3.1   COMPUTER APPLICATIONS IN MECHANICAL ENGINEERING

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RATIONALE

Today age is computer age. Most of our daily activities are being influenced by the use of computers. While in areas like science and technology, improvements cannot be achieved without computers. It has become necessary for each and everyone of us to have a basic knowledge of application of computers. PowerPoint is a feature packed presentation programme whereas access is database management systems. Programming is backbone for preparing various technological projects, which can be achieved by C^{++} lang
uage – most versatile one in today's scenario. This subject is being offered to acquaint the students about MS PowerPoint, MS Access and Programming using C^{++} language.

DETAILED CONTENT

1.   Computer Application Overview   (3 hrs)

   ▪ Commercial and business data processing applications
   ▪ Engineering computation

2.   MS PowerPoint   (15 hrs)

2.1   Introduction

   ▪ Elements of power point package- templates, wizards, views, color schemes
   ▪ Starting PowerPoint
   ▪ Exploring PowerPoint menus
   ▪ Starting a new slide
   ▪ Adding title, text and art
   ▪ Moving text area and resizing text box
   ▪ Starting a slide show
   ▪ Saving a presentation
   ▪ Printing slides
   ▪ Inserting and deleting slides
   ▪ Closing a presentation
   ▪ Exercise for making a presentation and slide show

2.2   Views

   ▪ PowerPoint views – slide view, outline view, slide sorter view, notes view, slide show view, slide setup
   ▪ Zoom in, zoom out
   ▪ Exercises on various views of presentation

2.3   Formatting and Enhancing text

- Formatting
- Changing format with a new layout
- Alignment of text and text spacing
- Enhancing text formatting – use of bullets, changing text font and size
- Selecting text style and color
- Applying design template
- Closing and applying the transition
- Spell checking
- To set header and footer
- Exercise on formatting text and applying design template.

2.4   Slide with graphs
- Creating a graph
- Adding graphic objects
- Adding clipart pictures
- Adding movies and sounds
- Adding multimedia to presentation
- Inserting excel worksheet or word table
- Exercise on inserting graphs, tables, movies and clipart.

3   MS - Access   (16 hrs)

3.1   Introduction to Microsoft access
- Components of access

3.2   Table creating
- Starting access, creating tables, tool bars and views of tables
- Editing the design and contents of the table
- Creating relationship between tables
- Adding OLE objects to a table
- Use of import and export facility
- Exercise on table creating

3.3   Query Handling
- Creating a new query, use of criteria, expressions and operation
- Editing a query, print a query
- Exercise on creating and editing query

3.4   Form designing
- Introduction, creating a form, modify a form design, designing a form using design view.
- Sub – forms, printing the forms, exercise on form designing.

3.5   Report designing
- Creating a report, managing the different controls of the records, saving and printing the report, use of graphs in reports
- Exercise on report designing

4   Programming fundamentals   (6 hrs)

- Algorithm, pseudo language, flow charts: advantages and disadvantages
- Decision table – type, advantages and disadvantages
- Structured programming: structuring the control flow, modular programming
- Exercise on making algorithm and flow charts.

5 C^{++} programming   (24 hrs)

5.1   Fundamentals
- Introduction, oop, character set, C^{++} tokens, keywords, identifiers, constants, basic data type, declaration of variables, defining symbolic constants, assignment statement, comments in a programme, structure of C^{++} programme, output using COUT, output using CIN, manipulators.

5.2   Operators and Expressions
- Arithmetic operators, relational operators, logical operators, shorthand assignment operator, increment and decrement operators, conditional operators, bit wise operators, precedence in C^{++} operators, casting of data, standard mathematical functions.

5.3   Control structures
- IF statements, IF---ELSE statements, nested IF statements, switch statements, Go To statements, repetitive structures, while statements, do statement, for loop, break statement, continue statement, nested loops.

5.4   Programs

- Write a program to check if a number is even or odd.
- Write a program to find the smallest of 3 numbers.
- Write a program to find largest of 4 numbers
- Write a program to find the roots of quadratic equation.
- Write a program to find the sum of the first N natural numbers using a for - do loops.
- Write a program that reads in N numbers and finds the smallest number among them.
- Write a program to find the sum of squares of the digits of a number.

