

Rationale

Interpersonal communication is a natural and necessary part of organizational life. Yet, communicating effectively can be challenging because of our inherent nature to assume, overreact to and misperceive what actually is happening. Poor communication or lack of communication is often cited as the cause of conflict and poor teamwork. In today's team-oriented workplace, managing communication and developing strategies for creating shared meaning are crucial to achieving results and creating successful organizations. The goal of the *Communicating Effectively in English* course is to produce civic-minded, competent communicators. To that end, students must demonstrate oral as well as written communication proficiency. These include organizational and interpersonal communication, public address and performance.

Objectives of Course in Communicating Effectively in English for the First Year

(I & II Semesters) are: * *Understanding how communication works* * *Gaining active listening and responding skills* * *Understanding the importance of body language*

* *Acquiring different strategies of reading texts* * *Increasing confidence by providing opportunities for oral and written expressions*

DETAILED CONTENTS FOR FIRST SEMESTER**48 Hrs****1. COMMUNICATION SKILLS 6 hrs**

- 1.1 Verbal and Non-verbal Communication
- 1.2 Process of Communication
- 1.3 Barriers to Communication; Overcoming Strategies
- 1.4 Listening and Speaking Skills and Sub-Skills
- 2. Spoken English-Introduction, Features of Spoken English

(Note: This module is only for practice. This should not be included in the final examination)

2. DEVELOPING ORAL COMMUNICATION SKILLS 8 hrs

- 2.1 Greeting, Starting a Conversation
- 2.3 Introducing Oneself
- 2.4 Introducing Others
- 2.5 Leave Taking
- 2.6 Thanking, Wishing Well
- 2.7 Talking about Oneself
- 2.8 Talking about Likes and Dislikes

3. GRAMMAR AND USAGE 12 hrs

- 3.1 Punctuation
- 3.2 Articles-a, an, the
- 3.3 Framing Questions
- 3.4 Verbs-Classification: Main Verb, Auxiliary Verb, Transitive & Intransitive Verbs, Phrasal Verbs
- 3.5 Word Formation

4. WRITING SKILLS 10 hrs

- 4.1 Writing Paragraphs
- 4.2 Picture Composition

5. READING SKILLS 12 hrs

- 5.1 Vocabulary Enhancement
- 5.2 Techniques of Reading: Skimming, Scanning, Intensive and Extensive Reading

NOTE: The Reading Skills of the learners (along with vocabulary enhancement) will be through reading thematic articles/essays and/or stories.

1.2 APPLIED MATHEMATICS – I

RATIONALE

Applied Mathematics forms the backbone of engineering discipline, Basic elements of permutations and combinations, trigonometry, vector, complex number and statistics have been included in the curriculum as foundation course and to provide base for continuing education to the students.

DETAILED CONTENTS

1. Algebra (20 hrs)
 - 1.1 Permutations and Combinations, Value of “ p_r ” and “ c_r ”, its properties and simple problems
 - 1.2 Binomial theorem (without proof) for positive integral index (expansion and general term); Binomial theorem for any index (expansion only) first and second binomial approximation with application to engineering problems
 - 1.3 Partial fractions (linear factors, repeated linear factors, non reducible quadratic factors)
 - 1.4 Determinants and Matrices – expansion of determinants (upto third order) using sarrus rule, expansion method and pivotal’s condensation method. Properties of determinants, solution of equations (upto 3 unknowns) by Cramer’s rule. Definition of matrix, addition, subtraction and multiplication of matrices (upto third order). Inverse of a matrix by adjoint method and elementary row transformations. Solution of equations (up to 3 unknowns) by Matrix method
 - 1.5 Logarithm: general properties of logarithms, calculations of engineering problems using log tables
2. Trigonometry (11 hrs)
 - 2.1 Addition and Subtraction formulae, Product formulae and their application in engineering problems. Transformation from product to sum or difference of two angles or vice versa, multiple and sub-multiple angles
 - 2.2 Conditional identities, solution of triangles (excluding ambiguous cases).
 - 2.3 Graphs of $\sin x$, $\cos x$, and $\tan x$, e_x
3. Vectors (11 hrs)

Definition of vector and scalar quantities, Addition and subtraction of vectors. Dot product and cross product of two vectors. Thumb rule. Angle between two vectors, application of dot and cross product in engineering problems, scalar triple product and vector triple product
4. Complex Numbers (9 hrs)

Definition, Real and Imaginary parts of a complex number, Polar and Cartesian representation of a complex number and conversion from one form to the other, conjugate

of complex number, modulus and argument of a complex number, addition, subtraction, multiplication and division of a complex number.

5. Statistics and Probability (13 hrs)

Evaluation of standard deviation and process capabilities Rank, Rank correlation, probability: definition and laws on probability, concept of random variable, probability distribution (Binomial, Poisson and Normal) and their applications. Drawing control charts for average (\bar{x}) and range (R)

RECOMMENDED BOOKS

1. Applied Mathematics Vol. I by SS Sabharwal and Others by Eagle Prakashan, Jalandhar
2. Applied Mathematics Vol. II by SS Sabharwal and Others by Eagle Prakashan, Jalandhar
3. Engineering Mathematics Vol. I by Ishan Publishing House
4. Engineering Mathematics Vol. I by S Kohli and Others; IPH, Jalandhar
5. Applied Mathematics Vol. I by RD Sharma
6. Engineering Mathematics by Dass Gupta
7. Advanced Engineering Mathematics by AB Mathur and VP Jagi; Khanna Publishers, Delhi
8. Higher Engineering Mathematics by BS Grewal; Khanna Publishers, Delhi
9. Engineering Mathematics by C Dass Chawla; Asian Publishers, New Delhi

1.3 APPLIED PHYSICS – I

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects 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 (6 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, coefficient of viscosity and strain)
 - 1.5 Principle of homogeneity
 - 1.6 Dimensional equations and their applications, conversion from one unit to another unit for density, force, pressure, work, power, energy, velocity, acceleration
 - 1.7 Limitations of dimensional analysis
2. Force and Motion (8 hrs)
 - 2.1 Scalar and vector quantities – examples, addition and multiplication (scalar product and vector product) of vectors
 - 2.2 Force, resolution and composition of forces – resultant, parallelogram law of forces
 - 2.3 Equilibrium of forces, Lami's theorem
 - 2.4 Newton's Laws of motion – concept of momentum, Newton's laws of motion and their applications, determination of force equation from Newton's second law of motion; Newton's third law of motion conversion of momentum, impulse and impulsive forces, simple numerical problems based on third law.
 - 2.5 Projectile, horizontal and oblique projections and equation of trajectory
 - 2.6 Derivation of time of flight, maximum height and horizontal range
 - 2.7 Circular motion
 - 2.8 Relation between linear and angular velocity and linear acceleration and angular acceleration
 - 2.9 Centripetal force (derivation) and centrifugal force

- 2.10 Banking of roads
3. Work, Power and Energy (8 hrs)
- 3.1 Work: definitions and its SI units
- 3.2 Work done in moving an object on horizontal and inclined plane (incorporating frictional forces)
- 3.3 Power: definitions and its SI units, calculation of power in simple cases
- 3.4 Energy: Definitions and its SI units: Types: Kinetic energy and Potential energy, with examples and their derivation
- 3.5 Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another
4. Properties of Matter (8 hrs)
- 4.1 Elasticity, definition of stress and strain
- 4.2 Different types of modulus of elasticity
- 4.3 Explanation of stress – strain diagram
- 4.4 Pressure – its units, gauge pressure, absolute, atmospheric pressure, Bourdon's pressure, manometers and barometer gauges
- 4.5 Surface tension – its units, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension
- 4.6 Fluid motion, stream line and turbulent flow, Reynolds number
- 4.7 Viscosity and coefficient of viscosity; derivation of terminal velocity; effect of temperature on viscosity
5. Waves and vibrations (8 hrs)
- 5.1 Generation of waves by vibrating particles
- 5.2 Wave motion with examples
- 5.3 Types of wave motion, transverse and longitudinal wave motion with examples
- 5.4 Velocity, frequency and wave length of a wave (relationship $v = \eta\lambda$)
- 5.5 Sound and Light waves
- 5.6 Simple harmonic motion: definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M.
- 5.7 Vibration of cantilever and beam, determination of time period of a cantilever
- 5.8 Free, forced and resonant vibrations with examples

6. Rotational Motion (5 hrs)
- 6.1 Definitions of torque, moment of inertia, radius of gyration
 - 6.2 Derivation of rotational kinetic energy and angular momentum
 - 6.3 Conservation of angular momentum (qualitative)
 - 6.4 Theorems of parallel and perpendicular axes
7. Gravitation and satellites (8 hrs)
- 7.1 Kepler's law of planetary motion
 - 7.2 Newton's law of gravitation
 - 7.3 Escape velocity (derivation)
 - 7.4 Satellites, Geo-stationary satellite
8. Temperature and its measurement (5 hrs)
- 8.1 Principles of measurement of temperature and different scales of temperature
 - 8.2 Difference between heat and temperature on the basis of K.E. of molecules
 - 8.3 Bimetallic and Platinum resistance thermometer: their merits and demerits
 - 8.4 Pyrometers – Disappearing filament optical pyrometer
9. Transfer of Heat (8 hrs)
- 9.1 Modes of transfer of heat (conduction, convection and radiation with examples)
 - 9.2 Coefficient of thermal conductivity, determination of thermal conductivity of good conductor (Searle's method) and bad conductor (Lee's disc method)
 - 9.3 Properties of heat radiation
 - 9.4 Stefan's law, Kirchhoff's law, Wien's law, Planck's back radiation law
 - 9.5 Prevost's theory of heat exchange

LIST OF PRACTICALS

1. To find the thickness of wire using a screw gauge
2. To find volume of solid cylinder and hollow cylinder using a vernier caliper
3. To determine the thickness of glass strip and radius of curvature of a concave surface using a spherometer
4. To find the surface tension of a liquid by capillary rise method
5. To determine and verify the time period of cantilever by drawing graph between load (w)
6. To determine the atmospheric pressure at a place using Fortin's Barometer
7. To determine the coefficient of linear expansion of a metal rod

8. To find the coefficient of thermal conductivity of copper using Searle's conductivity apparatus
9. To find the coefficient of thermal conductivity of Bakelite sheet (bad conductor) by Lee's Disc Method

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 Holiday, Asian Books Pvt. Ltd., New Delhi
10. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi

1.4 APPLIED CHEMISTRY – I

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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. Language of Chemistry (6 hrs)
 - 1.1 Definition of symbol, formula, valency and chemical equation.
 - 1.2 Writing of the chemical formula of a simple chemical compound. Calculation of percentage composition of chemical compound
 - 1.3 Essentials of a chemical equation, balancing of a chemical equation by Hit and Trial method
2. Chemical Bonding (4 hrs)
 - 2.1 Electronic concept of valency
 - 2.2 Elementary account of electrovalent, covalent and coordinate bond formation on the basis of the electronic concept of valency with the help of suitable examples to each
3. Water (10 hrs)
 - 3.1 Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) in industrial use (ii) boilers for steam generation.
 - 3.2 Methods to remove hardness of water (i) Clark's Process (ii) Permutit Process (iii) Soda Lime process (iv) Ion-Exchange 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.
 - 3.4 Qualities of water used for drinking purposes, treatment of river water to make it fit for town supply
4. Solutions (6 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
- 4.2 Strength of a solution (i) Normality (ii) Molarity (iii) Molarity as applied in relation to a solution.
- 4.3 Simple numerical problems related to volumetric analysis
- 4.4 Definition of pH, and different industrial applications of pH
- 5. Electrolysis (6 hrs)
 - 5.1 Definition of the terms: Electrolytes, Non-electrolytes conductors and non-conductors with suitable examples
 - 5.2 Faraday's Laws of Electrolysis
 - 5.3 Simple numerical problems based upon the laws of electrolysis
 - 5.4 Different account of (i) lead acid battery and (ii) Ni-Cd battery with special reference to their reaction mechanisms.

