joint
5. Exercise on spot welding
6. Exercise on brazing

7. Exercise on TIG/MIG welding
8. Testing & Inspection of welding defects visually
9. Pattern making:
 - 9.1 Preparation of solid pattern (single piece)
 - 9.2 Preparation of split pattern
10. Preparation of the following types of moulds.
 - 10.1 Floor molding
11. Testing moisture content of moulding sand
12. Moulding and casting of
 - a) a solid pattern b) a split pattern
13. Testing and inspection of casting defects visually

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 audiovisual aids/video films should be made to show specialized operations.

RECOMMENDED BOOKS

1. Welding Technology by R.L. Agarwal and Tahil Maghanani; Khanna Publishers, Delhi.
2. Principles of Foundry Technology by Jain; Tata Mc Graw Hill Publishers, New Delhi.
3. Workshop Technology by B S Raghuvanshi; Dhanpat Rai and Sons, Delhi.
4. Manufacturing Technolgoey by M Adithan and AB Gupta, New Age International (P) Ltd., Delhi.
5. Elements of Workshop Technology by SK Chaudhry and Hajra; Asia Publishing House, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	5	8
2.	5	9
3.	5	9
4.	7	10
5.	7	10
6.	5	6
7.	4	6
8.	6	9
9.	5	9
10.	5	8
11	5	8
12.	5	8
Total	64	100

MACHINE DRAWING - I

L T P
- - 6

RATIONALE

Diploma holders are required to read and interpret drawings .Therefore, it is essential that they have competency in preparing drawings and in sketching various machine parts and this will also improve their imagination skill.

DETAILED CONTENTS

1. Introduction to Machine Drawing

- 1.1 System of orthographic projections. Third angle projection, first angle Projection No. of views required. One view, Two views, Three views drawing
- 1.2 Sectioning- Material convention, important types of section- full section, half Section ,revolved section and aligned section

2. Limit fits and Tolerances

- 2.1 Limit system tolerance- limits, deviation, allowances basic size, design size.
- 2.2 Tolerances- Fundamental tolerances, fundamental deviation, method of placing limit dimension.
- 2.3 Fit- clearance, transition, interference fit, hole basis system, shaft basis system, tolerance grade.
- 2.4 Calculating values of clearance/ interference, hole tolerance and shaft tolerance with given basic size for common assemblies like H7/ g6, H7/m6, H8/ U7

3. Surface Roughness

- 3.1 Introduction- Actual profile,reference profile,Daturn profile,mean profile
- 3.2 Use of Machining symbols in production drawing
- 3.3 Indication of surface roughness

4. Bearings (3 sheets)

- 4.1 Bush bearing
- 4.2 Foot Step bearing
- 4.3 Simple wall bracket

5. Pulleys (2 sheets)

- 5.1 Flat belt pulley
- 5.2 V belt pulley

- 5.3 Cone or stepped pulley
- 5.4 Fast and loose pulley

6. Pipe Joints (4 sheets)

- 6.1 Flange joint
- 6.2 Spigot and socket joint
- 6.3 Threaded pipe joint
- 6.4 Expansion joint
- 6.5 piping joint

7. Assembling drawing from detail drawing (4 sheets)

- 7.1 Stuffing box
- 7.2 Eccentric
- 7.3 Blow off cock
- 7.4 Cross head

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.
4. Focus should be on the proper selection of drawing instrument and its proper use.

RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; Kataria and Sons, Ludhiana.
2. A Text book of Machine Drawing by R.K. Dhawan , S.Chand and Company Ltd., New Delhi.
3. Machine Drawing by GR Nagpal; Khanna Publishers, New Delhi.
4. Machine Drawing by ND Bhatt, Charotar Book Depot, Anand.

MECHANICS OF SOLIDS

L T P
4 - 2

RATIONALE

Diploma holders in this course are required to analyse reasons for failure of different components and select the 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. Hence this subject has been introduced.

DETAILED CONTENTS

1. Introduction to Material Properties

Mechanical properties of materials such as elasticity, plasticity, ductility, brittleness, toughness, hardness, tenacity, fatigue, malleability, stiffness. Elastic bodies, plastic bodies and rigid bodies, deformation.

2. Stresses and Strains

- 2.1 Force, its definition and types, units, different types of loads.
- 2.2 Definition of stress and strain, axial loading, different types of stresses and strains, tensile and compressive stress and strain, elastic limit, Hooke's law, stress-strain curve for ductile and brittle material, salient features of stress-strain curve. Young's modulus of elasticity
- 2.3 Factor of safety, safe stresses, ultimate stress
- 2.4 Stress and strain in straight, stepped bars and taper bar of circular cross section, determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only
- 2.5 Temperature stresses for single section.
- 2.6 Stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and composite bars and metallic tyres
- 2.7 Shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson's ratio
- 2.8 Volumetric strain, bulk modulus. relation between modulus of elasticity, modulus of rigidity and bulk modulus

3. Shear Force and Bending Moment

- 3.1 Types of beams and types of supports
- 3.2 Concept of shear force and bending moment, sign convention
- 3.3 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point load and uniformly distributed loads only. Maximum bending moment and point of contraflexure

4. Theory of Simple Bending

- 4.1 Concept of pure bending, neutral axis, moment of resistance, section Modulus, bending equation, bending of simple and flitched beams, beams of uniform strength
- 4.2 Application of flexural formula for solid rectangular and circular section, Channel section, hollow rectangular and circular section

5. Strain Energy

- 5.1 Concept of strain energy, proof resilience and modulus of resilience
- 5.2 Stresses developed due to gradual, sudden and impact load
- 5.3 Strain energy stored due to gradual, sudden and impact load
- 5.4 Strain energy due to bending and torsion

6. Slope and Deflection

- 6.1 Introduction, determination of slope and deflection by Macaulay's method, moment area of method
- 6.2 Simple cases of slope and deflection in simply supported beam with uniformly distributed load on whole of the length and a point load at the centre
- 6.3 Cantilever beam with uniformly distributed load on whole length and a point load at the end (no derivation of formula)

7. Torsion

- 7.1 Pure torsion, torsion equation (relation between twisting moment, shear stress and angle of twist), polar modulus of section
- 7.2 Assumptions in theory of pure torsion
- 7.3 Strength of circular solid shaft and hollow shaft in pure torsion
- 7.4 Power transmitted by shaft
- 7.5 Torsion in helical springs

8. Springs

- 8.1 Laminated spring (semi-elliptical and quarter-elliptical type), determination of number of plates, maximum deflection under axial load
- 8.2 Helical Springs closed coiled and open coiled helical springs subjected to axial load
- 8.3 Angle of twist, strain energy, shear stress and maximum deflection under axial load
- 8.4 Effect of falling load helical spring

9. Columns and struts

- 9.1 Definition, Types of column

- 9.2 Buckling load, crushing load
- 9.3 Slenderness ratio.
- 9.4 Factors affecting strength of column
- 9.5 Euler's formula for long columns
- 9.6 End restraints, effective length for different end conditions
- 9.7 Rankine Gourdan formula
- 9.8 Direct and eccentric loading with stress diagram
- 9.9 Direct and bending stresses and their combination

LIST OF PRACTICALS

1. Perform tensile test on bars of mild steel and aluminum.
2. Perform shear test on specimen of two different metals.
3. Carry out bending tests on a steel bar or wooden beam.
4. Perform following impact test:
 - (a) Izod impact test
 - (b) Charpy test
5. Perform torsion test on specimen of different metals for determination of angle of twist for a given torque.
6. Determine the stiffness of a helical spring and to plot a graph between load and extension.
7. Perform hardness test on metal and finding the Brinell hardness, Rockwell hardness and Vicker's hardness.

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. Strength of Materials by R.S. Khurmi; S. Chand and Company, Delhi.
2. Strength of Materials by S. Ramamurtham; Dhanpat Rai Publishing Co.(P) Limited, Delhi.
3. Mechanics of Materials by Kirpal Singh; Standard Publishers, New Delhi.
4. Elements of Strength of Materials by D.R. Malhotra and H.C, Gupta; Satya Parkashan, New Delhi.
5. Mechanics of Solids by VS Prasad; Galgotia Publications, New Delhi.
6. Strength of materials Dr. B.C Puniya & S.Rama Murthi; Laxmi Publication, New Delhi.

7. Mechanics of solids by J.K.Kapoor; Bharat Bharati Prakashan, Meerut

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	2	3
2.	8	12
3.	16	25
4.	12	20
5.	4	6
6.	8	12
7.	6	10
8.	4	6
9.	4	6
Total	64	100

GENERAL ENGINEERING

L T P
4 - 2

RATIONALE

A diploma holder has to assist in activities of installation, operation and maintenance etc of different machines and equipment. These activities are not branch specific and instead require him to know basics of civil, electrical and mechanical engineering. The subject of General Engineering has been included to impart basic knowledge of civil, electrical and mechanical engineering to the students.

Note:

1. The students of Civil Engineering, will be studying Part A (Mechanical Engineering) and Part B (Electrical Engineering) only.
2. The students of Electrical engineering, Electronics and Communication Engineering, Instrumentation and Control Engineering, Computer Engineering and Information Technology will be studying Part A (Mechanical Engineering) and Part C (Civil Engineering) only.
3. The students of Mechanical Engineering will be studying Part B (Electrical Engineering) and Part C (Civil Engineering) only.
4. The students of remaining branches of engineering and technology will be studying all the three Parts A (Mechanical Engineering), Part B (Electrical Engineering) and Part C (Civil Engineering), unless specified otherwise
5. A time of 2 hours per week has been allotted to Mechanical Engineering, 2 hours per week to Electrical Engineering and 2 hour per week to Civil Engineering in the lecture hours, for teaching theory and a lump-sum time of 2 hours per week has been allotted for the Practicals.

