Fifth Semester

COMPUTER APPLICATIONS IN Mechanical DRAFTING, DESIGN AND ANALYSIS (DME-501)

Discipline core (DC): Credit 4(3-0-2)

Objective:

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

COURSE OUTLINE:

1. MS Word: Introduction to MS word for preparing technical report. Use of different fonts, size, tables, and equations should be considered.

2. MS Excel Creation of graphs such as bar chart, PI chart, line diagram using technical data, Examples: Load deformation data of any material may be given to the students and ask to convert these data to stress strain form and plot of stress strain curve. Determination of modulus of elasticity, yield strength, percentage elongation, ultimate strength, etc from the above curve. With given x-y data, plotting of the data and fitting various regression equations using Excel program.

3. MS Power Point: Templates, wizard, views, color schemes, Introduction to various Power Point toolbars, Presentations using Power Point:- - Slide Views - Slide Formatting - Animation – Graphs

4. Computer Aided Design using any sotware such as AUTO CAD/ IDEAS/ etc

4.1 Concept of AutoCAD, Tool bars in Auto CAD, coordinate system, snap,grid, and ortho mode 4.2 Drawing commands – point, line, arc, circle, ellipse,

4.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.

4.4 Dimensioning and placing text in drawing area

4.5 Sectioning and hatching

4.6 Inquiry for different parameters of drawing entity

5. Assembly and detail drawings of the following using AUTOCAD

5.1 Tool post

5.2 Tail stock

5.3 Screw jack

5.4 Safety valve

5.5 Stuffing Box

5.6 Bench vice

6. Isometric Drawings by CAD Drawings of following on computer: - Cone - Cylinder - Isometric view of objects

7. 3D Modelling 3D modelling, Transformations, scaling, rotation, translation

8. Project work Technical report writing where all such chapters are to be used.

RECOMMENDED BOOKS

1. AutoCAD 2000 for you by Umesh Shettigar and Abdul Khader; Janatha Publishers, Udupi.
2. Machine Drawing by P.S. Gill; Kataria and Sons, Ludhiana.

THEORY OF MACHINES (DME-502)
Discipline core (DC): Credit 3(3-0-0)

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

COURSE:

1. Basic Concepts

1.1 Definition of statics, dynamics, kinetics, and. kinematics
1.2 Rigid body and resistant body.
1.3 Links, its classification, Kinematics chain and their types
1.4 Kinematics pairs and it's classification.
1.5 Mechanism. Machine, Structure & Inversion
1.6 Degree of freedom, Types of joints, Problems on determination of degree of freedom of mechanism
1.7 Constrained motion, and it's classification .
1.8 Classification of mechanisms.
1.9 Equivalent mechanism.
1.10 Laws of inversion of mechanisms.
1.11 Four bar chain and it's inversion
1.12 Single slider crank chain and its inversions.
1.13 Double slider crank mechanism and it's inversion .
1.14 Applications of mechanisms and their selection from manufacture catalogue.
1.15 Indicator mechanism, pantograph.
1.16 Straight line mechanism such as Peaucellier and Harts mechanism
1.17 Steering gear mechanism such as Davis and Ackerman mechanism

2. Fly Wheel

2.1 Turning moment diagram plotting and its purpose
2.2 Turning moment diagram for single cylinder double acting steam engine
2.3 Turning moment diagram for multi- cylinder engines
2.4 Fluctuation of energy of Flywheel
2.5 Functions of fly wheel.
2.6 Types of fly wheels.
2.7 Mass and size calculations in different cases

3. Governors

3.1 Functions of governor
3.2 Classification of governor - elementary knowledge of porter governor, Watt governor, Proell governor, Porter governor, Hartnell governor and Wilson-Hartne governor

3.3 Terminology used in governors
3.4 Gonernor effort and power

4. Cams

4.1 Definition of cam
4.2 Classification of cams
4.3 Followers and their classification
4.4 Basic definition related to cams.