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. Determine the strength of a given solution of sodium hydroxide with the help of a standard solution of oxalic acid
- 4. Determine the strength of solution of HCl with the help of a solution of NaOH and an intermediate solution of standard oxalic acid
- 5. Find the amount of chlorides in mg per liter in a sample of H₂O with the help of a solution of AgNO₃
- 6. Determine the degree of temporary hardness of water by O' Hehner's method
- 7. Estimate the amount of Cu in a sample of CuSO₄ using a standard solution of Na₂S₂O₃
- 8. Estimate of amount of iron in hematite ore volumetrically
- 9. Estimate of total alkalinity of water volumetrically
- 10. Determine conductance, pH of water sample using conductance bridge and pH meter

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 Other; 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

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 environment, 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; holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

1. *Teaching of theory should be dovetailed with practical work*
2. *The following topics may be taught in the laboratory along with the practical exercises.*

DETAILED CONTENTS

1. Information Technology – its concept and scope
2. Computers for information storage, information seeking, information processing and information transmission
3. Elements of computer system, computer hardware and software; data – numeric data, alpha numeric data; contents of a program, processing
4. Computer organization, block diagram of a computer, CPU, memory
5. Input devices; keyboard, mouse etc; output devices; VDU and Printer, Scanner, Plotter
6. Electrical requirements, inter-connections between units, connectors and cables
7. Secondary storage; magnetic disk – tracks and sectors, optical disk (CD and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
8. Exercises on file opening and closing; memory management; device management and input - output (I/O) management with respect of windows
9. Installation concept and precautions to be observed while installing the system and software
10. Introduction about Operating Systems such as MS-DOS and Windows
11. Special features, various commands of MS word and MS-Excel
12. About the internet – server types, connectivity (TCP/IP, shell); applications of internet like: e-mail and browsing
13. Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)

14. 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 and loading the system software and application software
4. Installation of DOS and simple exercises on TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP commands
5. Exercises on entering text and data (Typing Practice)
6. Installation of Windows 98 or 2000 etc.
 - (1) 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 footnote, end note, use of comments
- 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, formulas to calculate values, format data, create chart, printing chart, save worksheet, switching from another spread sheet
- 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 analyzes data
- Using a list to organize data, sorting and filtering data in list
- Retrieve data with MS – query: Create a pivot table, customizing a pivot table. Statistical analysis of data
- Customize MS-Excel:
How to change view of worksheet, outlining a worksheet, customize workspace, using templates to create default workbooks, protecting work book

- Exchange data with other application: linking and embedding, embedding objects linking to other applications, import, export documents.

9. 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 a 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 Hal 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

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. SP46 – 1988 should be followed
 4. Instruction 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. Different types of Lines and Free Hand Sketching (1sheet)
 - 2.1 Different types of lines in engineering drawing as per BIS specifications
 - 2.2 Practice in free hand sketching of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, small and large circles, parabolas, curves and ellipses
3. Lettering Techniques and Practice (2sheets)
 - 3.1 Instrumental single stroke (capital and inclined) lettering of 35 mm height in the ratios of 7:4
 - 3.2 Instrumental double stroke lettering of 35 mm height in the ratio of 7:4, vertical
 - 3.3 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
4. Dimensioning (1 sheet)
 - 4.1 Necessity of dimensioning, terms and notations – methods and principles, dimensioning small components as in 4.2 below (mainly theoretical instructions)
 - 4.2 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

5. Scale (3 sheets)
 - 5.1 Scales – their need and importance, Definition of representative fraction (RF); Find RF of a given scale
 - 5.2 Types of scales
 - 5.3 Construction of plain and diagonal scales
6. Principle of Projections (strictly in first angle projection)(8sheets)
 - 6.1 Principle of orthographic projection
 - 6.2 projection of points situated in different quadrants
 - 6.3 Projection of lines, Lines inclined to one plane and parallel to the other and vice versa
 - 6.4 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
 - 6.5 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
 - 6.6 Drawing 3 orthographic views of given objects (at least five objects)
 - 6.7 Drawing 6 views of given objects (non-symmetrical one or two objects may be selected for this exercise)
 - 6.8 Identification of surfaces on drawn orthographic views from isometric object drawn
 - 6.9 Exercises on missing lines, surfaces and views
 - 6.10 Sketching practice of pictorial views from isometric objects
7. Sectional views (2 sheets)

Need for sectional views – cutting planes methods of representing sections, conventional sections of various material, classification of sections, conventions in sectioning

Drawing of full section, half section, partial broken out sections, off-set sections, revolved sections and removed sections. Exercises on sectional views of different isometric views

Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
8. Isometric Views (2 sheets)
 - 8.1 Fundamentals of isometric projections (theoretical instructions)
 - 8.2 Isometric views from 2 or 3 given orthographic views
9. Introduction to Third angle projection (1 sheet)

1. Elementary Engineering Drawing (in first angle projection) by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh, Published by Dhanpat Rai and Co., New Delhi
3. Engineering Drawing by PS Gill, Published by SK Kataria and Sons, Delhi

1.7 and 2.7 GENERAL WORKSHOP PRACTICE – I and II

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I	-	-	6	
II	-	-	6	

RATIONALE

Manual abilities to handle engineering materials with hand tools need to be developed in the students. They will be using different types of tools/equipment in different shops for fabrication purposes. Besides developing the necessary skills, the students will appreciate the importance of quality and safety measures.

DETAILED CONTENTS

Note:

1. 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.
2. The shops to be offered in I and II semester may be decided at polytechnic level
3. The students should be taken to various shops (not included in the curriculum) in the polytechnic in batches and should be given knowledge of the various machines/equipment. Such as machine shop, foundry shop, sheet metal shop, etc.
4. **Students of diploma in computer Engineering and information Technology will undergo shops 2,6 and 7 only**

Following seven shops are being proposed:

1. **Carpentry shop**
2. **Fitting and plumbing shop**
3. **Welding Shop**
4. **Paint Shop**
5. **Forging and sheet metal shop**
6. **Electric shop**
7. **Electronics shop**

1. **Carpentry Shop**

- 1.1 Introduction to various types of wood, carpentry tools – their identification with sketches. Different types of wood joints.
- 1.2 Simple operations viz. hand sawing, marking, planning
- 1.3 Introduction and sharpening of wood working tools and practice of proper adjustment of tools
- 1.4 Demonstration and use of wood working machines i.e. band saw, circular saw, rip saw, bow saw and trammels. Universal wood working machine and wood turning lathe
- 1.5 Making of various joints (Also draw the sketches of various wooden joints in the Practical Note Book)
 - a) Cross lap joint
 - b) T-lap joint
 - c) Corner lap joint
 - d) Mortise and tenon joint
 - e) Dovetail joint
 - f) Prepare a file handle or any utility items by wood turning lathe

2. **Fitting and Plumbing shop**

- 2.1 Introduction to fitting shop, common materials used in fitting shop, description and demonstration of various types of work-holding devices and surface plate, V-block
- 2.2 Demonstration and use of simple operation of hack-sawing, demonstration of various types of blades and their uses
- 2.3 Demonstrate and use of all important fitting shop tools with the help of neat sketches (files, punch, hammer, scraper, taps and dies etc.)
- 2.4 Introduction of chipping, demonstration on chipping and its applications. Demonstration and function of chipping tools.
- 2.5 Description, demonstration and practice of simple operation of hack saw, straight and angular cutting
- 2.6 Demonstrations description and use of various types of blades – their uses and method of fitting the blade.
- 2.7 Introduction and use of measuring tools used in fitting shop like: Try square, Steel rule, Measuring Tape, Outside micrometer, Vernier Calipers and Vernier height Gauge
- 2.8 Description, demonstration and practice of thread cutting using taps and dies

- 2.9 Plumbing: Descriptions and drawing of various plumbing shop tools, Safety precautions, Introduction and demonstration of pipe dies, Pipe holding devices, Demonstration and practice of Pipe Fittings such as Sockets, Elbow, Tee, Reducer, Nipple, Union coupling, plug, Bend, Float valves and Taps

Job: Cutting and filing practice on a square of 45 X 45 mm² from MS flat

Job: Angular cutting Practice of 45⁰ (on the above job)

Job: Preparation of stud (to out external threads) with the help of dies (mm or BSW)

Job: Drilling, counter drilling and internal thread cutting with Taps

Job: H-Fitting in Mild steel (ms) square

Job: Pipe cutting Practice and thread cutting on GI Pipe with pipe dies

3. **Welding Shop**

- 3.1 Introduction to welding, type of welding, common materials that can be welded, introduction to gas welding equipment, types of flame, adjustment of flame, applications of gas welding. Welding tools and safety precautions

- 3.2 Introduction to electric arc welding (AC and DC), practice in setting current and voltage for striking proper arc, precautions while using electric arc welding. Applications of arc welding. Introduction to polarity and their use

- 3.3 Introduction to brazing process, filler material and fluxes; applications of brazing. Use of solder. Introduction of soldering materials

- 3.4 Demonstrate and use of the different tools used in the welding shop with sketches. Hand shield, helmet, clipping hammer, gloves, welding lead, connectors, apron, goggles etc.

- 3.5 Demonstration of welding defects and various types of joints and end preparation

Job: Preparation of cap joint by arc welding

Job: Preparation of Tee joint by arc welding

Job: Preparation of single V or double V butt joint by using Electric arc welding

Job: Brazing Practice. Use of Speltor (on MS sheet pieces)

Job: Gas welding practice on worn-out and broken parts

4. **Paint shop**

Introduction of painting shop and necessity, Different types of paints. Introduction of powder coating plant their uses.

Job: Preparation of surface before painting such as cleaning, Sanding, putty, procedure and application of primer coat, and painting steel item.

Job: Painting practice by rush on MS sheet

Job: Practice of dip painting

Job: Practice of lettering: Name plates / Sign board

Job: Polishing and painting on wooden and metallic surfaces

Job: Practical demonstration of powder coating

5. Forging and sheet metal shop

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

- 5.1 Forge a L hook or Ring from MS rod 6 mm ϕ
- 5.2 Forge a chisel and give an idea of hardening and tempering
- 5.3 Lap joint with forge welding
- 5.4 High strength steel (HSS) tools – forging of Lathe shaper tools like side-tools and V-shape tools
- 5.5 Making sheet metal joints
- 5.6 Making sheet metal tray or a funnel of a computer chassis
- 5.7 Preparation of sheet metal jobs involving rolling, shearing, creasing, bending and cornering
- 5.8 Prepare a lap riveted joint of sheet metal pieces

6. Electric Shop

- 6.1 Demonstration of tools commonly used in Electric Shop
- 6.2 Safety precautions, electric shock treatment
- 6.3 Demonstration of Common Electric material like: wires, fuses, ceiling roses, battens, cleats and allied items
- 6.4 Demonstration of Voltmeter, Ammeter, Multimeter and Energy meter
 - Job: Wiring practice in batten wiring, plastic casing-capping and conduit
 - Job: Control of one lamp by one switch
 - Job: Control of one lamp by two Switches
 - Job: Control of one bell by one switch
 - Job: Assemble a Tube light
 - Job: Dismantle, study, find out fault, repair the fault, assemble and test domestic appliances like electric iron, electric mixer, ceiling and table fan, tube-light, water heater (geyser) and desert cooler
 - Job: Laying out of complete wiring of a house (Single-phase and Three-phase)

7. Electronics Shop

- 7.1 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.
- 7.2 Identification, familiarization and uses of commonly used tools; active and passive components; colour code and types of resistor and potentiometers
- 7.3 Cut, strip, join and insulate two lengths of wires/cables (repeat with different types of cables/wires)
- 7.4 Demonstrate and practice the skill to remove components/wires by unsoldering
- 7.5 Cut, bend, tin component, leads, inserts. Solder components e.g. resistor, capacitor, diodes, transistors on a PCB
- 7.6 Wiring of a small circuit on a PCB/tag strip involving laying, sleeving and use of identifier tags
- 7.7 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
- 7.8 Exposure to modern soldering and de-soldering processes (Field visits)
- 7.9 De-solder pump, remove and clean all the components and wires from a given equipment a PCB or a tag strip

Rationale

Interpersonal communication is a natural and necessary part of organizational life. Yet communicating effectively can be challenging because of our inherent nature to assume, overreact to and misperceive what actually is happening. Poor or lack of communication is often cited as the cause of conflict and poor teamwork. In today's team-oriented workplace, managing communication and developing strategies for creating shared meaning are crucial to achieving results and creating successful organizations. The goal of the *Communicating Effectively in English* course is to produce civic-minded, competent communicators. To that end, students must demonstrate oral as well as written communication proficiency. These include organizational and interpersonal communication, public address and performance.