DETAILED CONTENTS

PART-A

MECHANICAL ENGINEERING

Theory

1. **Transmission of Power** (8 hrs)
 - 1.1 Belt Drives:
Types of belts, belt materials, cross and flat belt drives, advantages of V-belt drive over flat belt drive.
 - 1.2 Gears Drives:
Types of gears (briefly), types of gear trains
2. **Internal combustion Engines** (10 hrs)
 - 2.1 Classification of IC engines

- 2.2 Working principles of two stroke and four stroke engines
- 2.3 Working principles of petrol engine and diesel engines
- 2.4 Gas turbines (working principle only)

3. Refrigeration and Air Conditioning System (8 hrs)

- 3.1 Different types of refrigeration principles and refrigerants
- 3.2 Working of domestic refrigerator
- 3.3 Working of Window type AC system

4. Hydraulics: (6 hrs)

- 4.1 Classification of pumps (reciprocating and centrifugal)
- 4.2 Working principles of both reciprocating and centrifugal pumps
- 4.3 Turbine: Working principles of impulse turbine and reaction turbine

PRACTICAL EXERCISES IN MECHANICAL ENGINEERING

- 1. Demonstration and study of main parts of 4 stroke petrol and diesel engines by actually dismantling them (The idea is to acquaint the students with the most common troubles occurring in the engines)
- 2. Demonstration and study of main parts of 2 stroke petrol engine by actually dismantling it. (The idea is to acquaint the students with the most common trouble occurring in the engines)
- 3. Demonstration and study of gas turbines through models
- 4. Demonstration and study of different hydraulic pumps
- 5. Demonstration and study of various drives for transmission of powers i.e. models of belts and gears.
- 6. Demonstration and study of air conditioning system in a building
- 7. Demonstration and study of domestic refrigerating system

PART B

ELECTRICAL ENGINEERING

Theory

Electrical:

- 1. Basic Quantities of Electricity: (4 hrs)
 - 1.1 Definition of voltage, current, power and energy with their units
 - 1.2 Name of the instruments used for measurement of quantities such as voltmeter, ammeter, wattmeter, energy meter.
 - 1.3 Connection of the instruments in electric circuit
- 2. Application and Advantages of Electricity: (3 hrs)
 - 2.1 Difference between AC and DC

- 2.2 Various applications of electricity
- 2.4 Advantages of electrical energy over other types of energy
- 3. Various Types of Power Plants: (3 hrs)
 - 3.1 Elementary block diagram of thermal, hydro and nuclear power stations
 - 3.2 Brief explanation of the principle of power generation in above power stations
- 4. Transmission and Distribution System (6 hrs)
 - 4.1 Key diagram of 3 phase transmission and distribution system
 - 4.2 Brief functions of accessories of transmission line
 - 4.3 Distinction between high and low voltage distribution system
 - 4.4 Identification of three phase wires, neutral wires and the earth wire on a low voltage distribution system
 - 4.5 Identification of the voltage between phases and between one phase and neutral
 - 4.6 Distinction between three phase and single phase supply
- 5. Supply from the Poles to the Distribution Board: (4 hrs)
 - 5.1 Arrangement of supply system from pole to the distribution board
 - 5.2 Function of service line, energy meter, main switch, distribution board
- 6. Domestic Installation: (6 hrs)
 - 6.1 Distinction between light and fan circuits and single phase power circuit, sub circuits
 - 6.2 Various accessories and parts of installation, identification of wiring systems
 - 6.3 Common safety measures and earthing
 - 6.4 Introduction to BIS code of safety and wiring installation
- 7. Electric Motors and Pumps: (6 hrs)
 - 7.1 Definition and various application of single phase and three phase motors
 - 7.3 Conversion of horse power in watts or kilowatts
 - 7.4 Type of pumps and their applications
 - 7.5 Use of direct online starter and star delta starter

PRACTICAL EXERCISES IN ELECTRICAL ENGINEERING:

- 1. Use of Megger:

Objective: To make the students familiar with different uses of megger

2. Connection of a three phase motor and starter including fuses and reversing of direction of rotation.

Objective: Students may be made familiar with the equipment needed to control a three-phase motor
The students must experience that by changing any two phases, the direction of rotation is reversed.

3. Connection of a lamp, ceiling fan, socket outlet, geyser, floor grinder, voltage stabilizer etc.

Objective: Students may be made familiar with the different types of equipment and circuits used in the domestic installations

4. Trouble shooting in a three-phase motor

Note: The teacher may create anyone of the following faults

- (a) Loose connections
- (b) Blown fuse
- (c) Tripped overload protection
- (d) Incorrect direction of rotation
- (e) Single phasing
- (f) Burnt winding to be simulated by a loose connection behind a terminal box.

Objective: The students must be able to detect the most common faults, which may occur in a three-phase motor, using meggar wherever necessary

- 5 Treatment of electric shock

Note: The teacher may give a demonstration how an electric shock must be treated.

Objective: Students must be trained to treat the persons suffering from an electric shock

6. Demonstration and study of Domestic installation components used in single phase and three phase wiring

7. Demonstration and study of distribution line components

- 8 Demonstration and study of a distribution Board

Note: Students may be asked to study the distribution board in the institution and note down all accessories.

Objective: Students must be made familiar with the distribution board

9 Connections and taking reading of an energy meter (1 ϕ & 3 ϕ)

Objective: Students may be asked to connect an energy meter to a load and calibrate reading

10. Demonstration and study of submersible motor pump set and its working

Objective: To tell use of the set in water supply and irrigation works.

PART C

CIVIL ENGINEERING

Theory

1. Construction Materials (10 hrs)

Basics of various construction materials such as stones, bricks, lime, cement and timber along with their properties, physical/ field testing and uses, elements of brick masonry.

2. Foundations (8 hrs)

- i) Bearing capacity of soil and its importance
- ii) Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines

3. Basic concept of concrete (8 hrs)

Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/ field testing of concrete, mixing of concrete

4. RCC (6 hrs)

Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building

PRACTICAL EXERCISES IN CIVIL ENGINEERING

1. Testing of bricks

- a) Shape and size
- b) Soundness test
- c) Water absorption
- d) Crushing strength

2. Testing of concrete

- a) Slump test
- b) Compressive Strength of concrete cube

3. The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works

Note: While imparting instructions, teachers are expected to lay more emphasis on concepts and principles. It will be better if the classes for general engineering are conducted in the laboratories and organized demonstrations for explaining various concepts and principles.

RECOMMENDED BOOKS

Mechanical Engineering

1. General Mechanical Engineering by M. Adithan; TTTI, Chandigarh
2. Basic Civil and Mechanical Engineering by Jayagopal; Vikas Publications, New Delhi
3. IC Engines and Automobile Engineering by Dr.MP Poonia, Standard Publishers, New Delhi
4. Refrigeration and Air Conditioning by RK Rajput; SK Kataria and sons; Ludhiana
5. Theory of Machines by RS Khurmi and JK Gupta; S. Chand and Company Ltd., New Delhi

Electrical Engineering

1. Electrical Technology Part 1: Basic Electrical Engineering by Theraja, BL; S Chand and Company, New Delhi
2. Principles of Electrical Engineering by Gupta BR, S Chand and Company, New Delhi
3. Basic Electrical Engineering by Mehta VK; S Chand and Company, New Delhi
4. Basic Electricity and Measurements by Suryanarayan NV and N Delhi; Tata McGraw Hill, 1987, New Delhi
5. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and sons, New Delhi
6. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill, New Delhi
7. Basic Electricity by BR Sharma; Satya Parkashan, New Delhi

Civil Engineering

1. Textbook of Concrete Technology 2nd Edition by Kulkarni, PD Ghosh RK and Phull, YR; New Age International (P) Ltd., Publishers, New Delhi
2. Materials of Construction by Ghose; Tata McGraw Hill Publishing Co., Ltd., New Delhi
3. Civil Engineering Materials by TTTI, Chandigarh; Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Concrete Technology by Gambhir; Tata McGraw Hill Publishing Co., Ltd., New Delhi
5. Building Construction by J Jha and Sinha; Khanna Publishers, Delhi
6. Building Construction by Vazirani and Chandola; Khanna Publishers, Delhi
7. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, Delhi
8. Soil Mechanics and foundation Engineering by SK Garg; Khanna Publishers, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Part-A

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	25
2	10	31
3	8	25
4	6	19
Total	32	100

Part-B

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	12
2	3	9
3	3	9
4	6	18
5	4	16
6	6	18
7	6	18
Total	32	100

Part-C Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	31
2	8	25
3	8	25
4	6	19
Total	32	100

THERMAL ENGINEERING- I

L T P
4 - 2

RATIONALE

Looking at the needs of various industries and departments, the following topics lay a firm foundation for the advanced knowledge of topics like thermal power plants, internal combustion engines etc.

DETAILED CONTENTS

1. Fundamental Concepts

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

2. Laws of Perfect Gases

Definition of gases, explanation of perfect gas laws – Boyle’s law, Charle’s law, Avagadro’s law, Regnault’s law, Universal gas constant, Characteristic gas constants, derivation, (Simple numerical problems)

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

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, (Simple numerical problems)

4. Laws of Thermodynamics

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

Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Clausius statement, equivalence of statements, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction to third law of thermodynamics, concept of irreversibility, entropy, (Simple numerical problems)

5. Ideal and Real Gases

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

Mass fraction, mole fraction, partial pressure, introduction to compressibility of gases

6. Properties of Steam

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), measurement of dryness fraction, throttling calorimeter, separating and throttling calorimeter

7. Steam Boiler

Type of steam Generators, Working principle of boilers, need of high pressure modern boilers, characteristics of modern boilers. Working principle of sterling, La-mont, loefflor, Benson, Velox, Ramsin and Schmidt- Hartmann boiler

8. Steam turbines

- Function and use of steam turbine
- Steam nozzles- types and applications
- Steam turbines, impulse, reaction, simple and compound, construction and working principle
- Governing of steam turbines

9. Steam condensers

- Function of a steam condenser, elements of condensing plant
- Classification-Jet condenser, surface condenser
- Cooling pond and cooling towers

10. Air compressors

Function of air compressor, type of air compressor - single stage reciprocating, multi stage, rotary, Construction and working

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. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
3. Engineering Thermodynamics by CP Arora, Tata McGraw Hill, Delhi.
4. A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.
5. Thermal Engineering by R.K.Rajput
6. Thermal Engineering by R.S.Khurmi

LIST OF PRACTICES

- 1 Demonstration of steam turbines through models and visit
- 2 Demonstration of steam condensers through models and visits
3. Study of modern high pressure steam boilers (at least one)
- 4 Demonstration of boiler Accessories and mountings
- 5 Demonstration/ study of an impulse turbines
- 6 Demonstration/ study of a reaction turbine
- 7 Demonstration of air compressor

SUGGESTED DISTRIBUTION OF MARKS

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

PRODUCTION MANAGEMENT

L T P
4 - -

RATIONALE

After studying the subject of production management, the students will be able to know the basics of production planning and control, industrial engineering, and estimation and costing. This will enable them to understand and handle production environment effectively.

DETAILED CONTENTS

1. Production and Productivity

Production, production functions, productivity, factors affecting productivity, measurement of productivity, causes of decrease in productivity, difference between production and productivity.

2. Plant Location, Layout and Material Handling

Plant location, factors affecting plant location, concept of plant layout, types of layout, their characteristics, factors affecting plant layout, work station design, factors considered while designing a work station, introduction, need and objective of material handling, factors considered while selecting a material handling device, safety concept of material handling equipment.

3. Work Study

Definition and scope of work study; areas of application of work study in industry, Role of work study in improving productivity, Objectives, needs and methods of method study, information collection, recording techniques, process symbols, charts and diagrams, critical examination, development, installation and maintenance of improved methods, work measurement objectives, needs and methods of work measurement, time study, various allowances, calculation of time, work sampling, standard data and its use. Application of engineered time standards and work sampling, Ergonomics, concept and advantages.

4. Job Evaluation and Incentives

Introduction, objectives, needs of job evaluation, job definition, job analysis, data source, job evaluation methods such as ranking method, grade description method, point system and factor comparison method, hybrid system. Incentive-definition and concept, incentive and productivity relation, types of incentives such as financial, non financial. Individual and group incentives, pre requisites for incentives, characteristics of a good incentives plan

5. **Production Planning and Control**

Introduction, objectives and components (functions) of P.P.C, Advantages of production planning and Production Control, stages of P.P.C, process planning, routing, scheduling, dispatching and follow up, routing purpose, route sheets, scheduling – purpose, machine loading chart, Gantt chart, dispatching – purpose, and procedure, follow up – purpose and procedure. Production Control in job order, batch type and continuous type of productions. Difference between these controls.