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

5.1 Introduction.
5.2 Belt, Rope and Chain drives
5.3 Material for Belt, and Rope
5.4 Open and crossed belt drives, action of belt on pulleys, velocity ratio.
5.5 Slip and Creep in belts,
5.6 Types of V Belt and Flat belt, joint preparation for flat belt.
5.7 Types of pulleys - step pulley, flat pulley, jockey pulley.
5.8 Crowning in pulley.
5.9 Laws of belting and length of belt in case of open and cross belt
5.10 Ratio of tensions in case of flat and V belt
5.11 Power transmitted and maximum power transmitted by belt
5.12 Centrifugal force and its effect on belt tension
5.13 Initial tension and its effect on the transmission of maximum power

6. Gear Drive

6.1 Functions of gear
6.2 Classification of gears and Gear material
6.3 Gear nomenclature
6.4 Law of gearing
6.5 Forms of teeth: Involute and Cycloidal
6.6 Comparison between Involute and Cycloidal gears
6.7 Simple, compound, reverted and epicyclic gear train
6.8 Horsepower transmitted by a gear train
6.9 Selection of gear trains- simple and epicyclic

7. Brakes and Dynamometers

7.1 Introduction and Classification of brakes
7.2 Brief description of different types of Mechanical Brake such as block or shoe brake Simple and Differential band brake, band and block, internal expanding, power brake and disc brake
7.3 Simple problems related to determination of braking torque in case of shoe brake, Simple and Differential band brake

8. Clutches

8.1 Function of clutch
8.2 Classification of clutches
8.3 Principle of working of Disc clutch and Cone clutch with simple line diagram
8.4 Principle of working of Multi plate clutch and Centrifugal clutch
8.5 Calculation of frictional torque by uniform pressure and uniform wear theory in case of Single/multi plate clutch and Cone Clutch

8.6 Horse power transmitted

RECOMMENDED BOOKS

1. Mechanism and Machine Theory; JS Rao and Dukkipati; Wiley Eastern, NewDelhi.
2. Theory of Mechanism and Machine; A Ghosh and AK Malik, East West Press(Pvt.) Ltd., New Delhi.

Machine Element Design (DME-503)
Open Elective (OE): Credit 3(3-0-0)

Objective: This course is designed for the diploma level students for Mechanical and Automobile engineering as first course in Machine Design. The contents of this subject are organised to understand the intricacies of different engineering design aspects. This will also help the students to enhance their imagination, innovative skill, adaptability to new situation and continued learning skills for problem solving.

COURSE OUTLINE:

1. Introduction

1.1 Design – Definition, Type of design, necessity of design

1.1.1 Comparison of designed and undesigned work

1.1.2 Design procedure

1.1.3 Practical examples related with design procedure

1.1.4 Characteristics of a good designer

1.1.5 Characteristics of environment required for a designer

1.2 Design terminology: stress, strain, factor of safety, factors affecting factor of safety, stress concentration, methods to reduce stress concentration, fatigue, endurance limit. General design considerations

1.3 Engineering materials and their mechanical properties :

1.3.1 Properties of engineering materials: elasticity, plasticity, malleability, ductility, toughness, hardness and resilience. Fatigue, creep, tenacity, strength

1.3.2 Selection of materials, criterion of material selection, numbering systems for Cast Iron, steel, Aluminium alloys, IS/BS/ASTM standards for material specification

2. Design Failure for static loading

2.1 Brittle and ductile behaviour of the materials, Various design failures under static loading, causes of failure - Maximum principal stress theory. - Maximum shear stress theory - Distortion Energy theory - Mohr's theory - Road maps for the selection of static failure theory for ductile and brittle materials

2.2 Design for tensile, compressive and torsional loading

2.3 Design for combined torsion and bending

3. Design Equation for Impact loading

Examples of impact loading, stress and deflection due to impact load, selection of impact factor for minor, medium and heavy shock load

4. Design for Cyclic loading

Types of cyclic loading, failure of parts due to cyclic loading, design strength for cyclic loading, design equation for simple cyclic loading

5. Design of Shaft

5.1 Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaft available

5.2 Design of shaft subjected to torsion on the basis of : - Strength criterion - Rigidity criterion

5.3 Design of shaft subjected to bending

5.4 Design of shaft subjected to combined torsion and bending

5.5 Introduction to stepped shaft

6. Design of Key

6.1 Types of key, materials of key, functions of key

6.2 Failure of key (by Shearing and Crushing).

6.3 Design of key (Determination of key dimension)

6.4 Effect of keyway on shaft strength. (Figures and problems).

7. Design of Joints

Types of joints - Temporary and Permanent, utility of joints

7.1 Temporary Joint:

7.1.1 Knuckle Joints – Different parts of the joint, material used for the joint, type of knuckle Joint, design of the knuckle joint. (Figures and problems).