II SEMESTER 48 hrs**1. LISTENING COMPREHENSION 4hrs**

- 1.1 Locating Main Ideas in a Listening Excerpt
- 1.2 Note-taking

2. ORAL COMMUNICATION SKILLS 14 hrs

- 2.1 Offering-Responding to Offers
- 2.2 Requesting-Responding to Requests
- 2.3 Congratulating
- 2.4 Expressing Sympathy and Condolences
- 2.5 Expressing Disappointments
- 2.6 Asking Questions-Polite Responses
- 2.7 Apologizing, Forgiving
- 2.8 Complaining
- 2.9 Persuading
- 2.10 Warning
- 2.11 Asking for and Giving Information
- 2.12 Giving Instructions
- 2.13 Getting and Giving Permission
- 2.14 Asking For and Giving Opinions

3. GRAMMAR AND USAGE 10hrs

- 3.1 Prepositions
 - 3.2 Pronouns
 - 3.3 Determiners
 - 3.4 Conjunctions
 - 3.5 Question and Question Tag
 - 3.6 Tenses (Simple Present, Simple Past)
- *One chapter revising the topics discussed during the first semester.
(Punctuation, Articles, Framing questions, Verbs, Word formation)

4. WRITING SKILLS 10hrs

- 4.1 Writing Notice
- 4.2 Writing Circular
- 4.3 Writing a Memo
- 4.4 Agenda for a Meeting
- 4.5 Minutes of the Meeting
- 4.6 Telephonic Messages

* Writing a paragraph will be a continuous exercise through out the session.
(Writing will be based on verbal stimuli, tables and graphs.)

5. READING SKILLS 10hrs

5.1 Vocabulary Enhancement

5.2 Techniques of reading: Skimming, Scanning, Intensive and Extensive Reading

NOTE: The Reading Skills of the learners (along with vocabulary enhancement) will be through reading thematic articles/essays and/or stories.

2.2 APPLIED MATHEMATICS – II

L T P
4 1 -

RATIONALE

Applied Mathematics forms the backbone of engineering discipline. Basic elements of differential calculus, integral calculus, differential equations and coordinate geometry have been included in the curriculum as foundation course and to provide base for continuing education to the students

DETAILED CONTENTS

- 1 Co-ordinate Geometry (18 hrs)
- 1.1 Area of a triangle, centroid and incentre of a triangle (given the vertices of a triangle), Simple problems on locus
- 1.2 Equation of straight line in various standard forms (without proof) with their transformation from one form to another, Angle between two lines and perpendicular distance formula (without proof)
- 1.3 Circle: General equation and its characteristics given:
- The center and radius
 - Three points on it
 - The co-ordinates of the end's of the diameter
- 1.4 Conics (parabola, ellipse and hyperbola), standard equation of conics (without proof), given the equation of conic to calculate foci, directrix, eccentricity, latus return, vertices and axis related to different conics Differential Calculus
2. Differential Calculus (22 hrs)
- 2.1 Concept of function, four standard limits
- $$\lim_{x \rightarrow a} (x^n - a^n) / (x - a), \quad \lim_{x \rightarrow 0} \sin x/x, \quad \lim_{x \rightarrow 0} (a^x - 1)/x, \quad \lim_{x \rightarrow 0} (1+x)^{1/x}$$

2.2 Concepts of differentiation and its physical interpretation

- Differentiation by first principle of x^n , $(ax + b)^n$, $\sin x$, $\cos x$, $\tan x$, $\sec x$, $\operatorname{cosec} x$ and $\cot x$, e^x , a^x , $\log x$, differentiation of a function of a function and explicit and implicit functions
- Differentiation of sum, product and quotient of different functions
- Logarithmic differentiation, Successive differentiation excluding n^{th} order

2.3 Application of derivatives for (a) rate measure (b) errors (c) real root by Newton's method (d) equation of tangent and normal (e) finding the maxima and minima of a function (simple engineering problems)

3. Integral Calculus (16 hrs)

3.1 Integration as inverse operation of differentiation

3.2 Simple integration by substitution, by parts and by partial fractions

3.3 Evaluation of definite integrals (simple problems) by explaining the general properties of definite integrals

3.4 Applications of integration for

- Simple problem on evaluation of area under a curve where limits are prescribed
- Calculation of volume of a solid formed by revolution of an area about axis (simple problems) where limits are prescribed
- To calculate average and root mean square value of a function
- Area by Trapezoidal Rule and Simpson's Rule

4. Differential Equations (8 hrs)

Solution of first order and first degree differential equation by

- Variable separation
- Homogeneous differential equation and reducible homogeneous differential equations
- Linear differential equations and reducible linear differential equations

RECOMMENDED BOOKS

1. Higher Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
3. Engineering Mathematics vol. II by S Kohli and others, IPH, Jalandhar
4. Engineering Mathematics by Ishan Publication
5. Applied Mathematics Vol. II by SS Sabharwal and Others; Eagle Parkashan, Jalandhar
6. Engineering Mathematics by IB Prasad
7. Applied Mathematics Vol. II by Dr RD Sharma
8. Advanced Engineering Mathematics by AB Mathur and VP Jai; Khanna Publishers, Delhi
11. Engineering Mathematics by C Dass Chawla; Asian Publishers, New Delhi

2.3 APPLIED PHYSICS – II

L T P
3 - 2

RATIONALE

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

DETAILED CONTENTS

1. Application of sound waves (6 hrs)
 - 1.1 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time
 - 1.2 Ultrasonics – production (magnetostriction and peizo-electric) and their engineering applications
2. Principle of optics (9 hrs)
 - 2.1 Introduction reflection of light, image formation in mirrors (convex and concave), refraction and refractive index, image formation in lenses, lens formulae (thin lens only), power of lens, total internal reflection
 - 2.2 Defects in image formation by lenses and their correction
 - 2.3 Simple and compound microscope, astronomical and Galileo telescope, magnifying power and its calculation (in each case)
 - 2.4 Overhead projector and slide projector
3. Electrostatics (9 hrs)
 - 3.1 Coulombs law, unit change
 - 3.2 Gauss’s Law
 - 3.3 Electric field intensity and electric potential

- 3.4 Electric field of point charge, charged sphere (conducting and non-conducting) straight charged conductor, plane charged sheet
- 3.5 Capacitance, types of capacitors, capacitance of parallel plate capacitor, series and parallel combination of capacitors
- 3.6 Dielectric and its effect on capacitors, dielectric constant and dielectric break down
- 4. Electricity (6 hrs)
 - 4.1 Ohm's law
 - 4.2 Resistance of a conductor, specific resistance, series and parallel combination of resistors, effect of temperature on resistance
 - 4.3 Kirchhoff's laws, wheatstone bridge principle and its applications
 - 4.4 Heating effect of current and concept of electric power
- 5. Semi conductor physics (9 hrs)
 - 5.1 Energy bands, intrinsic and extrinsic semi conductors, p-n junction diode and its characteristics
 - 5.2 Diode as rectifier – half wave and full wave rectifier, semi conductor transistor pnp and npn (concept only)
- 6. Modern Physics (9 hrs)
 - 6.1 Lasers: concept of energy levels, ionization and excitation potentials; spontaneous and stimulated emission; lasers and its characteristics, population inversion, type of lasers, helium – neon and ruby lasers and applications
 - 6.2 Fibre optics: introduction optical fiber materials, types , light propagation and applications
 - 6.3 Super conductivity: Phenomenon of super conductivity, effect of magnetic field, critical and, type I and type II super conductors and their applications)
 - 6.4 Energy sources – conventional and non-conventional (wind , water, solar, bio, nuclear energy), only elementary idea

LIST OF PRATICALS

- 1. To verify Ohm's law
- 2. To verify law of resistances in series and in parallel
- 3. To determine the magnifying power of a compound microscope
- 4. To determine the magnifying power of an astronomical telescope
- 5. To convert a galvanometer into an ammeter of a given range
- 6. To convert a galvanometer into a voltmeter of a given range
- 7. To find the wavelength of a He-ne laser

8. To find the frequency of a tuning fork by a sonometer
9. To study characteristics of a pn junction diode

RECOMMENDED BOOKS

1. Applied Physics Vol. II, TTI Publication Tata McGraw Hill, Dehi
2. Basic Applied Physics by RK Gaur; Dhanpat Rai Publicatio
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 Aroa; 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 Publicatio
9. Fundamentals of Physics by Resnick and Halidar, Asian Bookd Pvt. Ltd., New Delhi
10. Concepts in Physics by HC Verma; Bharti Bhawan Ltd., New Delhi

2.4 PROGRAMMING IN 'C' (Common with Information Technology)

L T P
2 - 2

RATIONALE

Computers play a vital role in present day life, more so, in the professional life of technician engineers. People working in field/computer industry use computers in solving problems more easily and effectively. In order to enable the students use the computers effectively in problem solving, this course offers the modern programming language C along with exposition to various applications of computers. The knowledge of C language will be reinforced by the practical exercises.

Note:

The subject is totally practical based. Students should be given clear idea about the basic concepts of

Programming. In practical session student should be asked to write algorithm and then write program for the Algorithm and run on computer. It is required that students should maintain records (files with printouts).

DETAILED CONTENTS

1. Algorithm and Programming Development (4 hrs)

- 1.1 Steps in development of a program
- 1.2 Flow charts, Algorithm development
- 1.3 Program Debugging

2. Program Structure (4 hrs)

- 2.1 I/o statements, assign statements
- 2.2 Constants, variables and data types
- 2.3 Operators and Expressions
- 2.4 Standards and Formatted

3. Control Structures (8 hrs)

- 3.1 Introduction
- 3.2 Decision making with IF – statement
- 3.3 While and do-while, for loop
- 3.5 Break and switch statements

4. Functions (4 hrs)

- 4.1 Introduction to functions
- 4.2 Global and Local Variables
- 4.3 Function Declaration
- 4.4 Standard functions
- 4.5 Parameters and Parameter Passing
- 4.6 Call – by value/reference

5. Arrays (4 hrs)

- 5.1 Introduction to Arrays
- 5.2 Array Declaration
- 5.3 Single and Multidimensional Array
- 5.4 Arrays of characters

6. Pointers (4 hrs)

- 6.1 Introductions to Pointers
- 6.2 Address operator and pointers
- 6.3 Declaring and Initializing pointers
- 6.4 Assignment through pointers
- 6.5 Pointers and Arrays

7. Structures and Unions (4 hrs)

- 7.1 Declaration of structures
- 7.2 Accessing structure members
- 7.3 Structure Initialization
- 7.4 Arrays of structure
- 7.5 Unions

LIST OF PRACTICALS

1. Programming exercises on executing and editing a C program.
2. Programming exercises on defining variables and assigning values to variables.
3. Programming exercises on arithmetic and relational operators.
4. Programming exercises on arithmetic expressions and their evaluation
5. Programming exercises on formatting input/output using printf and scanf.
6. Programming exercises using if statement.

7. Programming exercises using if – Else.
8. Programming exercises on switch statement.
9. Programming exercises on do – while statements.
10. Programming exercises on for – statement.

64

11. Programs on one-dimensional array.
12. Programs on two-dimensional array.
13. (i) Programs for putting two strings together.
(ii) Programs for comparing two strings.
14. Simple programs using structures.
15. Simple Programs using pointers.