6. **Inspection and Quality Control**

- 6.1 Definitions, types of inspection and procedure.
- 6.2 Quality, Quality control, Statistical quality control.
- 6.2 Process capability.
- 6.4 Control charts for variables - \bar{X} and R chart, control chart for fraction defectives (P chart), control chart for number of defects (C chart) .
- 6.5 Concept of ISO 9000, ISO 14000 and TQM.
- 6.6 Quality Circles

7. **Estimation and Costing**

Introduction, purpose/functions of estimating, costing concept, ladder and elements of cost, difference between estimation and costing. Overheads and their types, estimation of material cost, estimation of cost for machining processes, numerical problems.

INSTRUCTIONAL STRATEGY

Teacher should put emphasis on giving practical problems related to plant location and plant layout. Students should be taken to industrial units to give an exposure of production environment, plant layout and material handling.

Live problems may be given to students to carry out case studies in teams under the guidance of teacher.

RECOMMENDED BOOKS

1. Industrial Engineering by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.
2. Industrial Engineering by S.C. Sharma; Khanna Publisher.
3. Industrial Engineering and Management by T.R. Banga.
4. Elements of work study by Suresh Dalela.
5. Production Management by Jain and Aggarwal.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	6	10
2.	8	12
3.	12	18
4.	8	12
5.	12	20
6.	10	16
7.	8	12
Total	64	100

WORKSHOP TECHNOLOGY-II

L T P
3 - 6

RATIONALE

This subject provides knowledge of metal cutting, cutting fluids, cutting tools and materials and common machine tools and operations. These machine tools and operations are being used in all industries for production purposes. This course is essential for Mechanical diploma holders.

DETAILED CONTENTS

1. Theory of metal cutting

- 1.1 Elementry theory of metal cutting, chip formation, continuous chip, continuous chip with BUE, discontinuous chips.
- 1.2 Mechanism of chip formation, Geometry of chip formation, forces of chip, Merchant circle diagram.
- 1.3 Tool life, Economics of tool life.

2. Cutting Tools and Materials

- 2.1 Cutting Tools
 - 2.1.1 Various types of single point cutting tools and their uses
 - 2.1.2 Single point cutting tool geometry, tool signature and its effect
 - 2.1.3 Heat produced during cutting and its effect
 - 2.1.4 Cutting speed, feed and depth of cut and their effect
- 2.2 Cutting Materials
 - 2.2.1 Properties of cutting tool material
 - 2.2.2 Study of various cutting tool materials viz. High speed steel, tungsten carbide, cobalt steel, cemented carbides, stellite, ceramics and diamond.

3. Lathe

- 3.1 Principle of turning
- 3.2 Description and function of various parts of a lathe
- 3.3 Classification and specification of various types of lathe
- 3.4 Drives and transmission
- 3.5 Work holding devices
- 3.6 Lathe tools: Parameters/Nomenclature and applications
- 3.7 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling.

- 3.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
- 3.9 Speed ratio, preferred numbers of speed selection.
- 3.10 Lathe accessories:- Centers, dogs, chucks, collets, face plate, angle plate, mandrel, steady rest, taper turning attachment, tool post grinder

4. Drilling

- 4.1 Principle of drilling.
- 4.2 Classification of drilling machines and their description.
- 4.3 Various operations performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
- 4.4 Speeds and feed during drilling, impact of these parameters on drilling, machining time.
- 4.5 Types of drills and their features, nomenclature of a drill
- 4.6 Drill holding devices.
- 4.7 Types of reamers.

5. Boring

- 5.1 Principle of boring
- 5.2 Classification of boring machines and their brief description.
- 5.3 Specification of boring machines.
- 5.4 Description of jig boring machine.

6. Shaping, Planing and Slotting

- 6.1 Working principle of shaper, planer and slotter.
- 6.2 Quick return mechanism applied to shaper, slotter and planer machine.
- 6.3 Types of tools used and their geometry.
- 6.4 Specification of shaper, planer and slotting machine.
- 6.5 Speeds and feeds in above processes.

7. Cutting fluids and Lubricants

- 7.1 Function of cutting fluid
- 7.2 Types of cutting fluids
- 7.3 Difference between cutting fluid and lubricant
- 7.4 Selection of cutting fluids for different materials and operations
- 7.5 Common methods of lubrication of machine tools.

PRACTICAL EXERCISES

- 1. Single point cutting tool grinding.
- 2. Simple exercise on turning and step turning.
- 3. A composite job involving turning, taper turning, thread cutting and knurling.
- 4. Marking and drilling practice using column and knee type drilling machine and radial drilling machine.

5. A job on drilling, reaming, counter boring and counter sinking.
6. Prepare a V-block on shaper machine.
7. Exercise on key way cutting..
8. Planning of C.I. block

RECOMMENDED BOOKS

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons, Delhi.
2. Manufacturing Ttechnology by M.Adithan and AB Gupta; New Age International (P) Ltd, Delhi.
3. Elements of Workshop Technology By S.K.Choudhary and Hazara; Asia Publishing House, Delhi.
4. Principles of Foundry Technology by Jain; Tata McGraw Hill Publishers, New Delhi.
5. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
6. Practical Handbook for Mechanical Engineers by Dr. A B Gupta; Galgotia Publications, New Delhi.
7. Production Technology by HMT; Tata McGraw Publishers, New Delhi.
8. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
9. Workshop Practice by R.K. Singal, S K Kataria and Sons, New Delhi.
10. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.

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 on preparing jobs using various machines/equipment in the workshop.
3. Use of audiovisual aids/video films should be made to show specialized operations.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	4	8
2.	4	8
3.	12	28
4.	8	16
5.	6	12
6.	10	20
7.	4	8
Total	48	100

MACHINE DRAWING – II

L T P
- - 6

RATIONALE

Mechanical diploma holders are required to read and interpret the machine parts drawings. Therefore it is essential that they have competency in preparing drawings and free hand sketches of various machine parts at shop floor. It will also improve their imagination skill

NOTE:

1. First angle projection is to be followed.
2. SP46- 1988 should be followed.
3. Instruction relevant to various drawing may be given along with appropriate demonstration, before assigning drawing practice to the students.
4. The drawing should include dimensions with tolerance, wherever necessary, and material list as per BIS/ ISO specifications.

DETAILED CONTENTS

- 1. Preparation of assembly drawings (9 sheets)**
 - 1.1 Connecting rod
 - 1.1 Ram's bottom safety valve
 - 1.3 Stop valve
 - 1.4 Plummer block
 - 1.5 Tail stock
 - 1.6 Shaper toolhead
 - 1.7 Machine vice
 - 1.8 Screw jack
 - 1.9 Swivel Bearing
- 2. Gears and Gearing (2 sheets)**
 - 2.1 Spur gear- Nomenclature, gear formula, method to draw base circle, involute curve, tooth profile of internal and external gears.
 - 2.2 Bevel gear- Nomenclature, gear formula, method to draw Bevel gear
- 3. Free hand sketches (2 sheets)**
 - 3.1 Cutting tool of lathe, shaper, milling cutter, drilling tools, broaching tools.
 - 3.2 Gear puller, C clamp
 - 3.3 Square and hexagonal nut bolt assembly
 - 3.4 Cotter joint

- 3.5 Knuckle joint
- 3.6 Pipe joints

4. Jig, fixture and Gauges (2 sheets)

- 4.1 Concept of jig and fixture, types of jig and fixture and applications
- 4.2 Simple plate drill jig, drill jig for batch production
- 4.3 Indexing fixture
- 4.4 Introduction to gauges, use of Go-No Go gauge and ring gauge

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.
4. Focus should be on the proper selection of drawing instrument and its proper use.

RECOMMENDED BOOKS

1. Machine Drawing by P.S. Gill; Kataria and Sons, Ludhiana.
2. A Text book of Machine Drawing by R.K. Dhawan , S.Chand and Company Ltd., New Delhi.
3. Machine Drawing by GR Nagpal; Khanna Publishers, New Delhi.
4. Machine Drawing by ND Bhatt, Charotar Book Depot, Anand.

HYDRAULICS AND HYDRAULIC MACHINES

L T P
2 - 2

RATIONALE

Diploma holders in Mechanical Engineering are required to deal with problems of fluid flow and use of hydraulics in power generation. For this purpose, knowledge and skill about fluid mechanics, fluid flow and hydraulic machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about various properties of fluids, measurement of various flow parameters and about various hydraulic machines.

DETAILED CONTENTS

1. Introduction

Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility.

2. Pressure and its Measurement

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

2.3 Bourdon tube pressure gauge

2.4 Simple problems

3. Flow of Fluids

Types of fluid flow-steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; Bernoulli's theorem (without proof) and its applications, Discharge measurement with the help of venturimeter, orifice meter and pitot tube, simple problems

4. Notches and Weirs

Different type of notches, Measurment of discharge over rectangular notch. Francis and Brazin's fomula for rectangular weirs, submerged weirs, broad crested weirs.

5. Flow through orifices

C_c , C_v , C_d , flow through drowned, partially drowned orifices, time for emptying a tank through a circular orifice. Simple problems

6. Flow through pipes

- Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss.
- Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings, Simple problems

7. Hydraulic Devices

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

8. Water Turbines and Pumps (4 hrs)

- Concept of a turbine, types of turbines – impulse and reaction. Construction and working of pelton wheel, Francis turbine and Kaplan turbine
- Concept of hydraulic pump.
- Construction, working and operation of reciprocating pump and centrifugal pump.

LIST OF PRACTICALS

1. Measurement of pressure head by employing
 - i) Piezometer tube
 - ii) Single and double column manometer
 - iii) Pressure gauge
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 determine the coefficient of friction of pipe using Darcy's equation.
6. Study the working of a pelton wheel and Francis turbine

7. Dismantling and assembly of a single stage centrifugal pump to study its constructional details, operation including fault diagnosis.
8. To demonstrate the working of a Kaplan Turbine.
9. To demonstrate the working of a single acting and double acting Reciprocating pump.
10. To determine Cd, Cv and Cc for a orifice.

RECOMMENDED BOOKS

1. Hydraulics and Hydraulic Machines by RS Khurmi ; S.Chand & Co. Ltd., New Delhi.
2. Hydraulics and Fluid Mechanics by Jagdish Lal; Metropolitan Book Company Ltd., Delhi.
3. Fluid Mechanic, Hydraulics and Hydraulic Machines by K.K. Arora; Standard Publishers Distributors, Delhi.
4. Fluid Mechanics, Hydraulics and Fluid Machines by S. Ramamruthan; Dhanpat Rai and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS

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

THERMAL ENGINEERING-II

L T P
4 - 2

RATIONALE

Thermal energy is still a major means of power in the world. Knowledge of thermal contrivances and related principle is very essential for mechanical diploma holders. The subject presents an introduction to sources of heat, thermodynamics principles and their applications to thermal contrivances.

DETAILED CONTENTS

1. IC Engines

- 1.1 Introduction and classification of IC engine
- 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
- 1.4 Concept of IC engine terms: bore, stroke, dead centre, crank throw, compression ratio, clearance volume, piston displacement and piston speed, concept and classification of carburetion, simple numerical problems concerning the above.