7.1.2 Cotter Joint – Different parts of the joint, type of cotter joint – spigot and socket joint, gib and cotter joint, sleeve and cotter joint, Design of cotter joint (Figures and problems).

7.2 Permanent Joint: Welding symbols, standards and materials having high weldability.

7.2.1 Welded Joint - Type of welded joint, strength of parallel and transverse fillet welds.

7.2.2 Strength of combined parallel and transverse weld.

7.2.3 Axially loaded welded joints.

7.2.4 Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint – caulking and fullering.

7.2.5 Different modes of rivet joint failure.

7.2.6 Design of riveted joint – Lap and butt, single and multi riveted joint

8. Design of Flange Coupling

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

REFERENCE BOOKS

1. Machine Design- Fundamentals and Practices, by P C Gope, PHI Learning Pvt Limited, New Delhi. 2012

2. Machine Design by R.S. Khurmi and JK Gupta; Eurasia Publishing House (Pvt.) Limited, New Delhi

Manufacturing Process-I (DME-503)
Open Elective (OE): Credit 3(3-0-0)

Unit I: Manufacturing concepts, Manufacturing Processes, Pattern Making (Types of patterns, Patterns materials –relative advantages, Patterns allowances, Coloring codes for patterns, Introductions to cores and core boxes, Preservation and storage of patterns).

Unit-II: Introductions to moulding, Types of moulding sands and their properties, Synthetic sand moulds, Core materials, Core making, Position of cores, Types of core prints, Types of moulds, Gating systems, Moulding processes (Bench moulding, floor moulding, Pit moulding and Machine moulding), Melting furnaces (Pit furnace, Cupola furnace, Electrical furnace), Fettling of castings, Defects in casting and remedies

Unit-III: Working principle of Lathe machine, Description and function of main parts of centre Lathe, Specifications of Lathe, Lathe accessories and attachments, Lathe Tools (Types their angle and materials). Lathe operations (Plain turning, facing, different systems of taper turning, thread cutting, knurling, chamfering, grooving or necking,forming, drilling, boring, reaming, speed, feed and depth of cut, cutting fluid, safety guide lines for working on Lathe.

Unit-IV:Principle of drilling, classification of drilling machines and their description, operations performed on drilling machines,speeds and feeds during drilling, Types of drills and their features, drill holding devices, cutting fluid used in drillingPrinciple of boring, Classification of boring machines and their description, Specifications of boring machines, Boring tools, Boring bars and boring heads, Alignment of bores and its importance

Unit-V: Introduction to shaping, Principle parts features and use of shaper, Specifications of a shaper, Quick return mechanism, Methods of job holding, Shaper tools-types, angles and materials, Operations performed on shaper, Description of slotter, its tools and uses, Drive mechanism of a slotter, Cutting fluid used in shaping and slotting.
Comparison of shaping and planning, Main parts and features of planer, its working and use, Specification of planer, Types of planer, Quick return mechanism of table, Planer tools, Job holding devices.

TOOL ENGINEERING (DME-503)

Open Elective (OE): Credit 3(3-0-0)

A diploma holder should have complete knowledge of basic tools, their materials and their optimal utilization. This subject imparts skill and awareness of quality production in minimum time by using jigs and fixtures.

DETAILED CONTENTS

1. Cutting Tools

Mechanical property and uses of high-speed steel, stellite, cemented carbide, ceramics diamond, study of commercially available cutting tools. Tool geometry of single point cutting tools, multipoint cutting tools, reamer, drill, milling cutter, throw-away inserts, chip breaker, tool and cutter maintenance, regrinding and lapping of tools.

2. Location and Clamping

Principles of location, 3-2-1 principle, Location with previous machined hole, different locating devices, V-location, conical locations. Purpose of Clamping elements, types of clamps.

3. Jigs and Fixtures

Need for jigs and fixtures, fundamental principles of jigs and fixtures design. Types of bushes, advantages of bushings. Types of drilling jigs- template jig, channel jig, latch jig, quick acting jig, indexing jig, box jig. Types of fixtures-simple fixture, milling fixture, welding fixture, turning fixture, assembly fixture & inspection fixture.