RECOMMENDED BOOKS

1. Programming in C by Schaum Series, McGraw Hills Publishers.
2. Thinking in C by P.B.Mahapatra – Wheeler Pblcation
3. Exploring C by Yashwant Kanetkar – BPB Pblications
4. Programming in C by Stefin G. Coachin
5. Programming in C by R Subburaj, Vikas Publishing House Pvt. Ltd., Jangpura, New Delhi
6. Programming with C Language by C Balaguruswami, Tata McGraw Hill, New Delhi
7. Elements of C by M.H.Lewin,
8. Programming in C by Stephen G Kochan, TMH/Prentice Hall of India
9. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
10. Let Us C by Yashwant Kanetkar, BPB Publication, New Delhi

2.5 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 (6 hrs)
 - 1.1 Concept of engineering mechanics, definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields
 - 1.2 Concept of rigid body
2. Laws of forces (6 hrs)
 - 2.1 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces
 - 2.2 Parallelogram law of forces, triangle law of forces, polygon law of forces (graphically and analytically) resolution of forces, resolving a force into two rectangular components
 - 2.3 Free body diagram
 - 2.4 Equilibrium force and its determination
 - 2.5 Lami's theorem
3. Moment (6 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
- 3.5 Parallel forces (like and unlike) and calculating their resultant
- 3.6 Concept of couple, its properties and effects
- 3.7 General conditions of equilibrium of bodies under co-planar forces
- 3.8 Position of resultant force by moment
- 4. Friction (6 hrs)
 - 4.1 Definition and concept of friction, types 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 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
 - b) horizontally
 - c) at some angle with the inclined plane
- 5. Centre of Gravity (6 hrs)
 - 5.1 Concept, definition of center of gravity and centroid of plan figure and symmetrical solid body
 - 5.2 Determination of centroid of plain and composite lamina using moment method, 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
- 6. Application of the laws of motion (10 hrs)

Simple problems on second law of motion, piles, lift, bodies tied with strings
- 7. Simple machines (8 hrs)
 - 7.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machine
 - 7.2 Simple and compound machine

- 7.3 Definition of ideal machine, reversible and self locking machine
- 7.4 Effort lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 7.5 System of pulley (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 7.6 Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double purchase winch crab, expression for their velocity ratio and field of their application

Note: Simple problem/numerical may be included in all the above topics wherever feasible

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 a 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 winch crab
8. To find center of gravity of regular lamina
9. To find center of gravity of irregular lamina
10. To determine coefficient of friction between different surfaces on horizontal plane

RECOMMENDED BOOKS

1. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co.Ltd., New Delhi
2. Text Book in Applied Mechanics by MM Malhotra, R Subramanian, PS Gahlot and BS Rathore; Wiley Eastern Ltd., New Delhi
3. Engineering Mechanics by SS Bhavikatti, KG Rajashekarappa; Wiley Eastern Ltd., New Delhi
4. Engineering Mechanics and Strength of Materials by S Ramamurtham; Dhanpat Rai Publishing Co.(P) Ltd.

5. Engineering Mechanics by AB Basu; Tata McGraw Hill Publishing Co.Ltd.
6. Engineering Mechanics – Volume I and I by VS Mokashi; Tata McGraw Hill Publishing Co. LTD.
7. Elements of Strength of Materials by SP Timoshenko, DH Young; East West Press Pvt Ltd.
8. Schaum’s Outline Series – Theory and Problems of Strength of Materials by William A Nash, McGraw HILL Book Company
9. A Text Book of Applied Mechanics by NL Arora and RK Dhawan; India Publishing House, Delhi
10. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi
11. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi

2.6 ENGINEERING DRAWING – II

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. Detail and Assembly Drawing (2 sheets)
 - 1.1 Principle and utility of detail and assembly drawings

- 1.2 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortice and Tenon joint, Corner and Through halving joint, Closed Mortise and Tenon joint
2. Threads (3 sheets)
 - 2.1 Nomenclature of threads. Types of threads (metric), single and multiple start threads
 - 2.2 Forms of various external thread sections such as V, square and acme threads, BA, BSW and Knuckle, Metric, Seller Thread, Buttress Threads
 - 2.3 Simplified conventions of left hand and right hand threads, both external and internal threads
3. Locking Devices (1sheet)

Lock nuts, castle nuts, split pin nuts, sawn nuts, slotted nut
4. Nuts and Bolts (3 sheets)

Different views of hexagonal and square nuts; 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
5. Screws, Studs and Washers (1 sheet)
 - 5.1 Drawing various types of machine screws
 - 5.2 Drawing various types of studs and set screws
6. Keys and Cotters (3 sheets)
 - 6.1 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
 - 6.2 Cotter joints (i) sleeve and cotter joint (ii) gib and cotter joint (iii) knuckle joint (iv) Spigot and socket joint
7. Rivets and Riveted Joints (2 sheets)
 - 7.1 Types of structural and general purpose rivet heads
 - 7.2 Caulking and fullering of riveted joints
 - 7.3 Types of riveted joints – lap, butt (single riveted, double riveted lap joint, single cover plate and double cover plate), chain and zig – zag riveting
8. Welded Joints (1 sheets)
 - 8.1 Various conventions and symbols of welded joints (IS 696)

- 8.2 Practical applications of welded joints say joints on steel frames, windows, door and furniture
- 9. Couplings (2 sheets)
 - 9.1 Muff or Box coupling, half tap muff coupling
 - 9.2 Flange coupling (Protected and non-protected)
 - 9.3 Flexible coupling
- 10. Symbols and Conventions (2 sheets)
 - 10.1 Civil engineering sanitary fitting symbols
 - 10.2 Electrical fitting symbols for domestic interior installations
 - 10.3 Building plan drawing with electrical and civil engineering symbols
- 11. Development of Surfaces (3 sheets)
 - 11.1 Construction of geometrical figures such as square, pentagon, hexagon
 - 11.2 Development of surfaces of cylinder, square, pentagonal and hexagonal, Prism, Cone and Pyramid, Sequence pentagonal and hexa pyramid
- 12. Interpenetration of (2 sheets)
 - 12.1 Cylinder to Cylinder
 - 12.2 Cylinder to cone
- 13. AUTO CAD
 - 13.1 Concept of AutoCAD, Tool bars in AutoCAD, coordinate system, snap, grid, and ortho mode
 - 13.2 Drawing commands – point, line, arc, circle, ellipse
 - 13.3 Editing commands – scale, erase, copy, stretch, lengthen and explode
 - 13.4 Dimensioning and placing text in drawing area
 - 13.5 Sectioning and hatching
 - 13.6 Inquiry for different parameters of drawing entity

Note: A minimum of 15 sheets should be prepared by each student

RECOMMENDED BOOKS

1. Elementary Engineering Drawing (in first angle projection) by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh Published by Dhanpat Rai and Co. Delhi
3. Engineering Drawing by PS Gill; published by SK Kataria and Sons; New Delhi

3.1 METROLOGY

L T P
3 - 2

- 1.) **Introduction to Metrology** **(4 Hrs)**
 Definition of Metrology, Necessity of Metrology & its objectives, Errors likely to creep in precision measurement i.e. the effect of environment temperature, dirt, vibration, errors due to looseness & wear, precision & Accuracy, Standard of measurement.
- 2.) **Linear Measurement** **(5 Hrs)**
 Working principle and constructional details of:
 - a.) Engineering Scale
 - b.) Vernier Calliper
 - c.) Micrometer
 - d.) Height Gauge and Depth Gauge
 - e.) Dial Indicator
 - f.) Comparators
 - g.) Slip Gauges
- 3.) **Angular and Taper Measurements** **(6 Hrs)**
 Introduction
 Instruments for Angular Measurement-Protractors, Sine Bar, Sine Table, Sine Centre, Clinometers, Optical instrument for angular measurements. Taper Measurement-Gauge for Taper, Taper measuring instruments
- 4.) **Screw Thread Measurement** **(5 Hrs)**
 Introduction, Classification of Threads, Elements of screw threads, Specification of screw threads, Forms of Threads, Errors in Threads, Measuring elements of a screw thread- External screw thread measurement. Internal screw thread measurement. Screw thread Gauge
- 5.) **Gear Measurement** **(6 Hrs)**
 Introduction. Types of Gears, Forms of Gear teeth, Gear tooth Terminology. Involute curve. Measurement and testing of gears using-Verniers, Profile Projectors, Tool Maker's Microscope
- 6.) **Measurement of Surface Finish** **(8Hrs)**
 Introduction, Surface Texture, Methods of measuring surface finish, Surface Inspection by comparison methods-Touch inspection. Visual inspection, Scratch inspection, Microscopic inspection, Surface photographs, Comparison by standard specimens, Direct instrument measurement, Intersection method, Interference method, Stylus method, Indication of Surface Roughness symbols used

- 7.) **Straightness, Flatness, Squareness and Parallelism** (8Hrs)
Introduction, Straightness, Measurement of straightness. Straight edge method, Wedge method, The level method The Autocollimator method, Flatness, Definition, Flatness measurement using, Direct comparison, Dial gauge, Flatness comparators, Liquid methods, Autocollimator or Level method, Squareness, Engineers square, Indicator method, Autocollimator method, Parallelism

Recommended Books :

- 1.) A.J.T.Scarr, Metrology & Precision Engineering, Mcgraw Hill, N.York
- 2.) R.K.Jain, Engineering Metrology, Khanna Publishers, New Delhi
- 3.) Khare & Vajpayee, Dimensional Metrology, New Delhi
- 4.) O.P.Khanna, Metrology & Instrumentation, Dhanpat Rai Publication.

List of Practicals

- 1.) Use of linear measuring instruments like vernier caliper and micrometer.
- 2.) Use of height gauge and depth gauge.
- 3.) Measurement with the help of combination set and bevel protractor.
- 4.) Angle measurement by use of sine bar and slip gauges.
- 5.) Use of comparator for measurement.
- 6.) Measurement of taper by standard balls and rollers.
- 7.) Measurement of thread parameters by using tool maker's microscope.
- 8.) Measurement of gear elements by using tooth vernier.
- 9.) Measurement of profile by profile projector.
- 10.) Measurement of surface roughness of a surface.

3.2 STRENGTH OF MATERIALS

L T P
3 1 2

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the required materials 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. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles to the solution of applied problems to develop the required competencies.

DETAILED CONTENTS

1. Stresses and strains

(6 hrs)

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

2. Resilience and Instantaneous Stress

(5 hrs)

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

3. Beams and Bending Stress

(6 hrs)

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

4. Moment of Inertia

(6 hrs)

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

5. Bending Stress

(7 hrs)

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

6. Springs

(4 hrs)

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

7. Columns

(5 hrs)

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

- Rankine Gourdan formula (without derivation)
- Numerical problems

8. Torsion

(7 hrs)

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

LIST OF PRACTICALS

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

RECOMMENDED BOOKS

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

3.3 BASIC OF ELECTRICAL AND ELECTRONICS ENGINEERING

L T P
3 1 2

RATIONALE

The objective of the course is to impart basic knowledge and skills regarding electrical engineering, which diploma holders will come across in their professional life

DETAILED CONTENTS

1. Application and Advantage of Electricity (4 hrs)
Difference between AC and DC, various applications of electricity, advantages of electrical engineering over other types of energy
2. Basic Quantities of Electricity (4 hrs)
Definition of voltages, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit
3. Electromagnetic Induction (4 hrs)
Production of e.m.f., idea of a transformer and its working principle
4. Distribution System (8 hrs)
Difference between high and low voltage distribution system, identification of three-phase wire, neutral wires and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply
5. Domestic Installation (7 hrs)
Distinction between light and fan circuits and single phase power circuit, sub-circuits, various accessories and parts of electrical installation. Identification of wiring systems. Common safety measures and earthing
6. Electric Motor (9 hrs)
Definition and various applications of single-phase and three-phase motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor
7. Electrical Safety (5 hrs)
Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs
8. Basic Electronics (7 hrs)
Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, their characteristics and uses, characteristics and application of a thyristor, characteristics and applications of servo motors.