2. Cooling and Lubrication

- 2.1 Function of cooling system in IC engine
- 2.2 Air cooling and water cooling system, use of thermostat, radiator and forced circulation in water cooling (description with line diagram)

3. Testing of IC Engines

- 3.1 Engine power - indicated and brake power
- 3.2 Efficiency - mechanical, thermal, relative and volumetric
- 3.3 Methods of finding indicated and brake power
- 3.4 Morse test for petrol engine
- 3.5 Heat balance sheet
- 3.6 Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO - 2, methods of reducing pollution in IC engines, alternative fuels like CNG, LPG (Simple numerical problems)

4. Fundamentals of Refrigeration

Introduction to refrigeration and air conditioning, units of refrigeration, meaning of refrigerating effect, compressor work, condenser work and COP, difference between COP and efficiency, methods of refrigeration, natural system and artificial system of refrigeration (Simple numerical problems)

5. Vapour Compression System

Principle, function, parts and necessity of vapour compression system, T- ϕ and p- H charts, dry, wet and superheated compression. Sub cooling, super heating, mass flow rate, entropy, enthalpy, work done, refrigerating effect and COP. actual vapour compression system (Simple numerical problems)

6. Refrigerants

Functions, various 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

7. Vapour Absorption System

Introduction, principle, NH₃ absorption system, lithium bromide absorption system, domestic electrolux system, analysis of vapour absorption system, solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression refrigeration system (Simple numerical problems)

8. Refrigeration Equipment

8.1 Compressors

Function, various types of compressors, volumetric efficiency, power for single stage compressor, intermediate pressure for multistage compressor for maximum power, performance characteristics

8.2 Condensers

Function, various types of condensers, essential requirements of a condenser, water cooled and air cooled condensers, free and forced convection condensers, fouling factor, heat rejection factor, overall heat transfer coefficient

8.3 Evaporators

Function, DX and flooded evaporator, advantages and disadvantages, other types of evaporators

8.4 Expansion Valves

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

AIR CONDITIONING

9. Psychrometry

Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, humid heat, latent heat, relationship amongst them.

10. Applied Psychrometry and Heat Load Estimation.

Psychrometric chart, various lines, psychrometric process, by pass factor, room sensible heat factor, effective room sensible heat factor, ADP, room DPT, supply air condition, different heat sources for calculation of heat load, factors which contribute towards load of an air conditioning room (Simple numerical problems)

LIST OF PRACTICALS

1. Study of working principle of two/ four stroke petrol engines.
2. Study of simple/ compound carburetor.
3. To determine brake horse power by dynamometer.
4. To determine indicated horse power of a multicylinder petrol/diesel engine.
5. To prepare that balance sheet of diesel/ petrol engines
6. To study a vapour compression/ absorption refrigeration system
7. Study a cold storage through a visit
8. Study a room air conditioner
9. Study of cooling system of I.C. engines
10. Study of lubrication system of four stroke I.C. engine

INSTRUCTIONAL STRATEGY

1. Models of various components/ parts should be demonstrated to develop comprehension amongst students
2. Industrial visit to thermal power plant and roadways/ private automobile workshop should be arranged
3. Video films for demonstration of working of IC engines, jet propulsion and gas turbine should be shown.

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 Mc Graw Hill Publishers, New Delhi.
5. Thermal engineering by RK Purohit; Standard publishers Dustributors, New Delhi.
6. Refrigeration and air conditioning by Domkundwar; Dhanpat Rai & sons, Delhi.
7. Refrigeration and air conditioning by CP Arora , Tata McGraw Hill , New Delhi.
8. Refrigeration and air conditioning by R.S Khurmi and J.K Gupta; S Chand and Company Limited, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

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

COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING

L T P
- - 4

RATIONALE

Today age is computer age. Most of our daily activities are being influenced by the use of computers. It has become necessary for diploma students to have a basic knowledge of computer applications related to their branch. This subject is being offered to provide further practice to students on MS Power Point and MS Access and acquaint them to Computer Aided Design softwares for modeling, assembling and drafting.

LIST OF PRACTICALS

1. MS Power Point:

- 1.1 Templates, wizard, views, color schemes
- 1.2 Introduction to various Power Point toolbars
- 1.3 Presentations using Power Point:-
 - Slide Views
 - Slide Formatting
 - Animation
 - Graphs

2. MS Access:

- 2.1 Table creation
- 2.2 Query handling
- 2.3 Form designing
- 2.4 Report designing

3. Computer Aided Design using IDEAS

- 3.1 Product development cycle, Process steps in Computer Aided Design
- 3.2 Product modeling and surfacing
- 3.3 Advance surfacing
- 3.4 Assembly and design simulation
- 3.5 Drafting from 3D model

4. Internet

Use of internet through explorer and Netscape Navigator

5. Introduction to CAD, CAM and FMS

6. Project

ENTREPRENEURIAL AWARENESS CAMP

The employment opportunities for diploma holders especially in public sector are dwindling. The diploma holders need to explore the possibilities of becoming entrepreneurs. For this, they must be acquainted with entrepreneurship development, scope of setting up small-scale industry, existing business opportunities, financial support available and various aspects of managing business. In this context, an entrepreneurial awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. may be invited to deliver expert lectures. Successful entrepreneurs may also be invited to interact with the students. Students may be encouraged to read papers or give seminar during the camp on Entrepreneurship Development related topics.

The camp 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 self 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

INDUSTRIAL TRAINING

Industrial Training aims at exposing the students to field practices, size and scale of operation and work culture at practical sites. For this purpose, students at the end of fourth semester are required to be sent for a period of 4 weeks to industry. The evaluation of industrial training will be made during 5th semester.

Each student is supposed to study the material and technology used at site and prepares a detailed report of the observation of process seen by him/her. These students should be supervised and guided by respective subject teachers. Each teacher may guide a group of four to five students.

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

a) Punctuality and regularity	15%
b) Initiative in learning new things	15%
c) Relationship with workers	15%
d) Industrial training report	55%

THEORY OF MACHINES

L T P
4 - -

RATIONALE

Diploma holder in Mechanical Engineering comes across many machines. He must have the knowledge of various mechanisms, power transmission devices, balancing of masses, vibrations etc. Hence this subject is offered.

DETAILED CONTENTS

1. Basic Concepts

- 1.1 Definition of statics, kinetics, kinematics and dynamics.
- 1.2 Rigid body and resistant body.
- 1.3 Links.
- 1.4 Kinematics pairs and their types.
- 1.5 Degree of freedom.
- 1.6 Kinematics chain and their types.
- 1.7 Constrained motion and mechanisms.
- 1.8 Classification of mechanisms.
- 1.9 Equivalent mechanism.
- 1.10 Laws of inversion of mechanisms.
- 1.11 Single slider crank chain and its inversions.
- 1.12 Quick return mechanism and IC engine mechanism.
- 1.13 Double slider crank chain mechanism and its inversions like scotch yoke mechanism.
- 1.14 Applications of mechanisms and their selection from manufacture catalogue.
- 1.15 Indicator mechanism, pantograph.
- 1.16 Steering gear mechanism.

2. Fly Wheel

- 2.1 Functions of fly wheel.
- 2.2 Types of fly wheels.
- 2.3 Mass and size calculations in different cases

3. Governors

- 3.1 Functions of governor
- 3.2 Types of governor - elementary knowledge of porter governor, watt governor, proell governor, Hartnell governor, spring controlled gravity governor
- 3.3 Hunting, isochronism, stability, sensitiveness of a governor
- 3.4 Simple problems related to watt, porter and proell governor

4. Cams

- 4.1 Definition of cam
- 4.2 Classification of cams
- 4.3 Followers and their classification
- 4.4 Brief description of different types of cams and followers with simple line diagram
- 4.5 Simple cam profile for uniform velocity, SHM and uniform acceleration and deceleration

5. Power Transmission Devices (Belt, Rope and Chain Drive)

- 5.1 Introduction.
- 5.2 Belt and rope drives, open and crossed belt drives, action of belt on pulleys, velocity ratio.
- 5.3 Material for belts and ropes.
- 5.4 Slip in belts, ropes, and chains.
- 5.5 Types of V Belt and Flat belt, joint preparation for flat belt.
- 5.6 Types of pulleys - step pulley, flat pulley, jockey pulley.
- 5.7 Crowning in pulley.
- 5.8 Laws of belting and length of belt
- 5.9 Ratio of tensions
- 5.10 Power transmitted and maximum power transmitted by belt
- 5.11 Centrifugal effect on belt
- 5.12 Initial tension, creep
- 5.13 Chain drive, chain length, classification of chains
- 5.14 Selection of belt, chain and pulley for different applications on the basis of centre distance between the shaft, power to be transmitted, availability of space, slip, velocity ratio
- 5.15 Selection of rope based on the load to be lifted
- 5.16 Simple problems on power transmitted by belts and ropes

6. Gear Drive

- 6.1 Functions of gear
- 6.2 Classification of gears
- 6.3 Gear nomenclature
- 6.4 Simple, compound, reverted and epicyclic
- 6.5 Horsepower transmitted by a gear train
- 6.6 Selection of gear trains- simple and epicyclic

7. Brakes and Dynamometers

- 7.1 Introduction
- 7.2 Brief description of different types of brake such as block or shoe brake, band brake, internal expanding, power brake and disc brake

- 7.3 Simple problems related to shoe brake and band brake
- 7.4 Definition and types of dynamometers, pony brake dynamometer, rope brake dynamometers, hydraulic dynamometer, belt transmission dynamometer and Bevis Gibson torsion dynamometer

8. Clutches

- 8.1 Function of clutch
- 8.2 Classification of clutches
- 8.3 Principle of working of single plate clutch and cone clutch with simple line diagram
- 8.4 Multi plate clutch
- 8.5 Calculation of frictional torque for uniform pressure and uniform wear
- 8.6 Horse power transmitted
- 8.7 Selection of clutches for different applications from hand book/catalogue

9. Balancing

- 9.1 Need of balancing
- 9.2 Concept of static and dynamic balancing
- 9.3 Balancing of rotating mass by another mass in the same plane
- 9.4 Forces due to revolving masses
- 9.5 Concept of reference plane
- 9.6 Balancing of several masses rotating in same plane
- 9.7 Balancing of several masses rotating in different planes

10. Vibrations

- 10.1 Introduction
- 10.2 Types of vibration - longitudinal, transverse and torsional vibration
- 10.3 Damping of vibrations

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. Mechanism and Machine Theory; JS Rao and Dukkipati; Wiley Eastern, New Delhi.
2. Theory of Mechanism and Machine; A Ghosh and AK Malik, East West Press (Pvt.) Ltd., New Delhi.
3. Theory of Machines; SS Rattan: Tata McGraw Hill, New Delhi.
4. Theory of Machines by RS Khurmi and JK Gupta; S.Chand and Company Ltd., New Delhi.
5. Theory of Machines and Mechanisms by PL Ballaney; Khanna Publishers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

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

METROLOGY

L T P
3 - 2

RATIONALE

Diploma holders in these courses are required to measure and inspect for ensuring quality of product. For this purpose, knowledge and skills about standards of measurement, limit, fits and tolerances, types of inspection and various measuring instruments are required. Hence this subject is offered

DETAILED CONTENTS

1. Introduction

- 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

2. Linear Measurement

- 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.
- 2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic comparator.