6.   Demonstration of CNC machine.

RECOMMENDED BOOKS

1. MS Office 2000 for everyone by Sanjay Saxena; Vikas Publishing House Pvt. Ltd.
2. MS Office 2000 by Steve Hill; BPB Publications.
3. Programming in C++ by B. Subharamanayam.
4. Programming in C by Abdul Khader; Ajanata Publications

3.2 THERMODYNAMICS

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RATIONALE

A diploma holder in Mechanical Engineering is supposed to maintain steam generators, turbines and other power plant equipment. In addition he is required to maintain various types of automobiles. Therefore, it is essential to teach him concepts, principles and applications of basic thermodynamics, steam generators, steam turbine and other power plant equipment; non-conventional energy sources and about IC engines. Hence this subject.

DETAILED CONTENTS

1. Fundamental Concepts (4 hrs)

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

2. Laws of Perfect Gases (4 hrs)

    Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants, derivation

    Specific heat at constant pressure, specific heat at constant volume of gas, derivation of an expression for specific heats with characteristics, simple problems on gas equation

3. Thermodynamic Processes of Gases (4 hrs)

    Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes

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

4. Laws of Thermodynamics (6 hrs)

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

Heat source and heat sinks, statement to second laws of thermodynamics; Kelvin Planck's statement, Classius statement, equivalence of statements, Perpetual motion Machine of first kind, second kind, (PMM1, PMM2), Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy

5. Steam Boiler (4 hrs)

Water and fire tube boilers, construction and working of lancashire, babcock and Wilcox boilers. Various mounting and accessories of boilers.

6. Ideal and Real Gases (4 hrs)

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

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

7. Properties of Steam (4 hrs)

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

Quality of steam (dryness fraction), measurement of dryness fraction, throttling calorimeter, separating and throttling calorimeter

8. Fuels and Combustion (8 hrs)

Definition of fuel, types – solid, liquid and gaseous fuels, examples, uses of different types of fuels

Calorific values of fuels, Dulong's formula for calorific value, calculation of calorific values, chemical composition of a fuel

Bomb calorimeter unit – description, procedure for determination of C.V. of solid or liquid fuel using bomb calorimeters, calculation of CV with test data

Junker's gas calorimeter unit – description, determination of gas using Junker's calorimeter, Problems on CV determination with Junker's calorimeter test data

Balance chemical equations for the combination of C, H, S, CH_4, and ethane

Calculation of minimum air requirement for the complete combustion of unit mass/unit volume of fuel having a given composition, Conversion of volumetric analysis to gravimetric analysis and vice versa, calculation of percentage composition (by weight and volume) of fuel gas. Calculation of weight of fuel gases obtained by combustion of fuel with and without excess air, simple problems

Description of Orsat apparatus and use, procedure for determination of flue gas analysis, chemicals used for absorption of different gases in flue gases

Description and working of a mechanical type of CO_2 recorder.

9.   Air Standard Cycles   (4 hrs)

Meaning of air standard cycle – its use, condition of reversibility of a cycle

Description of Carnot cycle, Otto cycle, Diesel cycle, simple problems on efficiency, calculation for different cycles

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

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

10.   Air Compressors   (4 hrs)

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

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

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

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

11.   Introduction to Heat Transfer   (2 hrs)

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

LIST OF PRACTICALS

1.   To find out the dryness fraction of steam by throttling calorimeter.

2.   Determination of calorific value of fuel by bomb calorimeter.

3.   To find out specific fuel consumption by gravimetric or volumetric fuel equipment.

4.   To find out the viscosity index of lubricant by Orsat Apparatus.

5.   To find out CO_2 value of exhaust from engine by CO_2 recorder (Smokemeter).

6.   To study the construction and working of single stage air compressor.

7.   To find out the flash point of fuel by flash point apparatus.

8.   Study of various fire tube and water tube boiler by models or by visits.

9.   Study of various mounting and accessories of boilers.

RECOMMENDED BOOKS

1.   Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi

2.   Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi

3.   Basic Thermodynamics by PB Joshi and US Tumne; Pune Vidyarthi Grah Prakashan

4.   Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi

5.   A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.

3.3 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

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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 enginergy 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 PRACTICALS

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

2.   Connection of a single-phase induction motor with supply and reversing of its direction of rotation

3.   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 pratices

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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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.   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 Risering System   (2 hrs)

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

11.   Casting Defects   (3 hrs)

- 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 for 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, tapping.
- 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   (3 hrs)

- 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; Dhanpat 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

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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 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   (1 sheet)

RECOMMENDED 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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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 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 types of joints by arc welding on M.S, C.I and aluminium

   - 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 types 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, taper 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 the 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.