LIST OF PRACTICAL

1. Connection of a three-phase motor and starter with fuses and reversing of direction of rotation

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

RECOMMENDED BOOKS

1. Basic Electrical Engineering by PS Dhongal; Tata McGraw Hill Publishers, New Delhi
2. A Text Book of Electrical Technology, Vol, I and II by BL Thareja; S Chand and Co., New Delhi
3. Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
4. Basic Electrical Engineering by JB Gupta, S Kataria and Sons, Delhi
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi
6. Basic Electronics by VK Mehta; S Chand and Co., New Delhi
7. Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi

3.4 WORKSHOP TECHNOLOGY – I

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3 - -

RATIONALE

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

DETAILED CONTENTS

1. Welding Process (2 hrs)
 - Principle of welding
 - Welding positions and techniques, symbols.
2. Gas Welding (3 hrs)
 - Types of gas welding flames and their applications
 - Gas welding equipments- Gas welding torch, Oxy – acetylene cutting torch, Blowpipe, Pressure regulators, Filler rods and fluxes.
3. Arc Welding (3 hrs)
 - Arc welding machines and equipment
 - A.C. and D.C. arc welding
 - Effect of polarity, current regulation and voltage regulation
 - Electrodes; Classification, B.I.S. specification and selection
 - Flux for arc welding
4. Other Welding Processes (3 hrs)
 - Principle of resistance welding, working and applications of spot welding, seam welding, projection welding and percussion welding.
 - Welding defects and inspection of welded joints.
5. Modern Welding Methods (4 hrs)

Principle of operation, advantages, disadvantages and applications of:

 - Tungsten inert gas (TIG) welding
 - Metal inert gas (MIG) welding

- Thermit welding
 - Electro slag welding
6. Pattern Making (3 hrs)
- Types of pattern
 - Pattern material
 - Pattern allowances
 - Pattern codes as per B.I.S.
 - Introduction to cores, core boxes and core materials
 - Core making procedure
 - Core prints, positioning of cores
7. Moulding Sand (2 hrs)
- Properties of moulding sand, their impact and control of properties viz, permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility.
 - Various types of moulding sand.
8. Mould Making (3 hrs)
- Introduction to moulding tools
 - Types of moulds
 - Step involved in making a mould
 - Moulding boxes, hand tools used for mould making
 - Moulding processes: Bench moulding, floor moulding, pit moulding and machine moulding.
9. Special Casting Processes (2 hrs)
- Principles, working and applications of
- Dies casting: hot chamber and cold chamber
 - Centrifugal casting
10. Gating and Riser System
- Elements of gating system
 - Pouring basin, sprue, runner, gates
 - Types of risers, location of risers
 - Directional solidification
11. Casting Defects
- Different types of casting defects
 - Testing of defects: radiography, magnetic particle inspection, and ultrasonic inspection.
12. Lathe (8 hrs)
- Description and function of various parts of a lathe
 - Classification and specification of various types of lathe
 - Work holding devices

- Lathe operations: - Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling.
- Cutting parameters – speed, feed and depth of cut of various materials and for various operations, machining time.
- Lathe accessories:- Centers, dogs, chucks, collets, face plate, angle plate, mandrel, steady rest, taper turning attachment, tool post grinder

13. Drilling (4 hrs)

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

14. Boring (3 hrs)

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

15. Cutting Tools and Cutting Materials

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

REFERENCE BOOKS

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

8. Elements of Workshop Technology by S.K.Choudhary and Hazara; Asia Publishing House.

3.5 MACHINE DRAWING

73

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- - 6

RATIONALE

Diploma Holders are required to read and interpret drawings. Therefore it is essential that they have competency in preparing drawings and sketches of various machine parts. Therefore this subject is essentially required.

DETAILED CONTENT

1. Introduction

- Limits and Fits: Limit system – tolerance, limits, deviation, allowance, basic size, design size, tolerances-fundamental tolerances, fundamental deviation, method of placing of placing limit dimensions.

Fits: Clearance fit, transition fit, interference fit, hole basis system, shaft basis system, tolerance grades.

Calculating values of clearance/interference, hole tolerance and, shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6, H8/u7.

- Surface Roughness

Introduction-actual profile, reference profile, datum profile, mean profile, peak-to-valley height, mean roughness index, surface roughness number.

Use of machining symbols in production drawings, indication of surface roughness-indication of special surface roughness characteristics, indication of machining allowance, indication of surface roughness, symbols on drawings, method of indicating surface roughness on given components.

Indicating roughness on a component for:-

- i. Surface to be obtained by any production method.
- ii. Surface to be obtained without removal of material.

2. Shaft Couplings (2 sheets)

- Oldham coupling
- Universal coupling

3. Bearings (5 sheets)

- Bush bearing
- Foot step bearing
- Plummer block
- Self aligning bearing
- Brackets

4. Pipe Joints (5 sheets)

- Symbols for piping and layout plan of piping
- Flanged joint
- Socket and spigot joint
- Union joint
- Expansion pipe joint

5. I.C. engine parts (2 sheets)

- I.C. engine connecting rods
- I.C. engine pistons

6. Screw Jack

RECOMMEDED BOOKS

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

2. Machine Drawing by R.K.Dhawan; S.Chand and Company, Delhi.
3. Machine Drawing by R.B.Gupta; Satya Parkashan, New Delhi.
4. Machine Drawing by N.D.Bhatt; Charotar Publishing House.

- Note:**
1. The drawings should include dimensions with tolerances, wherever necessary, and material list according to B.I.S. specifications as per SP46: 1988.
 2. 25% of the drawing sheets should be drawn using AutoCAD.

3.6 WORKSHOP PRACTICE I

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- - 9

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in various machining processes, modern machining methods, processing of plastic, CNC machining, tool, jigs and fixtures is required to be imparted. Hence the subject of workshop practice.

LIST FO PRACTICALS

WELDING

1. Making following types of joints by gas welding
 - Preliminary joining practice
 - Vertical welding
2. Exercises of gas welding on the following
 - Aluminum
 - Brass
 - Copper
 - C.I.
3. Gas cutting of the following types
 - Preliminary gas cutting practice
 - Stock cutting by oxy acetylene
 - C.I. cutting
4. Making following type of joints by arc welding on M.S.C.I and aluminum
 - Joining practice by arc welding
 - Butt and lap joint (in vertical position, travel up and down).
 - Welding of outside corner joint.

- Inspection of the welding defects occurred in the job.
- 5. Exercise on spot welding.
- 6. Exercise on projection welding (industrial visit should be arranged).
- 7. Exercise on brazing.
- 8. Exercise on TIG welding.
- 9. Exercise on MIG welding.

FOUNDRY

- 10. Preparation of the following type of moulds.
 - Floor molding
- 11. Moulding and casting of
 - A solid pattern
 - A Split Pattern
- 12. Testing and inspection of casting defects visually.
- 13. Study of constructional features of coupla furnace.

TURNING

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

DRILLING AND FITTING

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

PATTERN MAKING

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

- Note:** 1. The Workshop Superintendent will prepare & finalize the specific drawings of all jobs in the beginning of semester in consultation with staff
2. The Institutions where foundry shop is not existing, they should arrange a visit to foundry industry in the nearby area.

4.1 CAM

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3 - 2

1. **Introduction to CAM** (4 hrs)
CAM, definition, History CAM development, Definition of CAM tool, Automation & CAM, Industrial look at CAM, CAM market trends
2. **Hardware in CAM** (6 hrs)
Introduction, Type of systems – Mainframe Based system. Minicomputer based system, Microcomputer based system, Workstation based system, Input Devices- Keyboards, Lightpens, Digitizing tablets, Mouse system, joystick, Trackballs & others. Output Devices-Graphics displays, Hardcopy printers & Plotters.
3. **Software in CAM** (8 hrs)
Introduction, Graphics standards, Basic definitions-Data structure, Data base, Data Management system, Coordinate System-Database coordinate system, Working coordinate system, screen coordinate system, Software development, Efficient use of CAM software, Software trends.
4. **Conventional numerical control** (6 hrs)
Introduction, Basic components of NC system, The NC Procedure, NC coordinate system, NC motion control system, Applications of NC, Economics of NC.
5. **NC part programming** (8 hrs)
Introduction, The punched tape in NC, Tape coding & format. Methods of part programming-Manual part programming, Computer-Assisted part programming, Advantages of CAM in NC programming
6. **Computer control in NC** (8 hrs)
Introduction, Problems with conventional NC ,NC controller technology, Types of control systems-Computerised numerical control, Direct numerical control, Adaptive control machining systems, Combined CNC & DNC systems

List Of Practicals

1. Four Programmes : Two Programmes on Lathe and Two Programmes on Milling
2. Four Jobs in Group Of Four Students
 - a) Plain turning, Facing, Threading
 - b) Plain Milling
 - c) Grooving, Profile Milling
3. Industrial Visit to Industry using CNC Machines.

RECOMMENDED BOOKS

1. CAD/CAM Theory and practice by Ibrahim Zeid, Tata McGraw Hill, N.Delhi
2. CAD/CAM . By Mikell P. Grover and Emory W,Zimmers, N.Delhi
3. CAD/CAM by Dr. Surender Kumar and A.K. Jha, Dhanpat Rai and sons

4.2 JIGS, FIXTURES AND GAUGES-DESIGN AND DRAWING

L T P
3 - 3

RATIONALE

Knowledge regarding design & drawing of jigs, fixtures and gauges is essential as fixtures help to achieve mass production of components/parts at relatively low cost. The subject enables the students to know about the practices being adopted for design of jigs, fixtures & gauges.

DETAILED CONTENTS

Section A

1. Jigs and Fixtures

(5 hrs)

Concept of jigs & fixtures, need and advantages, concept of interchangeability, classification of jigs & fixtures.

2. Location and Clamping devices

(7 hrs)

Basic principles of location, 3-2-1 principle of location, location for various services, location methods and devices. Concept of clamping and various clamping devices.

3. Drilling Jigs

(10 hrs)

Definition of a drilling jig. Drilling jig. Drilling bushes & their function. Types of drilling jigs such as box type, channel jig, latch jig, indexing jig.

4. Fixtures

(12 hrs)

Introduction to fixtures, types of fixtures such as milling fixture (single piece, gang milling) lathe and boring fixtures, grinding and welding fixture. Application of pneumatic in jigs and fixtures.

5. Limit gauges

(14 hrs)

Introduction to plain limit gauges, classification of limit gauges such as plug, ring & snap gauges. Brief description of thread gauges. Material selection. Taylor's principle of maximum & minimum material condition. Go and not-go ends of gauges and selection of gauge for inspection.

Section B (Design, Drawing & Practice)

6. Design and drawing of drilling jigs (at least 2 sheets)

(10 hrs)

7. Design and drawing of fixtures for milling (at least 2 sheets)

(10 hrs)

8. Design and drawing of limit gauges such as lug gauge, ring gauge and snap gauge (at least 1 each).

(12 hrs)

Note* The question paper on this subject will consist of two parts:

Section A will contain theory part to the extent of 40%

Section B will contain design & drawing to the extent of 60%

At least, 2 Industrial visit should be arranged in the related industry.

81

RECOMMENDED BOOKS

1. Prakash H Joshi, Press tools design & construction, Wheeler Publisher.
2. Donaldson, Fundamental of tool design.
3. Surrender Kr & Umesh Chandra, Production Engg. & Design, Satya Parkashan, New Delhi.
4. D.Engene Ostergard, Basic Die Making; McGraw Hill Book Co.
5. ASTME, "Fundamentals of Tool Design".
6. Handbook of Fixture Design, by Frank W. Wilson; McGraw Hill Book Company.

82

4.3 Material Science

L T P
3 - 2

- 1) Importance of materials (4 Hrs)**
 - a) Classification:- Metal and non metals, Ferrous and non ferrous metals and their alloys.
 - b) Properties of metal & alloy i.e. Physical properties :- Appearance, luster, colour, density and melting point
Mechanical properties:- Strength, stiffness, elasticity, Plasticity, Toughness, ductility, Malleability, brittleness, hardness, fatigue & creep.
 - c) Thermal and electrical conductivity
 - d) Corrosion, causes, effects and prevention.
- 2) Metallurgical Consideration (6 hrs)**
 - a) Solidification of metals from liquid to solid state of pure metals
 - b) Cooling curves of pure metals
 - c) Dendritic solidification
 - d) Crystal formation
 - e) Types of crystal structure
 - f) Phase diagram of :- (!) Solid – Solubility
(!!) Partial Solubility
(!!!) Nil Solubility i.e. Eutectic solution (Binary only)
 - g) Effect of all alloying element on engineering materials
 - h) Effect of grain size on mechanical properties
- 3) Ferrous Metals and Alloys (10 hrs)**
 - a) Flow diagram for the production of ferrous metals from their ores
 - b) Constituents of iron, Iron-carbon diagram
 - c) Classification, composition and uses of cast iron and plain carbon steel. IS, BS and SAE grades.

- d) Effects of alloying elements i.e. aluminium, chromium, nickel, cobalt, manganese molybdenum, tungsten, Vanadium, silicon, sulphur, and phosphorus steel.
- e) Composition, properties, grades and uses of special steel i.e. High speed steel, Stainlesssteel, heat resistant steel, spring steel.
- f) Identification of metals and alloys i.e. appearance, sound, weight, magnetic, spark, Bend and microstructure

4) Non ferrous metals, its alloys and other materials

- a) Copper :- properties and uses
- b) Composition, properties and uses of copper alloys.
- c) Brasses:- Cartridge brass, nickel silver
- d) Bronzes:- Phosphor bronze, Al-bronze, Mn-bronze and gun metal

83

- e) Properties and uses of aluminium and its alloys
- f) Properties and uses of lead, tin and magnesium
- g) Protective coating materials :- Paints, primers, varnishes, enamels, putti, electroplating materials, Teflon coating, sealant and adhesives
- h) Application & availability of sealant and adhesive for industrial user.