3. Angular Measurement

- 3.1 Construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, clinometer.
- 3.2 Optical instruments for angular measurement, auto collimator.

4. Measurement of Surface Finish

- 4.1 Terminology of surface roughness.
- 4.2 Concept of primary texture and secondary texture.
- 4.3 Factors affecting surface finish.
- 4.4 CLA, RMS and RA value.
- 4.5 Principle and operation of stylus probe instruments for measuring surface roughness

5. Measurements of Screw threads and Gears

- 5.1 Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.
- 5.2 Effective diameter measurement by three wire method.
- 5.3 Measurements of gears (spur) – Measurement of tooth thickness, pitch, testing of alignment of teeth.
- 5.4 Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.

6. Machine Tool Testing

- 6.1 Alignment test on lathe, drilling machine and milling machine.

7. Limits, Fits and Tolerances

- 7.1 Definition and terminology of limits, fits and tolerances.
- 7.2 Hole basis and shaft basis systems.
- 7.3 Type of fits.
- 7.4 Limit gauges.

8. Instrumentation

Brief description about the measurement of displacement, vibration, frequency, pressure, temperature and humidity by electromechanical transducers

LIST OF PRACTICALS

- 1. Internal and external measurement with vernier caliper and micrometer.
- 2. Measurement with height gauge and depth gauge.
- 3. Measurement of flatness with dial indicator.
- 4. Measurement with combination set and bevel protector.
- 5. Study and use of slip gauges.
- 6. Measurement of gear characteristics
- 7. Measurement of angle with sine bar and slip gauges
- 8. Measurement of worn out IC engine piston clearance between cylinder and piston.
- 9. Measurement of flatness using comparator.
- 10. Determination of temperature by (i) pyrometer (ii) thermocouple.
- 11. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
- 12. Measurement of surface roughness of a surface

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 PC 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.	4	10
2.	8	18
3.	7	14
4.	6	12
5.	6	12
6.	6	12
7.	5	10
8.	6	12
Total	48	100

PRODUCTION TECHNOLOGY- I

L T P
3 - 6

RATIONALE

This subject provides knowledge and develops skills on various machine operations viz capstan and turret Lathe, milling, grinding, gear manufacturing, broaching and automatic machines which is very essential for Mechanical diploma holders to work in manufacturing industries

DETAILED CONTENTS

1. Capstan and Turret Lathe

- 1.1 Concept of capstan and turret lathe
- 1.2 Principal parts of capstan and turret lathe
- 1.3 Turret indexing mechanism, Bar feeding mechanism
- 1.4 Work holding devices – Jaw and collet chucks
- 1.5 Tool holding devices – Slide tool holder, Knee tool holder, knurling tool holder, recessing tool holder, form tool holder, tap and die holder, V-steady box tool holder, roller steady, box tool holder, bar stops.
- 1.6 Introduction to turret tooling layout
- 1.7 Comparison of capstan, turret and conventional lathe.

2. Milling

- 2.1 Specification and working principle of milling machine
- 2.2 Classification, brief description and applications of milling machines
- 2.3 Details of column and knee type milling machine
- 2.4 Milling machine accessories and attachment – Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, spiral milling attachment, slotting attachment and rack milling attachment.
- 2.5 Milling methods - up milling and down milling
- 2.6 Identification of different milling cutters and work mandrels
- 2.7 Work holding devices
- 2.8 Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.
- 2.9 Cutting speed and feed, simple numerical problems.
- 2.10 Indexing on dividing heads, plain and universal dividing heads.

3. Grinding

- 3.1 Purpose of grinding
- 3.2 Various elements of grinding wheel – Abrasive, Grade, structure, Bond
- 3.3 Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels. Specification of grinding wheels as per BIS.

- 3.4 Truing, dressing, balancing and mounting of wheel.
- 3.5 Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
- 3.6 Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder.
- 3.7 Selection of grinding wheel

4. Gear Manufacturing Processes

- 4.1 Gear hobbing
- 4.2 Gear shaping

5. Broaching

- 5.1 Introduction
- 5.2 Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down.
- 5.3 Elements of broach tool, broach teeth details – nomenclature, types, tool material.

PRACTICAL EXERCISES

- 1. Exercise on Turrent/ Capstan Lathe to prepare a job of given dimensions
- 2. To produce a rectangular block by face milling and prepare a slot on one face.
- 3. Exercise on milling- slab milling, Gang milling and straddle milling
- 4. To produce a gear by indexing device on a milling machine
- 5. Preparing job on following machines:-
 - a) Surface grinder
 - b) Cylindrical grinder
- 6. Exercise on tool and cutter Grinder
 - a) To grind Lathe tools
 - b) To grind a drill bit
 - c) To grind a milling cutter

INSTRUCTIONAL STRATEGY

- 1. Teaches should lay special emphasis in making the students conversant with concept, principle, procedure and practices related to various manufacturing processes
- 2. Focus should be laid on preparing jobs using various machines/ equipment in the workshop
- 3. Aids/ Video films should be used to show operations

RECOMMENDED BOOKS

1. Manufacturing technology by Rao; Tata McGraw hill Publishers, New Delhi
2. Manufacturing technology by M. Adithan and AB. Gupta; New Age International (P) Ltd, New Delhi
3. Workshop Technology vol I, II, III by Champman; Standard publishers Distributors
4. Practical hand book for Mechanical Engineers by AB Gupta; Galgotia publications, New Delhi
5. Production technology by HMT, Tata McGraw Publishers; New Delhi
6. Principle of metal cutting by Bhattacharya, Standard publishers Distributors, New Delhi
7. Fundamentals of metal cutting and machine tools by Juneja and Sekhon; Wiley Eastern Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	12	28
2.	12	28
3.	8	12
4.	10	20
5.	6	12
Total	48	100

COMPUTER AIDED DRAFTING

L T P
- - 6

1. Introduction to AutoCAD commands

- 1.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap, grid, and ortho mode
- 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

2. Assembly and detail drawings of the following using AUTOCAD (9 sheets)

- 2.1 Tool post
- 2.2 Tail stock
- 2.3 Screw jack
- 2.4 Safety valve
- 2.5 Stuffing Box
- 2.6 Bench vice

3. Isometric Drawings by CAD

Drawings of following on computer:

- Cone
- Cylinder
- Isometric view of objects

4. 3D Modelling

3D modelling, Transformations, scaling, rotation, translation

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. AutoCAD 2000 for you by Umesh Shettigar and Abdul Khader; Janatha Publishers, Udupi.
2. Machine Drawing by P.S. Gill; Kataria and Sons, Ludhiana.
3. A Text book of Machine Drawing by R.K. Dhawan , S.Chand and Company Ltd., New Delhi.
4. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
5. AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill, New Delhi.

MACHINE DESIGN

L T P
4 - -

RATIONALE

The contents of this subject are organised to understand the intricacies of different engineering design aspects. This will also help the students to enhance their imagination, innovative skill, adaptability to new situation and continued learning skills for problem solving.

DETAILED CONTENTS

1. Introduction

- 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 Practical examples related with design procedure
 - 1.1.4 Characteristics of a good designer
 - 1.1.5 Characteristics of environment required for a 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. General design considerations
- 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

- 2.1 Various design failures
 - Maximum principal stress theory.
 - Maximum shear stress theory
 - Maximum strain theory
- 2.2 Design for tensile, compressive and torsional loading
- 2.3 Design for combined torsion and bending

3. Design of Shaft

- 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 on the basis of :
 - Strength criterion
 - Rigidity criterion
- 3.3 Shaft subjected to bending
- 3.4 Shaft subjected to combined torsion and bending

4. Design of Key

- 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

Types of joints - Temporary and Permanent, utility of 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 joint, type of cotter joint – spigot and socket joint, gib and cotter joint, sleeve and cotter joint, Design of cotter joint (Figures and problems).

5.2 Permanent Joint:

Welding symbols, standards and materials having high weldability.

- 5.2.1 Welded Joint - Type of welded joint, strength of parallel and transverse fillet welds.
- 5.2.2 Strength of combined parallel and transverse weld.
- 5.2.3 Axially loaded welded joints.
- 5.2.4 Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint – caulking and fullering.
- 5.2.5 Different modes of rivet joint failure.
- 5.2.6 Design of riveted joint – Lap and butt, single and multi riveted joint, Diamond (Lozenzo) joint, circumferential and longitudinal boiler joints

6. Design of Flange Coupling

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

7. Design of Pulley

- 7.1 Types of pulley, crowning of pulley, pulley materials, components of a pulley.
- 7.2 Determination of pulley dimensions (Figures and problems).

8. Design of Screw, Nut, Bolt and Thread

- 8.1 Form of thread (ISO), Type of nut heads, type of threads and their nomenclature.
- 8.2 Nature of loads on nut and bolts, types of failure of nut and bolts.
- 8.3. Initial stresses due to screwing up, stresses due to combination of different loads.

INSTRUCTIONAL STRATEGY

- 1. Use models of machine parts/components.
- 2. Presentation should be arranged for various topics.

REFERENCE 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. Machine design by R.A Agarwal; Nav Bharat parkashan, Meerut.
- 4. Machine Design by Sharma and Agrawal; Katson Publishing House, Ludhiana.
- 5. Machine design by J.K. Kapoor, B. Bharat Parkashan, Meerut.

SUGGESTED DISTRIBUTION OF MARKS

<u>Topic No.</u>	<u>Time Allotted (Hrs)</u>	<u>Marks Allotted (%)</u>
1.	6	10
2.	3	5
3.	14	22
4.	4	6
5.	20	30
6.	6	10
7.	3	5
8.	8	12
Total	64	100

CNC MACHINES AND AUTOMATION

L T P
3 - 4

RATIONALE

Students are required to supervise and handle specialized machines and equipments like CNC machines. This subject aims at development of knowledge and skill about CNC machines tools, equipment and use of high tech. machines

DETAILED CONTENTS

1. Automation

- 1.1 Definition
- 1.2 Types of Automation
- 1.3 Need of Automation
- 1.4 Advantages of Automation

2. Introduction to Numerical Control

Computer applications in manufacturing, basic concepts of NC, CNC, DNC and adaptive control, advantages and application of CNC machines in industry

3. Components of CNC System

Machine control unit, NC control and PLC control system, introduction to C axis and special constructional requirements of CNC machines, machine bed, slide ways, bolt, screw and nut assembly, lubrication and cooling system, spindle and spindle motors, axis drive motors, automatic tool changers, multiple pallets, swarf removal mechanisms and safety provision

4. Part Programming

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

5. Common Problems in CNC Machines

Common problems in mechanical, electrical, pneumatic, electronic and PC components of CNC machines, diagnostic study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines

6. Other Automation Equipment

CNC turning centres, CNC vertical and horizontal machining centre, CAM,

introduction to flexible manufacturing system (FMS) and robotics

LIST OF PRACTICALS

1. Study the constructional details of CNC lathe.
2. Study the constructional details and working of following:-
 - Automatic tool changer and tool setter
 - Multiple pallets
 - Swarf removal system
 - Safety devices
3. Develop a part programme for following lathe operations:
 - Plain turning and facing operations
 - Taper turning operations (internal and external)
 - Thread cutting operations (internal and external)
4. Preparation of preventive maintenance schedule for CNC machine.

INSTRUCTIONAL STRATEGY

This is a 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. Numerical Control of Machines Tools by Yorem Korem and IB Uri, Khanna Publishers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	4	8
2.	6	14
3.	10	20
4.	16	30
5.	6	14
6.	6	14
Total	48	100

GENERIC SKILL DEVELOPMENT CAMP – I

As per general feedback received from the employers regarding Technician Engineers during formal interactions, the pass outs of polytechnics are labeled of falling short of employable skills which comprises of Communication, inter-personal relationship, leadership qualities, team work, problem solving, managing task, managing self etc. in addition to technical knowledge and skills. We have, therefore, added papers such as English and Communication Skills and Entrepreneurship Development and Management in the curriculum in addition to proposed camps of 3-4 days to be conducted in polytechnics on common and vital issues e.g. Environmental Awareness, Entrepreneurship Development and Generic Skill Development.

It is proposed that a camp of 3-4 days duration on Generic Skills Development (GSD) during 5th semester be organized by arranging expert lectures/discussion sessions either by polytechnic teachers or by eminent educationists from the neighborhood to deal with the following topics. Few students may also be encouraged to prepare on some of these topics and make presentation during the camp. Expert lectures must be followed by distribution of relevant handouts for further study. The attendance of students should be compulsory and marks be awarded under provision of Student Centred Activities.

It is envisaged that such camps will bring in a significant improvement in confidence level and personality of the pass outs from polytechnics.

Suggested list of topics for arranging lectures/discussion sessions:

1. Independent Study Technique
 - 1.1 Information search, information extraction, storage and retrieval
 - 1.2 Reading skills
 - 1.3 Life long learning
 - 1.4 Continuing education
2.
 - 2.1 Introduction
 - 2.2 Time Management
 - 2.3 Stress and emotions
 - 2.4 Health and hygiene
3. Task Management
 - 3.1 Task planning and organizing
 - 3.2 Task execution
 - 3.3 Task evaluation
 - 3.4 Event management
4. Action Research
 - 4.1 Importance and Scope
 - 4.2 Steps in action research
 - 4.3 Analysis of data
 - 4.4 Conclusions and report writing

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L T P
4 - -

RATIONALE

The knowledge of this subject is required for all engineers/technicians who wish to choose industry/field as their career. This course is designed to develop understanding of various functions of management, role of workers and engineers and providing knowledge about industrial and tax laws.

DETAILED CONTENTS

1. Principles of Management (12 hrs)
 - 1.1 Management, Different Functions: Planning, Organising, Leading, Controlling
 - 1.2 Organizational Structure, Types, Functions of different departments
 - 1.3 Motivation: Factors, characteristics, methods of improving motivation, incentives, pay, promotion, rewards, job satisfaction, job enrichment
 - 1.4 Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader, promoting team work
 - 1.5 Introduction to operations management and MIS

2. Human Resources Development (03hrs)
 - 2.1 Introduction, objectives and functions of human resource development (HRD) department.
 - 2.2 Recruitment, methods of selection, training strategies and career development

3. Wages and Incentives (03 hrs)
 - 3.1 Definition and factors affecting wages, methods of wage payment.
 - 3.2 Wage incentive – type of incentive, difference in wage, incentive and bonus; incentives to supervisor.
 - 3.3 Job evaluation and merit rating.

4. Human and Industrial Relations (06 hrs)
 - 4.1 Human relations and performance in organization
 - 4.2 Understand self and others for effective behaviour
 - 4.3 Behaviour modification techniques
 - 4.4 Industrial relations and disputes
 - 4.5 Relations with subordinates, peers and superiors
 - 4.6 Characteristics of group behaviour and trade unionism
 - 4.7 Mob psychology
 - 4.8 Grievance, Handling of grievances
 - 4.9 Agitations, strikes, Lockouts, Picketing and Gherao
 - 4.10 Labour welfare schemes
 - 4.11 Workers' participation in management

5. Professional Ethics (03 hrs)
 - 5.1 Concept of professional ethics
 - 5.2 Need for code of professional ethics
 - 5.3 Professional bodies and their role

6. Sales and Marketing management (08 hrs)
 - 6.1 Functions and duties of sales department
 - 6.2 Sales forecasting, sales promotion, advertisement and after sale services.
 - 6.3 Concept of Marketing.
 - 6.4 Problems of Marketing.
 - 6.5 Pricing policy, break even analysis
 - 6.6 Distribution channels and methods of marketing.

7. Labour Legislation Acts (as Ammended on date) (06 hrs)
 - 7.1 Factory Act 1948.
 - 7.2 Workmen's Compensation Act 1923.
 - 7.3 Apprentices Act 1961.
 - 7.4 PF Act, ESI Act
 - 7.5 Industrial Dispute Act 1947
 - 7.6 Employers State Insurance Act 1948
 - 7.7 Payment of Wages Act, 1936

8. Entrepreneurship Development (06 hrs)
 - 8.1 Concept of entrepreneur and need of entrepreneurship in the context of prevailing employment conditions.
 - 8.2 Distinction between an entrepreneur and a manager.
 - 8.3 Project identification and selection.
 - 8.4 Project formulation.
 - 8.5 Project appraisal.
 - 8.6 Facilities and incentives to an entrepreneur

9. Environmental Engineering (05 hrs)
 - 9.1 Ecology
 - 9.2 Factory causing pollution
 - 9.3 Effects of pollution on Human health
 - 9.4 Air pollution and control
 - 9.5 Water pollution and control
 - 9.6 Solid waste management
 - 9.7 Noise pollution and its control
 - 9.8 Environmental protection Act at State and National level

10. Accidents and Safety (04 hrs)
 - 10.1 Classification of accidents based on nature of injuries, event and place.
 - 10.2 Causes and effects of accidents
 - 10.3 Accident-prone workers
 - 10.4 Action to be taken in case of accidents with machines, electric shock, fires and erection and construction accidents.
 - 10.5 Safety consciousness and publicity
 - 10.6 Safety procedures
 - 10.7 Safety measures - Do's and Don'ts and good housing keeping

11. Materials Management (4 hrs)
Inventory control models, ABC Analysis, Safety stock, Economic ordering quantity, Stores equipment, Stores records, purchasing procedures, Bin card, Cardex, Material handling techniques
12. Financial Management (4 hrs)
Importance of ledger and cash book, Profit and loss Account, Balance sheet, Interpretation of Statements, Project financing, Project appraisal, return on investments

RECOMMENDED BOOKS

1. Industrial Engineering and Management by O.P.Khanna; Dhanpat Rai and Sons, Delhi
2. Industrial Organization and Management by Tara Chand; Nem Chand and Brothers; Roorkee.
3. Marketing Management by Phillip Kotler; Prentice Hall of India, New Delhi
4. Environmental and Pollution Awareness by BR Sharma; Satya Prakashan, New Delhi.
5. Industrial Organisation and Engineering Economics by Banga and Sharma; Khanna Publishers, Delhi.
6. Industrial Management by C.L. Mahajan; Saluja Parkashan, New Delhi.
7. Management by Jams A Stoner, R Edward Freman and Daniel R. Gilbrat, JR, Sixth Edition, Pearson Education, New Delhi
8. Industrial Management by VK Sharma, OP Harkut
9. Thakur Kailash, Environment Protection Law & Policy in India: Deep & Deep publication, New Delhi.
10. Handbook of Small Scale Industry by P.M. Bhandari.
11. Principles of Management by Philip Kotler, TEE Publication.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	3	5
3	3	5
4	6	10
5	3	5
6	8	12
7	6	10
8	6	10
9	5	8
10	4	5
11	4	5
12	4	5
Total	64	100

MAINTENANCE ENGINEERING

L T P
4 - 2

RATIONALE

A diploma engineer comes across installation, maintenance, testing of various machines and equipment in industries. The layout of different machines, their foundation is an important phenomenon of an industry. He should know the various methods of testing and maintenance. This subject will enable diploma holders to deal with such aspects.

DETAILED CONTENTS

1. Introduction

- 1.1 Necessity and advantages of testing, repair and maintenance
- 1.2 Economic aspects, manpower planning and materials management
- 1.3 Fits and tolerances – common fits and tolerances used for various machine parts

2. Erection and Commissioning of Machines (Installation)

- 2.1 Location, layout and positioning of machines
- 2.2 Foundation – types of foundation, foundation plan, erection and leveling, grouting, vibration damping, vibration isolation – methods of isolation, anti vibration mounts.

3. Testing of Machines

- 3.1 Testing equipment – dial gauge, mandrel, spirit level, straight edge, auto collimator
- 3.2 Testing methods – geometrical/alignment test, performance test, testing under load, run test, vibrations, noise

4. Lubrication Systems

- 4.1 Lubrication methods and periodical lubrication chart for various machines (daily, weekly, monthly)
- 4.2 Handling and storage of lubricants
- 4.3 Lubricants conditioning and disposal
- 4.4 Lubricant needed for specific components such as gears, bearings, and chains
- 4.5 Purpose and procedure of changing oil periodically (like gear box oil)

5. Repairing

- 5.1 Common parts which are prone to failure, reasons of failure
- 5.2 Repair schedule
- 5.3 Parts that commonly need repair such as belts, couplings, nuts, and bolts

6. Maintenance

- 6.1 Definition, advantages, limitations and types of maintenance viz. preventive, breakdown, predictive
- 6.2 Organization of maintenance
- 6.3 Introduction to computerized maintenance record
- 6.4 ISO standards for maintenance documentation
- 6.5 Introduction to machine history card – purpose and advantages
- 6.6 Preparation of yearly plan for preventive maintenance
- 6.7 Need of frequently needed spare parts inventory

LIST OF PRACTICALS

- 1. Preparation of prevention maintenance check.
- 2. Condition monitoring by non destructive testing.
- 3. Case study on trouble free maintenance.
- 4. Project on maintenance of utility equipment like compressors, pumps, driers, valves (actuator type valves).
- 5. Equipment/machine leveling and alignment.
- 6. Maintenance of material handling equipment – pulley blocks, hand operated cranes, fork lifts, hydraulic jacks, mobile cranes, winches.
- 7. Use of lubrication equipment like oil gun, grease gun.
- 8. Removing old lubricant, cleaning and replenishing the machine with fresh lubricant.
- 9. Case study on computerized maintenance schedule.
- 10. Reconditioning of machine parts.
- 11. Replacing gear.
- 12. Replacing bearings (all types).
- 13. Practically making different types of fits.

INSTRUCTIONAL STRATEGY

- 1. Lay greater emphasis on practical aspects of maintenance.
- 2. Make use of transparencies, video films and CD's.
- 3. Expose the students to real life situation.
- 4. Promote continued learning through properly planned assignments.
- 5. Demonstrate sample of all types of gear and bearings.

RECOMMENDED BOOKS

- 1. Industrial Maintenance by HP Garg; S. Chand and Company, Delhi.
- 2. Plant Maintenance Engineering by RK Jain; Khanna Publishers, Delhi.
- 3. Installation, Servicing and Maintenance by SN Bhattacharya; S Chand and Company, Delhi.
- 4. Maintenance Engineering and Management by RC Mishra and K Pathak; Prentice Hall of India Pvt. Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

S.No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	12
2	10	15
3	12	20
4	12	20
5	10	15
6	12	18
Total	64	100

PRODUCTION TECHNOLOGY

L T P
3 - 6

RATIONALE

This subject provides knowledge of various metal forming processes viz. press working, forging, rolling, modern machining processes, jig and fixtures, plastic processes, coating processes and finishing processes which is required for mechanical diploma holders to work in manufacturing industries.