5) Heat Treatment & Iron-Carbon Diagram

- a) Heat Treatment itsd application
- b) Principle of heat treatment
- c) Heating & cooling
- d) Allotropic forms of iron, Various phase & their constituents, phase transformation
- e) Classification of iron, steel and cast iron group

6) Heat Treatment Processes (6 hrs)

- a) Common heat treatment processes for steel i.e. annealing, normalizing, hardening, and tempering .
- b) Tempering colour and temperatures
- c) Temperature range of heat treatment processes and rate of cooling
- d) Concept of Quenching
- e) Various Quenching media used in heat treatment.

7) TTT Curves (Isothermal Transformation) (6 hrs)

- a) Concept of TTT curve in heat treatment
- b) Transformation of various phases at constant temperature
- c) Procedure to describe transformation into various phases of steel with the help of TTT curves.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts in material lab, identify and indicate the type of materials with respect to their properties
2. Study of metallurgical microscope.
3. To prepare microscopic structure for examination and to examine the micro structure of specimens of various metals and alloys.
4. Study of heat treatment furnaces.
5. To study the effects of heat treatments processes on the following materials:

- (i) Low carbon steel
- (ii) Mild steel
- (iii) High Carbon Steel
- 6. Hardening & tempering of a chisel or similar item. Checking its hardness
- 7. (Full) Annealing of hardened chisel or similar item. Checking its hardness.
- 8. Prepare list of various types of steels used for tools & dies with BIS and BS designation and codes.
- 9. Prepare list of composition of various type of steels used for tools & dies.

84

RECOMMENDED BOOKS

1. Material Science by GBS Narang, Khanna Publishers, New Delhi.
2. Material Science and Metallurgy by RB Choudary, Khanna Publishers, New Delhi.
3. Material Science by RK Rajput; SK Kataria and Sons, Delhi
4. Material and Matallurgy by D.S.Nutt. SK Kataria and Sons, Delhi.
5. B.K.Agarwal “Introduction to Engg. Material” Tata McGraw Hill, Publishers Co. Ltd. New Delhi.
6. G.K.Narulla., K.S.Narula., V.K. Gupta., “Material Science” Tata Mc Graw Hill Publishers Ltd. Co. New Delhi
7. O.P.Khanna “A text book of Materials & Metallurgy, Dhanpat Rai Publishers Pvt. Ltd. New Delhi.

4.4 RELATIONAL DATABASE MANAGEMENT SYSTEM (RDBMS) (Common with information Technology)

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3 - 3

RATIONALE

Database and database systems have become an essential component of everyday life in modern society. This course will acquaint the students with the knowledge of fundamental concepts of DBMS and its application in different areas, storage, manipulation and retrieval of data using query languages.

DETAILED CONTENTS

1. Introduction

(3 hrs)

1.1 Database Systems

- Database and its purpose
- Characteristics of the database approach
- Advantages and disadvantages of database systems

1.2 Classification of DBMS Users

- Actors on the scene
- Database Administrators, Database Designers, End Users, System Analysis and Application Programmers

- Workers behind the scene (DBMS system designers and implementers, tool developers, operator and maintenance personnel)

2. Database System Concepts and Architecture (6 hrs)

2.1 Data models, schemas, instances, data base state

2.2 DBMS Architecture

- The External level

- The conceptual level

- The internal level

- Mappings

2.3 Data Independence

- Logical data Independence

- Physical data Independence

2.4 Database Language and Interfaces

- DBMS Language

- DBMS Interfaces

2.5 Classification of Database Management Systems

3. Data Modeling using E.R.Model (Entity Relationship Model) (5 hrs)

3.1 Data Models Classification : File based or primitive models, traditional data models, semantic data models.

3.2 Entities and Attributes

3.3 Key attribute and domain of attributes

95

3.5 Relationship among entities

4. Relational Model: (6 hrs)

4.1 Relational Model Concepts: Domain, Attributes, Tuples and Relations

4.2 Relational constraints and relational database schemes

- Domain constraints

- Key constraints and constraints on Null

- Relational databases and relational database schemes

- Entity integrity, referential integrity and foreign key

5. Functional Dependencies and Normalization (6 hrs)

5.1 Functional Dependencies

- Trivial and Non-trivial dependencies

- Closure of a set of dependencies and attributes

- Irreducible set of dependencies

5.2 Normalization

- Non-loss decomposition and functional dependencies

- First, Second and Third normal forms.

- Boyce/Codd normal form

6. Structured Query Language (6 hrs)

Data definition language : Create, Alter, Drop commands

-Data Manipulation Language (DML)

-Select command with where clause, using conditional expressions and Boolean operators, group by clause, like operator.

-Insert, Update and Delete commands

LIST OF PRACTICALS

1. Overview , Features and functionality, Application development in MS-Access

2. Exercises on different forms of select statement, altering and dropping of tables

3. Exercises on creation of tables

4. Exercises on insertion of data into tables

5. Exercises on deletion of data using different conditions
6. Exercises on UPDATE statement

INSTRUCTIONAL STRATEGIES

Explanation of concepts using real time examples, diagrams etc. For practical sessions books along with CDs or learning materials with specified activities are required.

Various exercises and

Small applications should be given along with theoretical explanation of concepts.

RECOMMENDED BOOKS

- 1) Fundamentals of Database Management Systems by Dr Renu Vig and Ekta Walia, - an ISTE, Publication, New Delhi
- 2) Database Management Systems by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., New Delhi
- 3) An introduction to database systems by Date C.J. Addison Wesley
- 4) Fundamentals of Database Systems by Elmasri/Navathe/Addison Wesley
- 5) An Introduction to database systems by Bipin C. Desai, Galgotia Publications Pvt.Ltd. Daryaganj, New Delhi 110 002
- 6) SQL Unleashed by Hans Ladanyi Techmedia Publications, New Delhi
- 7) Oracle 8, The complete reference by Koch and Loney, Tata McGraw Hill Publications New Delhi

87

4.5 WORKSHOP TECHNOLOGY – II

L T P
3 - -

RATIONALE

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

1. Milling (15 hrs)

- Specification and working principle of milling machine
- Classification, brief description and applications of milling machines
- Details of column and knee type milling machine
- Milling machine accessories and attachment – Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, spiral milling attachment, slotting attachment and rack milling attachment.
- Milling methods – up milling and down milling
- Identification of different milling cutters and work mandrels
- Work holding devices
- Milling Operations – face milling, angular milling, form milling, straddle milling and gang milling.
- Cutting speed and feed, depth of cut.
- Indexing on dividing heads, Plain and universal dividing heads.
- Indexing methods: direct, Plain or simple, compound differential and angular indexing.
- Cutting fluids used in milling.

2. Grinding (10 hrs)

- Purpose of grinding
- Specifications of grinding wheel - Abrasive, Grade, structure, Bond
- Common wheel shapes and types of wheel – built up wheels, mounted wheels and diamond wheels, Specification of grinding wheels as per BIS.
- Truing, dressing, balancing and mounting of wheel.
- Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
- Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder.

DETAILED CONTENTS

- Selection of grinding wheel
- Cutting fluids used in grinding

3. Shaping, Planing and slotting (8 hrs)

- Working principle of shaper, planer and slotter.
- Quick return mechanism applied to shaper, slotter and planer machine.
- Specification of shaper, planer and slotting machine.
- Speeds, feeds and depth of cut.

4. Broaching (5 hrs)

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

5. Metal Forming Process (10 hrs)

- Press Working
 - a) Press working – Types of presses, type of dies, selection of press die, die material
 - b) Press Operations - Shearing, piercing, trimming, punching, notching, shaving, gearing, embossing, stamping
- Forging
 - a) Open die forging, closed die forging
 - b) Cold and hot forging
- Rolling
 - a) Elementary theory of rolling
 - b) Types of rolling mills
 - c) Rolling defects and remedies
- Extrusion and Drawing
 - a) Type of extrusion – Hot and Cold, Direct and indirect
 - b) Pipe drawing, tube drawing

RECOMMENDED BOOKS

1. Workshop Technology by B.S. Raghuvanshi; Dhanpat Rai and Son, Delhi,
2. Manufacturing Technology by M. Adithan and AB Gupta: New Age International (P) Ltd, 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. Workshop Technology by R.C. Jindal; Ishan Publications, Ambala city.
6. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
7. Workshop Practice by R.K. Singal, S K Kataria and Sons, New Delhi

8. A text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.

9. Production Technology by HMT; Tata McGraw Publishers, New Delhi.

89

4.6 WORKSHOP PRACTICE – II

L T P
- - 8

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in various machining processes, modern machining methods, processing of plastic, CNC machining, tool, jigs and fixtures is required to be imparted. Hence the subject of workshop practice.

LIST OF PRATICALS

1. Produce a rectangular block by face milling and prepare a slot on one face with a slotting cutter / side and face cutter.
2. Gear manufacturing by some indexing device on a milling machine & gear hobber. Inspection of gear
3. Job on grinding using
 - Surface grinding
 - Cylindrical grinding
 - Centreless grinding
4. Milling cutter grinding on tool and cutter grinder.
5. Prepare a V-block to ± 0.2 mm accuracy on shaper machine.
6. Exercise on key way cutting and spline cutting.
7. Preparation of job through eccentric turning.
8. Practice of taper turning.
9. Exercise on EDM for preparation of electrodes (male and female)

Note: The workshop superintendent will finalize the specific drawings of all the jobs in the beginning of semester in consultation with staff

RATIONALE

Computer aided drafting these days is extensively being used in the industry. This subject has been added to enable a diploma holder to make drawings using computer software and like prints/plots.

PRACTICE WORK

Introduction to AutoCAD : Starting up , practice on – how to create a new drawing file, setting drawing limits & saving a file, drawing lines in different ways using absolute co-ordinates, user co-ordinates, WCS, UCS, drawing circles, drawing arcs, drawing ellipses. Drawing polygons, drawings splines. Drawing polylines, using window, zoom commands.

Practice on Edit commands such as erase, copy, mirror, array, offset, rotate, oops, undo, redo, scale, stretch, trim, break, extend, chamfer, fillet.

Practice on Text commands: editing text, text size, text styles, Change properties commands.

Practice on Layer commands: creating layer, freeze, layer on/off colour assigning, current layer, load line type, lock & unlock layer, move from one layer to other.

Practice on Hatching, Hatch pattern selection on Dimensioning, linear dimensioning, angular dimensioning radius/diameter dimensioning O-snap command, aligned dimensioning, editing of dimensioning, tolerances in dimensioning.

Practice on making complete drawings of components by doing exercises.

Practice on print/plot commands. Export/import commands

RECOMMENDED BOOKS

1. AutoCAD by R. W. Leigh, Galgotia, Publication, New Delhi.
2. Engg. Drawing with Auto CAD2000 by T. Jaypooran, Vikas Publishing House.

5.1 LOW COST AUTOMATION AND PRODUCTION SYSTEMS

1. INTRODUCTION OF AUTOMATION**(4 Hrs)**

Automation – definition , need and objective of Automation, Basic elements of Automation system, Advance Automation Function, Level of Automation, Advantage and Disadvantages of Automation

2. AUTOMATION PRINCIPLES AND STRATEGIES**(6 hrs)**

Introduction, Automation in Production Systems – Automated Manufacturing System, Computerized Manufacturing Support System, Reason for Automating. Automation Principles-U.S.A. Principle. Automation Strategies-Ten strategies for Automation and Production System, Automation Migration Strategy

3. AUTOMATED ASSEMBLY SYSTEM**(5 hrs)**

Assembly Automation, Fundamentals of Automated Assembly System, System Configuration, part delivery at workstations, Applications. Design for Automated Assembly Sensors and Actuators in Automated Systems. Performance and economy of Assembly System.

4. TRANSFER LINES AND AUTOMATED MANUFACTURING SYSTEM**(6 hrs)**

Introduction, Transfer lines, definition, Fundamentals of Automated Production Lines-System Configuration, work part transfer Mechanism, Storage Buffer, Control of the Production Line, Application of Automated Production Line-Machining System, System Design Configuration.