DETAILED CONTENTS

1. Metal Forming Processes

1.1 Press Working

- 1.1.1 Press working –
Types of presses, type of dies, selection of press die, die material
- 1.1.2 Press Operations-
Shearing, piercing, trimming, punching, notching, shaving,
gearing, embossing, stamping

1.2 Forging

- 1.2.1 Open die forging, closed die forging
- 1.2.2 Press forging, upset forging, swaging, up setters, roll forging
- 1.2.3 Cold and hot forging

1.3 Rolling

- 1.3.1 Elementary theory of rolling
- 1.3.2 Types of rolling mills
- 1.3.3 Thread rolling, roll passes
- 1.3.4 Rolling defects and remedies

1.4 Extrusion and Drawing

- 1.4.1 Type of extrusion- Hot and Cold, Direct and indirect
- 1.4.2 Pipe drawing, tube drawing

2. Modern Machining Processes

2.1 Mechanical Process

- 2.1.1 Ultrasonic machining (USM): Introduction, principle,
process, advantages and limitations, applications

- 2.2 Electro Chemical Processes
 - 2.2.1 Electro chemical machining (ECM) – Fundamental principle, process, applications
 - 2.2.2 Electro chemical Grinding (ECG) – Fundamental principle, process, application
- 2.3 Electrical Discharge Machining (EDM)
 - 2.3.1 Introduction, basic EDM circuit
 - 2.3.2 Principle, metal removing rate, dielectric fluid, applications
- 2.4 Laser beam machining (LBM) – Introduction, machining process and applications
- 2.5 Electro beam machining (EBM)- Introduction, principle, process and applications
- 2.6 Plasma arc machining (PAM) and welding – Introduction, principle process and applications

3. Jigs and Fixtures

- 3.1 Importance and use of jigs and fixture
- 3.2 Principle of location
- 3.3 Locating devices
- 3.4 Clamping devices
- 3.5 Types of Jigs – Drilling jigs, bushes, template jigs, plate jig, channel jig, leaf jig.
- 3.6 Fixture for milling
- 3.7 Advantages of jigs and fixtures

4. Plastic Processes

- 4.1 Injection moulding – working principle, advantages and limitations
- 4.2 Blow moulding – working principle, advantages and limitations
- 4.3 Compression moulding – Working principle, advantages and limitations

5. Metallic and Non Metallic Coating Processes

- 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
- 5.4 Properties and uses of varnishes, paints including primers and enamels

6. Metal Finishing Processes

- 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 Super finishing process, its applications.
- 6.10 Use of super finishing attachment on center lathe.
- 6.11 Polishing
- 6.12 Buffing.

7. Power Metallurgy

- 7.1 Introduction, principle, scope of process
- 7.2 Production of metal powders, sintering and finishing operations and extrusion
- 7.3 Advantages, limitations and applications of powder metallurgy

PRACTICAL EXERCISES

- 1. Preparation of chisel from round rod.
- 2. To forge squares on both ends of a circular rod.
- 3. Exercise on EDM Machine.
- 4. Exercise on electro plating.
- 5. Preparation of a drilling jig.
- 6. Preparation of a milling fixture.

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 on preparing jobs using various machines/equipment in the workshop.
- 3. Use of audiovisual aids/video films should be made to show specialized operations.

RECOMMENDED BOOKS

- 1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi.
- 2. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd., New Delhi.
- 3. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors, New Delhi.
- 4. Practical Handbook for Mechanical Engineers by Dr. AB Gupta; Galgotia Publications, New Delhi.
- 5. Production Technology by HMT; Tata McGraw Publishers, New Delhi.

6. Principle of Metal Cutting by Bhattacharya; Standard Publishers Distributors, New Delhi.
7. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
8. Modern Machining Process by Pandey; Tata McGraw Publishers, New Delhi.
9. Jigs and Fixtures by P.H. Joshi, Tata McGraw Hill Publishers, New Delhi.
10. A text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
11. Fundamentals of Metal Cutting and Machine Tools by Juneja and Sekhon; Wiley Eastern Limited, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

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

POWER PLANT ENGINEERING

L T P
4 - -

RATIONALE

A diploma holder in mechanical engineering is supposed to manage the power generating plant. In Uttaranchal state, hydropower potential is supposed to be very large. Therefore, he must have relevant knowledge and skills about various power plants e.g. steam power plant, nuclear power plant, hydro power plant, diesel engine power plant and gas turbine power plant. Hence this subject is offered.

DETAILED CONTENTS

1. Introduction

Sources of energy fuels, flowing stream of water, solar rays, wind, terrestrial heat, ocean tides and waves

Concept of power station, central and industrial power station, captive power station, classification of power station with respect to prime mover steam, IC engine, gas turbine and hydro power station, scope in Uttaranchal state

2. Steam Power Plant

2.1 Parameters of power cycle- thermal efficiency, work ratio, specific steam consumption

Rankine cycle flow diagram, representation on thermodynamic planes, thermal efficiency, effect on change of condenser pressure, boiler pressure, degree of super heat on thermal efficiency

Reheat cycle, simple regenerative cycle, (No numerical)

2.2 Steam prime movers

Concept of a prime mover, steam turbine- advantages as a prime mover, principle elements of a steam turbine and functions – nozzles, blades, rotor, shaft, casing, shaft seals, diaphragm, bearings, steam control, oil system

Governing of steam turbines- classification of steam turbines

Starting and stopping procedures for turbines, precautions during running

Performance of steam turbine, Thermal efficiency, efficiency ratio, mechanical efficiency, steam rate

2.3 Steam Condensing Equipment

Functions of condensers, classification, surface condenser components and their functions

Condenser auxiliaries- hot well, condensate pump, vacuum pump, air ejector, circulating pump, atmospheric relief valve

Requirement of a good condensing system

Cooling towers- purpose and types

2.4 Steam power station control

Effect of load variation of various parameters, types of control systems- area and centralized, basic components of a control system, compressed air and electrical control systems, controls and instruments in a modern central station control room

Working of feed water control system and steam temperature control system

Records maintained in a steam power station and their purpose

3. Nuclear Power Plant

Equivalence between mass and energy- Atomic structure of matter, atomic nomenclature, nuclear reactions- fission, fusion, mass defect, binding energy, chain reaction, methods of control of rate of fusion reaction, types of nuclear materials, fissile and fertile materials

Nuclear reactors- elements and functions of different elements, classification on the basis of different criteria

Nuclear power stations employing boiling water reactor, candu type reactor- system components, advantages and disadvantages

Comparison of nuclear power station with a steam power station

Health hazards, safety precautions

4. Diesel Engine Power Plant

Advantages and disadvantages of diesel engine. Essential elements of diesel power plant. Fuel injection system performance, testing of diesel engine power plant

5. Gas Turbine Power Plant

Brayton cycle- schematic diagram, thermal efficiency. Advantages of gas turbines over diesel engines. Classification of gas turbines, advantages and disadvantages methods of improving thermal efficiency, Important parts and their functions, Essential auxiliaries and controls for gas turbine power plant. Fuel for gas turbines

6. Hydro Power

Advantages, basic elements, dams, head works, water turbines, classification of water turbines, speed and pressure control, plant auxiliaries, plant operation, potential in Uttranchal state, detailed working

INSTRUCTIONAL STRATEGY

Treatment of the subject will be subjected to analysis and examples. One visit to Power plant station is compulsory.

RECOMMENDED BOOKS

1. A course in Power Plant Engineering by S. Domkundwar & Arora; Dhanpat Rai and sons
2. Power Plant Engineering by G.B.S Narang
3. Power plant engineering by G.R. Nagpal; S.K. Khanna Publishers, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	4	5
2.	19	30
3.	13	20
4.	6	10
5.	6	10
6.	16	25
Total	64	100

MECHATRONICS

L T P
4 - -

RATIONALE

The mechatronics, the integration of electronic, of electrical engineering, computer technology and control engineering with mechanical engineering is increasingly forming a crucial part in design, manufacture and maintenance of wide range of engineering products and processes. The diploma holders need skills and knowledge that are not confined to a single subject area. They need to be capable of operating and communicating across a range of engineering disciplines and linking those having more specialized skills. So it is important to introduce this subject.

DETAILED CONTENTS

1. Introduction

- 1.1 Introduction to Mechatronics
- 1.2 Mechatronic system
- 1.3 Measurement systems
- 1.4 Control system-open Loop, Close loop and sequential
- 1.5 Microprocessor based controllers
- 1.6 The Mechatronics approach

2. Sensors and Transducers

- 2.1 Sensors and transducers
- 2.2 Performance terminology
- 2.3 Displacement, position and motion sensors
- 2.4 Electromechanical sensors and transducers
- 2.5 Force sensors
- 2.6 Liquid flow sensors
- 2.7 Liquid level sensors
- 2.8 Temperature sensors
- 2.9 Light sensors
- 2.10 Selection of sensors
- 2.11 Simple problems

3. Data Presentation Systems

- 3.1 Displays
- 3.2 Data presentation elements
- 3.3 Magnetic recording
- 3.4 Data acquisition systems
- 3.5 Measurement systems
- 3.6 Testing and calibration
- 3.7 Simple problems

4. Pneumatic and Hydraulic Systems

- 4.1 Actuation systems
- 4.2 Pneumatic and hydraulic systems
- 4.3 Directional control valves
- 4.4 Pressure control valves
- 4.5 Cylinders
- 4.6 Process control valves
- 4.7 Rotary actuators
- 4.8 Simple problems

5. Mechanical Actuation Systems

- 5.1 Mechanical systems
- 5.2 Types of motion
- 5.3 Kinematic chains
- 5.4 Cams
- 5.5 Gear trains
- 5.6 Ratchet and pawl
- 5.7 Belt and chain drives
- 5.8 Bearing
- 5.9 Mechanical aspects of motor selection
- 5.10 Simple problems

6. Electrical Actuation System

- 6.1 Electrical systems
- 6.2 Mechanical switches
- 6.3 Solid-state switches
- 6.4 Solenoids
- 6.5 D.C. motors
- 6.6 A.C. motors
- 6.7 Stepper motors
- 6.8 Problems

7. Basic System Models

- 7.1 Mathematical models
- 7.2 Mechanical systems building blocks
- 7.3 Electrical system building blocks
- 7.4 Fluid system building blocks
- 7.5 Thermal system building blocks
- 7.6 Simple Problems

8. Digital Logic

- 8.1 Digital logic
- 8.2 Number systems
- 8.3 Logic gates

- 8.4 Boolean algebra
- 8.5 Karnaugh maps
- 8.6 Applications of logic gates
- 8.7 Sequential logic
- 8.8 Simple Problems

9. Microprocessors

- 9.1 Control
- 9.2 Microcomputer structure
- 9.3 Microcontrollers
- 9.4 Applications
- 9.5 Programming problems

10. Input/output Systems

- 10.1 Interfacing
- 10.2 Input/output ports
- 10.3 Interface requirements
- 10.4 Peripheral interface adapters
- 10.5 Serial communications interface
- 10.6 Examples of interfacing
- 10.7 Simple problems

11. Programmable Logic Controllers

- 11.1 Programmable logic controllers- Applications
- 11.2 Basic structure
- 11.3 Input/output processing
- 11.4 Programming- ladder diagrams
- 11.5 Mnemonics
- 11.6 Timers, internet relays and counter
- 11.7 Shift registers
- 11.8 Master and jump controls
- 11.9 Data handling
- 11.10 Analogue input/output
- 11.11 Selection of a PLC
- 11.12 Simple problems

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning.
2. Students should be taken to various industrial units for clear conception of various topics.
3. Efforts should be made to relate the process of teaching with direct experiences in the industry.

RECOMMENDED BOOKS

1. Mechatronics by HMT, Tata McGraw Hill, New Delhi
2. Mechatronics: Electronic Control System in Mechanical Engineering by W. Bolton; Pearson Education, Singapore.
3. Fundamentals of Electrical Engineering and Electronics by BL Thareja; S. Chand and Company, New Delhi.
4. Basic Electronics by Gupta, NN Bhargava, Kulshreshtha, TTTI, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	4	6
2.	6	10
3.	4	6
4.	8	12
5.	6	10
6.	8	12
7.	4	6
8.	4	6
9.	8	12
10.	4	6
11	8	14
Total	64	100

COMPUTER INTEGRATED MANUFACTURING

L T P
4 - -

RATIONALE

Manufacturing of this century belongs to computerized equipment & machine tools to manufacture a variety of components with high quality, high precision & low cost at a faster rate. Computer Aided Designing (CAD), Computer Aided Manufacturing (CAM), Numerical Control Machine Tools, Computer Aided Process Planning (CAPP), Automated Guided Vehicles (AGVs) & Flexible Manufacturing Systems-all are the part of Computer Integrated Manufacturing (CIM) which help to achieve the desired goals in manufacturing. After studying the subject, the students will be able to know about these integrated techniques which help a manufacturer to achieve his goal with in stipulated time.

DETAILED CONTENTS

1. Introduction

Fundamental of manufacturing, CAD-CAM Meaning, Activities of a CAD/CAM system, Manufacturing components of CAD/CAM integration, system approach in manufacturing, Introduction of Automation and Computer Integrated manufacturing, Concept of CIM.

2. Automation

Automation in manufacturing, Basic concepts of automation, Hard automation, Soft automation, comparison of manual operation, hard automation and flexible (Soft) automation, Trends in manufacturing automation, composition of work force in conventional and automated manufacturing system.

3. Computer System for CAD/CAM/CIM/FMS

Selection of a computer, CAD/CAM Hardware, CAD/CAM system components, computer languages and CIM/FMS, software selection.

4. Robotics

Introduction to robot, robot configuration, degrees of freedom and robotic motions, robot applications.

5. Computer Aided Process Planning (CAPP)

Concepts of group Technology, approaches to process planning-manual approach, variant process planning, Generative process planning; economic regions for different process planning system, role of process planning in computer integrated manufacturing, integrated process planning system, advantages of CAPP.

6. Automated Material Handling

Introduction to material handling, Objectives of material handling, Types of materials to be moved, Integrated material handling, handling system selection, Introduction to Automated Guided Vehicles (AGV), Types of AGV-Wire Guided Vehicles, Painted Guided Vehicle, Free ranging AGVs; Different AGVs guidance system, components of an AGV, AGV's basic function, Advantages of using AGVs, Industrial application of AGVs; Automated storage/retrieval systems, Industrial applications.

7. Flexible Manufacturing System (FMS)

Introduction to FMS, manufacturing flexibility, FMS elements, FMS data Files, Software for FMS, Design aspects of flexible manufacturing, Sequencing & Scheduling in FMS,

8. Introduction to Rapid prototyping and Re engineering

Rapid Prototyping (RP) definition, various RP technologies. Advantages of RP.

Reverse engineering- definition, reverse engineering tools: CMM (CoOrdinate Measuring Machine), white light scanners, laser scanners.

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching learning
2. Students should be motivated to use internet and relevant journals to acquaint them with latest development in automated manufacturing.

INSTRUCTIONAL STRATEGY

1. "Computer Aided Manufacturing" By Surinder Kumar, Aditya Shah; Satya Parkashan, New Delhi
2. "Numerical Control & Computer Aided Manufacturing" By T.K. Kundra, P.N. Rao & N.K.Tewari; Tata McGraw Hills Pub. Co. New Delhi.

3. “Systm Apporach to Computer Integrated Design & Manufacturing” By N.Singh; John Willey & Sons Inc.
4. “Computer Integrated Manufacturing Hand Book” By Teicholz, Orr; McGrawHill Book Co.
5. CAD/ CAM by Michael Groover, Zimmers: Prentice hall of India (P) Ltd., New Delhi.
6. Robotics by Yorem Korem, McGraw Hill Publishers, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	8	12
2.	10	16
3.	8	12
4.	8	12
5.	8	12
6.	9	16
7.	8	12
8.	5	6
Total	64	100

AUTOMOBILE ENGINEERING

L T P
4 - -

RATIONALE

The development of automobile industry and direct and indirect dependence of the present day society on the services of its products has made the knowledge of the technology imperative, this subject deals with automotive needs.

DETAILED CONTENTS

1. Introduction

- 1.1 Automobile and its development
- 1.2 Components of an automobile
- 1.3 Classification of automobiles
- 1.4 Layout of chassis
- 1.5 Types of drives-front wheel, rear wheel, four wheel, left hand, right hand

2. Transmission System

- 2.1 Clutch
 - 2.1.1 Function
 - 2.1.2 Constructional details of single plate and multi plate friction clutches
 - 2.1.3 Centrifugal and semi centrifugal clutch
 - 2.1.4 Hydraulic clutch
- 2.2 Gear Box
 - 2.2.1 Function
 - 2.2.2 Working of sliding mesh, constant mesh and synchromesh gear box
 - 2.2.3 Torque converter and overdrive
- 2.3 Propeller shaft and rear axle
 - 2.3.1 Function
 - 2.3.2 Universal joint
 - 2.3.3 Differential
 - 2.3.4 Rear axle drives and different types of rear axles
- 2.4 Hydraulic clutch
- 2.5 Wheels and Tyres
 - 2.5.1 Types of wheels - disc wheel and wire wheel
 - 2.5.2 Types of tyres used in Indian vehicles
 - 2.5.3 Toe in, toe out, camber, caster, kingpin inclination
 - 2.5.4 Tubeless tyres

3. Steering System

- 3.1 Function and principle
- 3.2 Ackerman and Davis steering gears
- 3.3 Types of steering gears - worm and nut, worm and wheel, worm and roller, rack and pinion type
- 3.4 Power steering
- 3.5 Wheel balancing

4. Braking system

- 4.1 Constructional details and working of mechanical, hydraulic and vacuum brake
- 4.2 Details of master cylinder, wheel cylinder
- 4.3 Concept of brake drum, brake lining and brake adjustment
- 4.4 Air brake

5. Suspension System

- 5.1 Function
- 5.2 Types
- 5.3 Working of coil spring, leaf spring
- 5.4 Shock absorber – Telescopic type
- 5.5 Air suspension

6. Battery

- 6.1 Constructional details of lead acid cell battery
- 6.2 Specific gravity of electrolyte - effect of temperature on specific gravity
- 6.3 Capacity and efficiency of battery
- 6.4 Battery charging, chemical reactions during charge and discharge.
- 6.5 Maintenance of batteries
- 6.6 Checking of batteries for voltage and specific gravity

7. Dynamo and Alternator

- 7.1 Dynamo
 - 7.1.1 Function and details
 - 7.1.2 Regulators - voltage current and compensated type
 - 7.1.3 Cutout - construction, working and their adjustment
- 7.2 Alternator
 - 7.2.1 Construction and working
 - 7.2.2 Charging of battery from alternator

8. Lighting System and Accessories

- 8.1 Lighting system
- 8.2 Wiring circuit
- 8.3 Headlight, aiming of headlights
- 8.4 Lighting switches
- 8.5 Direction indicators
- 8.6 Windscreen wiper
- 8.7 Horn
- 8.8 Speedometer
- 8.9 Heater
- 8.10 Air conditioning

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 Vol. I by Dr. Kirpal Singh; Standard Publishers and Distributors, Delhi.
2. Automobile Engineering Vol. I by GBS Narang; Khanna Publishers, Delhi.
3. Automobile Mechanic by Joseph, Heitner; CBS Publishers and Distributors, Delhi.
4. Automobile Mechanics: William Crouse: Tata McGraw Hill
5. Automobile Engineering by R.B Gupta, Satya Parkashan, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	4	6
2.	16	25
3.	8	12
4.	8	12
5.	6	8
6.	8	14
7.	8	14
8.	6	9
Total	64	100

PROJECT WORK

L T P
- - 12

Project work aims at developing skills in the students whereby they apply the totality of knowledge and skills gained through the course in the solution of particular problem or undertaking a project. The students have various 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. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. 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 for a group. The students should identify or given project assignment at least two to three months in advance. The project work identified in collaboration with industry may be preferred.

Each teacher is expected to guide the project work of 4-5 students.

A suggestive criteria for assessing student performance by the external (personnel 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

	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

In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance of undergoing 8 -10 weeks of project oriented professional training in the same industry and re-evaluated 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.

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 100 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 another 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 done by the students and invite leading Industrial organisations in such an exhibition. 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 industries are approached for instituting such awards.

GENERIC SKILL DEVELOPMENT CAMP – II

As per general feedback received from the employers regarding Technician Engineers during formal interactions, the pass outs of polytechnics are labeled of falling short of employable skills which comprises of Communication, inter-personal relationship, leadership qualities, team work, problem solving, managing task, managing self etc. in addition to technical knowledge and skills. We have, therefore, added papers such as English and Communication Skills and Entrepreneurship Development and Management in the curriculum in addition to proposed camps of 3-4 days to be conducted in polytechnics on common and vital issues e.g. Environmental Awareness, Entrepreneurship Development and Generic Skill Development.

It is proposed that a camp of 3-4 days duration on Generic Skills Development (GSD) during 6th semester be organized by arranging expert lectures/discussion sessions either by polytechnic teachers or by eminent educationists from the neighborhood to deal with the following topics. Few students may also be encouraged to prepare on some of these topics and make presentation during the camp. Expert lectures must be followed by distribution of relevant handouts for further study. The attendance of students should be compulsory and marks be awarded under provision of Student Centred Activities.

It is envisaged that such camps will bring in a significant improvement in confidence level and personality of the pass outs from polytechnics.

Suggested list of topics for arranging lectures/discussion sessions:

1. Ethics and Values
 - 1.1 Introduction and importance
 - 1.2 Ethics and values in profession and society
 - 1.3 Dignity of labour
 - 1.4 Net etiquettes

2. Group Dynamics
 - 2.1 Introduction
 - 2.2 Leadership
 - 2.3 Communication in group
 - 2.4 Team work

3. Personality Development
 - 3.1 PR technique
 - 3.2 Positive attitude
 - 3.3 Self-esteem
 - 3.4 Creativity

4. SWOT Analysis
 - 4.1 Importance
 - 4.2 Introduction to SWOT analysis steps
 - 4.3 SWOT analysis parameters