5. MATERIAL HANDLING SYSTEM**(6 hrs)**

Introduction, Overview of Material Handling equipment ,Configuration in Material Handling system Design-Material Characteristics, Flow Rate, Routing, Scheduling, Plant Layout. The ten principle of Material Handling. Introduction to Trucks. Automated Guided Vehicle System-Types of A.C. Vehicles – a)Driver Training b)Pallet Trucks c)Unit load carriers, ACVS Applications.

6. LEAN OR LOW COST PRODUCTION**(5 hrs)**

Introduction, Lean Production, Principles of Lean Production, Comparison of Lean Production with Mass Production, Material Requirement Planning (M.R.P.)-Inputs to the M.R.P. System, How M.R.P. works, M.R.P. outputs and benefits, Capacity Planning or Capacity Requirement Planning (CRP), Manufacturing Resources Planning (MRP) .

7. HYDRAULIC SYSTEMS**(6 Hrs)**

Study of construction of elements of hydraulic power pack such as hydraulic pumps, filter and reservoir, cooler, heater, oil level, gauge and temperature gauge.

8. PNEUMATIC SYSTEMS**(6 Hrs)**

Elements of Pneumatic system, Types of Compressors-Reciprocating, Rotary. Selection of Compressor. Air Receiver, Industrial Applications of Pneumatics ,Air Filters ,Pressure Regulator

and Lubricants. Pneumatic valve-direction control valve, Pilot operator valve. Pneumatic actuators. Pneumatic Tools- Tatory, Piston Type , Hammer Type.

LIST OF PRACTICALS

1. Study of piezometer vube, manometer and pressure guage and its calibration.
2. Study of design of automated system.
3. Study of following equipment with a view to illustrate its constructional details, common problems and their remedies.
 - Centrifugal pumps
 - Single acting reciprocating pumps
 - Hydraulic jacks
4. Study of hydraulic circuit in general and its application on surface grinder.
5. To study pneumatic circuit of any available or of pneumatic brake of a vehicle.

RECOMMENDED BOOKS

1. M.P. Grover, Automation, Production System & Computer Integrated Manufacturing, Pearson Education Delhi
2. B.C. Nakra, Automatic Control, New Age International , N. Delhi
3. S.Brian Morris, Automated Manufacturing System, Tata McGraw Hill, N. Delhi
4. S.R. Majumdar, Pneumatic Systems, Tata McGraw Hill, N. Delhi
5. Geofery Boothroyed, Assembly Automation , Tata McGraw Hill, N. Delhi

5.2 Computer Aided Design & Drafting

L T P
3 - 4

1. **Introduction to CAD** **(4 hrs)**
CAD, definition, product cycle & CAD, Automation & CAD, History & Industrial look at CAD, CAD market trends
2. **Fundamentals of CAD** **(6 hrs)**
Introduction, The design process, Applications of computers for design, Creating the manufacturing data base, Types of CAD, Stages of CAD, Benefits of CAD
3. **Introduction to transformation** **(8 hrs)**
Introduction, Review of Vector and Matrix, Basics of Geometric and Solid, Modeling, Explicit and Implicit Function, Parametric Equation, Coordinate System
4. **Transformation in 2-D** **(8 hrs)**
Transformation of point & line, 2-D Translation, Shearing, Rotation, Reflection, Scaling & Combined transformation
5. **Transformation in 3-D**
Homogeneous coordinate, 3-D Scaling, Translation, Shearing, Rotation, Reflection & Combined transformation
6. **Projection of Geometric models** **(6 hrs)**
Introduction, Orthographic Projection, Axonometric / Perspective transformation & Projection

LIST OF PRACTICALS

Total no. of 8 assignment on the assembly modeling using the different features of CAD software used such as solid works, Idea, Pro-E, CATIA, Unigraphics, Solid Edge etc.

RECOMMENDED BOOKS

1. CAD/CAM Theory and practice by Ibrahim Zeid, Tata McGraw Hill, N. Delhi
2. CAD/CAM. By Mikell P. Grover and Emory W. Zimmers, N. Delhi
3. CAD/CAM by Dr. Surender Kumar and A.K. Jha, Dhanpat Rai and sons

5.3 CNC MACHINES AND AUTOMATION

L T P
5 - -

RATIONALE

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

DETAILED CONTENTS

1. Introduction (6 hrs)

- Basic concepts of NC; CNC & DNC, adoption controls.
- Advantages & Disadvantage of CNC Machines.
- Application of CNC Machines.
- Difference between conventional & CNC Machines.
- Profitable applications of CNC Machines.

2. Construction of CNC Machines (16 hrs)

- Machine control unit.
- NC control.
- PLC control, its advantages & disadvantages.
- Application aid limitations of PLC machines.
- Axis designate of CNC machines.
- Special constructional requirement of CNC machines.
- Slide ways, bolt screw & nut assembly.
- Lubrication & spindle motors, axis drives motor.
- Spindle & spindle motors, axis drives motor,
- Swarf removal & safety provision of CNC Machines.
- Feedback mechanism in CNS machines.

3. Tooling of CNC Machines (6 hrs)

- Introduction.
- Various cutting tools for CNC machines.
- Work holding devices.
- Automatic tool changer.

4. Control System (8 hrs)

- Open & close loop control system 103
- Fundamental problem in control: Accuracy, resolution, repeatability, instability, response & damping,
- Type of position control:
 - i) Point to point
 - ii) Straight line
 - iii) Continuous

5. Part Programming (8 hrs)

Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rational components, part

programming using conned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation

6. Common Problems in CNS Machines (4 hrs)

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

7. Industrial Automation

(6 hrs)

- What is automation?
- Need of automation.
- Different types of automation.
- Advantages/disadvantages of automation.

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 Yore m Korem and IB Uri, Khanna Publishers, New Delhi.
4. CNC Machine by Bharaj Satya Publication, New Delhi.
5. Mechatronics by HMT Bangalore.

5.4 WORKSHOP TECHNOLOGY – III

L T P
3 - -

RATIONALE

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

DETAILED CONTENTS

1. Modern Machining Processes (20 hrs)
 - Mechanical Process: Ultrasonic machining (USM): Introduction, principle process, advantages and limitations, applications
 - Electro Chemical Processes: Electro chemical machining (ECM) – Fundamental principle, process, applications.
 - Electrical Discharge Machining (EDM): Introduction, principle parts of EDM machine, EDM terminology. Principal, metal removing rate, dielectric fluid and properties of electric fluid, applications, Wire cut EDM.

2. Plastic Moulding Techniques (8 hrs)
 - Injection moulding – working principle, advantages and limitations
 - Blow moulding – working principle, advantages and limitations
 - Compression moulding – working principle, advantages and limitations

3. Metallic Coating Process (4 hrs)
 - Metal Spraying – Wire process, powder process, applications
 - Electro plating, anodizing and galvanizing
 - Organic Coatings-oil base paint, rubber base coating

4. Gear Manufacturing and Finishing Processes (4 hrs)
 - Gear hobbing
 - Gear shaping
 - Gear shaving
 - Gear burnishing

5. Finishing Processes (15 hrs)

- Purpose of finishing surfaces
- Surface roughness – definition & units.
- Honing process and its applications
- Description of hones.
- Brief idea of honing machines.
- Lapping process, its applications.
- Description of lapping compounds & tools.
- Brief idea of lapping machines.
- Super finishing process and its applications.
- Use of super finishing attachment on center lathe.
- Polishing.
- Buffing.

6. Jigs & Fixtures (7 hrs)

- Importance and use of jigs & fixtures.
- Principle of location.
- Locating devices.
- Clamping devices.
- Types of jigs – Drilling jigs, bushes, template jigs, plate jigs, channel jig, leaf jig.
- Fixture of milling.
- Advantages of jigs & fixtures.

RECOMMENDED BOOKS

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi
2. Workshop Technology Vol. I,II, III by Chapman; Standard Publishers Distributors, New Delhi
3. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd., New Delhi.
4. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi
5. Modern Machining Process by Pandey; Tata McGraw Publishers, New Delhi
6. A text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi

99

5.5 WORKSHOP PRACTICE – III

L T P
- - 6

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in various machining processes, modern machining methods, processing of plastic, CNC machining, tool, jigs and fixtures is required to be imparted. Hence the subject of

LIST OF PRATICALS

CNC Machine

1. Plain turning, facing, step turning, taper turning.
2. Taper turning.
3. Concave and convex curves.
4. Threading.
5. Two Surface at 90° on a square block.
6. Machine students' first name on acrylic sheet on a CNC milling machine.
7. Demonstration of FMS & Wire cut EDM machine
8. Exercise for preparation of one female & one male electrode on EDM machine.
9. Exercise on profile cutting on EDM wire cut.
10. Various types of programming like polar programming, blue print programming and profile programming.

Milling & Shaper

11. Machine of a square block of 100mm*100mm*. *100mm on a shaper.
12. Cutting of a slot & V-groove on opposite faces of the block on the shaper.
13. Cutting of a slot and V- groove by a milling machine on a suitable block.
14. Cutting of a T slot by milling.
15. Milling of a spur gear.
16. Flute cutting of a tap or reamer.

Surface finishing

17. Exercise on hand lapping.
18. Honing of a hole.
19. Buffing practice.
20. Electroplating of copper and nickel.
21. Barrel polishing and barrel plating for small pieces.

105

Grinding

22. Grinding of surface at 45°, 60°, 75° on tool and cutter grinder.
23. Grinding and sharpening of lathe tool, drills.
24. Grinding of job on cylindrical grinder.
25. Grinding of job on centreless grinder.
26. Grinding of die plate on a surface grinder.
27. Grinding of a wedge shape job on a surface grinder.

Project Work

The students will make preparations for the project to be undertaken by them in the final semester like detailed drawing, materials, cost analysis and all other prerequisites.

100

(A Foreman Instructor in consultation with HOD/Workshop Superintendent will handle this group.

Note: The Workshop superintendent, will finalize the specific drawings of all the jobs in the beginning of semester in consultation with the staff.

5.6 CAD – IIL T P
- - 5**RATIONALE**

Diploma holder should be able to make 3D modeling, draw isometric views, carry out surface modeling, import and export data. Hence this subject.

DETAILED CONTENTS**1.Introduction to parametric Sketches**

Practice on making sketches using constraints, degree of freedom,

Practice on view port commands, practice on path sketch, practice on split line

2. Practice on creating isometric views**3.3D Modeling**

Creating sketches using sketch planes. Practice on extrusion, cut, joint, hole, commands.

4. Creating chamfer and fillet.

Practice on surface modeling, create part file, practice on assembly of parts, creating assembly view, orthographic views, section view, (Practice on different views), practice on data transfer.

RECOMMENDED BOOKS

1. AutoCAD by R.W. Leigh, Galgotia Pulication, New Delhi.
2. Engineering Drawing with Autocad-2000 by T. Jaypooran, Vikas Publisher House, Delhi.

RECOMMENDED BOOKS

1. Prakash H Joshi, Press tools design & construction. Wheeler Publisher.
2. Donaldson, Fundamental of tool design.
3. Surrender Kr & Umesh Chandra, Production Engg & Design, Satya Parkashan, New Delhi.
4. D. Engene Ostergard, Basic Die Making; Mc Graw Hill Book Co.
5. ASTME, “ Fundamentals of Tool Design”,
6. Handbook of Fixture Design by Frank W. Wilson; Mc Graw Hill Book Company.

5.7 CAM PRACTICE – I

L T P
- - 4

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in CAM Programming is required to be imparted.

LIST OF PRACTICALS

1. Exercise for Practice of various types of operations :
 - Facing
 - Plan turning, Step turning, Taper turning
 - Grooving
 - Boring
 - Drilling
 - Tapping
 - Core drilling
2. Exercise for preparation of Rectangular block using CAM Programming.
3. Prepare part programme for a given part having two operations with the help of CAM Programming.
4. Prepare part programme for a given part having more than two operations with the help of CAM Programming.

5. To Verify above Programmes on Software
(DELMIA): VIRTUAL NC Experiments

6.1 ROBOTICS TECHNOLOGY

L T P
4 - -

Introduction Robot and Its Classification, robot physical configurations, Basic robot motions robot anatomy. (5 hrs)

Manipulators: Robot manipulator Drives, general structure of robot, functional parameters, specifications of robot, advantages and disadvantages of various kinematics structure, servo and non servo manipulator. (5 hrs)

Actuators and transmissions system: Pneumatic, hydraulic and electrical actuators and their character ticks and control system. (5 hrs)

Feed back systems and sensors: encoders and other feed back systems, vision ranging systems textile sensors. (5 hrs)

Programming language: Description of VAN, RAIL and other languages. (5 hrs)

Artificial intelligence: Logged Locomotion, export system, concept of spatial description and transformation, manipulator, Kinematics; Inverse manipulator, Kinematics jacobians; velocities and static forces; manipulator dynamics, position control of manipulators. (8 hrs)

Air Cylinders: Their design and mounting, pneumatic and hydraulic valves, flow control valves metering valves, direction control valves, hydraulic servo system, pneumatic safety and remote control circuits. (8 hrs)

Industrial Applications: of robots for material transfer, machine loading/unloading, welding, assembly and spray painting operations, Assembly automation, automatic packaging and automatic inspection (7 hrs)

RECOMMENDED BOOKS:

1. Introduction of ROBOTICS by CRAIG.
2. Robotics Engineering by Dr. Surender Kumar, Dr.S.K.Mukherjee.
3. ROBOT Engineering and integrated approach by Richard D. Klafter.
4. ROBOTIC Technology by James G. Kermas.

6.2 PRESS TOOL – DESIGN AND DRAWING

105(a)

L T P
3 - 2

RATIONALE

The subject is intended to make the students understand concepts, principles and procedures of designing and drawing of press tool to be manufactured in workshop. It also aims at acquiring knowledge and skills in designing and drawing various press tools. It also help in understanding the order subject areas such as strength of materials, workshop technology, estimating and costing and computer aided machining.

DETAILED CONTENT

Section – A

1. Introduction (4 hrs)

Concept of mass production of sheet metal components, sheet material components and their applications, concept of press tools, press and their applications in mass production of components in industry.

2. Press Tool operations (6 hrs)

- a) Concept and principle of shearing operations, Cutting operations and cutting dies such as blanking, piercing, trimming, notching and shaving.
- b) Concept and principle of non – cutting operations such as forming, bending, curling, coining, embossing

3. Elements of press Tools (10 hrs)

Press tool parts as Die-set, stripper plate, guiding plate, punch & punch plate, die plate, Selection of material for each element of press tool, BIS standards for die-sets such as Bottom Plate, Top plate, pillars, bushes and types of bushes.

4. Classification of Press Tools (10 hrs)

Concept and description of

Cutting dies/tools such as blanking tool, piercing tool, compound tool, progressive tool, Notching tool, trimming tool and shaving tool.

Bending tool, forming tool, draw tools.

5. Classification of Presses (6 hrs)

- Concept and working of presses for press tools such as Hand Presses, Hydraulic and pneumatic presses.
- Specification of presses.
- Selection of press of press tool operations.

6. Design Parameters in Press Tool Design (12 hrs)

- Concepts of sheering force, stripping force, cutting clearance, angular clearance. Land and shear angle, concept of die life.
- Concept of strip layout classifications of strip layout such as piloting & stopping, strip guiding, material condition. Principle of grain direction. Material utilization, feeding mechanism.

105(b)

Section B

1. Design and Drawing of at least one blanking tool. (16 hrs)
2. Design and Drawing of at least one piercing tool. (16 hrs)
3. Design and Drawing of at least one Bending tool. (16 hrs)
4. Design and Drawing of at least one Progressive tool. (16 hrs)

Note:-

The question paper on the subject will consist of two parts i.e. Section-A and Section-B Section A will contain Theory contents to the extent of 40%. Section –B will contain Design and Drawing to the extent of 60%.

At least, 2 Industrial visit of a concerned industry should be arranged.

RECOMMENDED BOOKS

1. Mechanical Presses Dr. Ing Heinrich Makelt; Edward Arnold (Publishers) Ltd.
2. Machine Tool Design hand book by Central Machine Tool Institute, Bangalore; Tata McGraw Hill Publishing Company Ltd; New Delhi.

6.3 Installation, Testing & Maintenance

L T P

2 - 3

RATIONALE

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

DETAILED CONTENTS

1. **Introduction** (4 hrs)
Necessity of testing, repair and maintenance, Economic aspects, manpower planning and materials management, Fits and tolerance – common fits and tolerance used for various machine parts.
2. **Execution and commissioning of machines (Installation)** (4 hrs)
Location, layout and positioning of machines, Foundation-type of foundation, foundation plan, erection and leveling, grouping, vibration damping, vibration isolation-methods of isolation.
3. **Inspection, Servicing, Repair & Overhauling of machines and equipments** (8 hrs)
Inspection of various machines and equipments, Servicing of various machines and equipments, Repair of various machines and equipments, Overhauling and various machines and equipment, Recalibration of various Measuring instruments, testing the speed of machines, accuracy of machines, alignment and performance of machines.
4. **Maintenance, Planning & stages of Maintenance** (6 hrs)
Maintenance Planning, Various stages of Maintenance.
5. **Reliability, availability and Maintainability** (5 hrs)
6. **Overhauling** (6 hrs)
Frequent failure of common parts, their causes & remedial measures, Maintenance schedule, Parts which require frequent maintenance such as belts, coupling, nut, bolts, their repair & Maintenance to avoid downtime.
7. **Maintenance** (10 hrs)
Meaning to Maintenance, advantages & disadvantages, types of Maintenance, Preventive, Predictive & break down maintenance, Maintenance organization

- Centralized maintenance and decentralized maintenance, computerization of maintenance.

8 Storage of Parts

- Storage of parts used frequently for replacement and parts which are not normally available in local market.
- History cards to different machines.
- Machine repairs / replacements decision

LIST OF PRACTICALS

1. Preparation of preventive maintenance check
2. Condition, monitoring by Non Destructive Testing
3. Case study on trouble free maintenance
4. Project on maintenance of utility equipment
5. List compressor, pump , driers and actuator type valves.
6. Equipment/machine leveling and alignment.
7. Maintenance of material handling equipment – pull block, hand operated crains , fork life, hydraulic jack, mobile Crain and inches.
8. Use of lubrication equipment like oil gun, grease gun.
9. Removing all the lubricants, draining & replacing and fill with fresh lubricants.
11. Reconditioning of machine parts
12. Visit to maintenance department of industry and prepare a report.

RECOMMENDED BOOKS

1. Industrial Maintenance by H.P. Garg and published by S.Chand & Co.
2. Plant Maintenance Engg. by R.K. Jain Pulished by Khanna publishers.
3. Installation, Servicing and Maintenance by S.N. Bhattacharya published by S Chand & Co.
4. Installation ,Maintenance , Servicing by A.R. Basu published by M Datta & Co.
5. Maintenance Engg. & Management by R.P.Mishra & K Pathak Published by Prentice Hall of India Pvt. Ltd. New Delhi.

108

6.4 INDUSTRIAL ENGINEERING AND MANAGEMENT

L T P
5 - -

1) Production and Productivity (6 hrs)

Production, productivity functions, productivity, factor affecting productivity, measurement of productivity, Causes of decrease in productivity, Difference between production and productivity.

2) Plant Location , Layout and Job Evaluation (6 hrs)

Plant location, factor affecting plant location, Concept of plant layout, Types of layout and their characteristics, factor affecting plant layout, Definition of job evaluation, job evaluation methods such as ranking method, grade description method, Point system and factor comparison method, hybrid system.

3) Work Study (12 hrs)

Definition and scope of work study, area of application of work study in industry, role of work study in improving productivity, Objective, needs and method of work study, information collection, Recording techniques, process symbol, Charts and diagram, Critical examination, work measurement objectives, Needs and method of work measurement, Time study, various allowances, Calculation of time, Work sampling, Standard data and its use.

4) Production Planning and Control (12 hrs)

Introduction, Objectives and components (functions) of P.P.C., Advantages and stages of P.P.C., Process planning, routing, scheduling, Dispatching and follows up, Routing process, Route sheet, CPM/PERT techniques, drawing of simple networks and critical time calculation, Production Control in job order, Batch type and continuous types of production, difference between these controls.

5) Estimation and Costing (10 hrs)

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 of machining process, numerical problems.

6) Materials and Financial Management (6 hrs)

Introduction to management, Different function of management, Material in industry, Inventory control model, ABC analysis, Safety stock, RE-order level,

109

Economic order quantity, material handling, Concept of financial management, Important, Ledger, Journal, Profit and Loss account, Balance sheet.

7) Quality, Measurement and Gauging (14 hrs)

Introduction, Quality definition, need & objectives, what is Quality Control, Planning to inspection, Types of inspection, Basic Principles used in Measurement and gauging, Mechanical, Optical, Electrical and Electronic

Study of various measuring instruments:- Callipers, Micrometer, dial indicator, surface plate, straight edge, Try square, Protectors, Sine bar, Clinometer, Compactors (Mechanical, Electrical, Pneumatic), slip gauges, Tool room microscope and profile projector, Talysurf.

Limit gauges:- Plug, Ring, Snap, Tapes, Thread, Height, Depth, Form, Feeler, wire and their applications. Testing and maintenance of Measuring instruments

8) Introduction of Statistics

(4 hrs)

Basic statistical concept, Histogram , Frequency, Mean , Mode, Standard deviation, Normal distribution.

Introduction to control charts:- X-chart, P-chart, R-chart, and C-chart, and their application.

RECOMMENDED BOOKS

1. Industrial Engineering and Management by TR Banga.
2. Industrial Engineering and Management by OP Khanna, Dhanpat Rai Publications, Delhi.
3. Industrial Management by VK Sharma, OP Harkut.
4. Sharma BR. Environmental and Pollution Awareness: Satya Prakashan, New Delhi.
5. Principles of Management by Philip Kotler, TEE Publication.
6. Industrial Organization and Management by Tara Chand, Nem Chand and Brothers, Roorkee.
7. Industrial Engineering by S.C.Sharma; Khanna Publisher.
8. Industrial Engineering and Management by T.R.Banga.

110

6.5 WORKSHOP PRACTICE – IV

L T P
- - 6

RATIONALE

After having studied workshop Technology I,II,III & workshop Practice I,II,III. The students have developed competency to fabricate. Students should be provided opportunities to make machine tools parts, press tools, jigs & fixture, moulds and die casting dies as per market requirement. Therefore this subject is essentially required for fabrication practice.

DETAILED CONTENTS

1. Fabrication of machine tools parts-lead screw and nut, of vice, milling arbor & nut, clapper box of shaper, splined shaft, bevel gears.
2. Fabrication of machine pres tool – washer cutting progressive die , stamping die, air cooler cover die.
3. Fabrication of machine jigs & fixtures – drilling jig & fixture for round pieces, milling fixture.
4. Fabrication of machine moulds – for single ended spanner.

5. Fabrication of machine die-casting die for aluminum parts, and cost iron parts like water tap, wing nut, brake shoe die.

111

6.6 PROJECT WORK

L T P
- - 6

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 strength. Project work, therefore, should match the strength 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 assignment. 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 month in advance. The project work identified in collaboration with industry may be preferred.

Each teacher is expected to guide the project work of 5-6 students.

-Projects related to increasing productivity

-Projects related to quality assurance

-Projects related to estimation and economics of production

-Projects connected with repair and maintenance of plant and equipment

-Projects related to identification of raw material thereby reducing the wastage

-Any other related problems of interest of host industry

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	10	10	8	6	4	2

	considerations						
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		100	100	80	60	40	20

112

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

Sr.No.	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 near by 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 organizations 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 institute. It would be better if specific industries are approached for instituting such awards.

107

6.7 CAM PRACTICE - II

L T P
- - 4

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, skills in CAM Programming is required to be imparted.

LIST OF PRATICALS

1. Put CNC Machine centre practicals :
Slot
V-Block
Side milling
Slab milling and others
2. Demonstration of FMS & wire cut EDM Machine.
3. Various types of programming like polar programming, blue print programming and profile programming.
4. Prepare part programme for a given two dimensional part using CAM Programming.
5. Prepare part programme for three dimensional part using CAM Programming.
6. To verify above programmes on software

(DELMIA) : VIRTUAL NC Experiments