RECOMMENDED BOOKS

1.Production Engineering by P.C. Sharma; S. Chand & Company Ltd., Delhi.
2.Tool Design by Donaldson and Lecain; Tata McGraw Hill Company, New Delhi
3.Production Engineering & Design by Dr. Surender Kumar and Umesh Chandra
4.E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

REFRIGERATION AND AIR CONDITIONING (DME-504)

Discipline core (DC): Credit 3(3-0-0)

RATIONALE

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

DETAILED CONTENTS

REFRIGERATION

1. Fundamentals of Refrigeration

Introduction to refrigeration, and air conditioning, meaning of refrigerating effect, units of refrigeration, COP, methods of refrigeration. Introduction to air refrigerator working on reversed carnot cycle.

2. Vapour Compression System

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

3. Refrigerants

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

4. Vapour Absorption System

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

5. Refrigeration Equipment

5.1 Compressor - Function, various types of compressors

5.2 Condenser - Function, various types of condensers

5.3 Evaporator - Function, types of evaporators

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

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

AIR CONDITIONING

6. Psychrometry

Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air. Psychrometry chart and various processes of psychrometry

7. Air-Conditioner

Study of window air-conditioning, split type air conditioning, concept of central air- condition, automobile air-conditioning

LIST OF PRACTICALS

1. Identify various tools of refrigeration kit and practice in cutting, bending, flaring, swaging and brazing of tubes.
2. Study of thermostatic switch, LP/HP cut out overload protector filters, strainers and filter driers.
3. Identify various parts of a refrigerator and window air conditioner.
4. To find COP of Refrigeration system
5. To detect trouble/faults in a refrigerator/window type air conditioner
6. Charging of a refrigerator/window type air conditioner.
7. Study of cut section of single cylinder compressor
8. Visit to an ice plant, cold storage plant, central air conditioning plant

RECOMMENDED BOOKS

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

CNC MACHINES AND AUTOMATION (DME-505)

Discipline core (DC): Credit 4(3-0-2)

Objective: Its primary purpose is to create a faster production process and components and tooling with more precise dimensions and material consistency, which in some cases, uses only the required amount of raw material (thus minimizing waste), while simultaneously reducing energy consumption.

COURSE OUTLINE:

1: Automation

Introduction to CAM, Automated Manufacturing system, Need of automation, Basic elements of automation, Levels of automation, Automation Strategies, Advantages & disadvantages of automation, Historical development and future trends. **Features of NC Machines-** Fundamental of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system, Methods for improving Accuracy considering the factors such as tool deflection and chatter and Productivity.

2 NC Part Programming & Common Problems in CNC Machines

Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rotational components, part programming using canned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation Manual (word address format) programming, Examples: Drilling, Turning and Milling, Canned cycles, Subroutine and Macro. APT programming, Geometry, Motion and Additional statements, Macro- statement. Common problems in mechanical, electrical, pneumatic, electronic and PC components of CNC machines, diagnostic study of common problems and Remedies, use of on-time fault finding diagnosis tools in CNC machines.

3: System Devices

Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa. **Interpolators** Digital differential Integrator-Principle of operation, exponential declaration, DDA Hardware Interpolator- Linear, Circular, DDA Software Interpolator. **Control of NC Systems** Open and closed loops, Control of point to point systems, Incremental open loop control, Incremental close loop, Absolute close loop, Control loop in contouring systems, Adaptive control.

4 Computer Integrated Manufacturing system

Group Technology, Flexible Manufacturing System, CIM, CAD/CAM, Computer aided process planning-Retrieval and Generative, Concept of Mechatronics, Computer aided Inspection.

5: Robotics and Intelligent Manufacturing

Types and generations of Robots, Structure and operation of Robot, Robot applications, Economics, Robot programming methods. Introduction to Artificial Intelligence for Intelligent manufacturing.

List of Practical

1To study the basic feature and operation of NC, CNC machine & Study the constructional details of CNC lathe , working of following ,tool changer and tool setter ,Multiple pallets , Safety devices.

2To demonstrate how to program (using the computer-assisted method) and machine a simple part on the CNC lathe and Develop part programms for following lathe operations:-Plain turning and facing operations-Taper turning operations (internal and external)-Thread cutting operations (internal and external)

3To operate a CNC milling machine and become familiar with set-up, procedures and data flow.

4To use AutoCAD to define a series of closed 2-D polygons that form initials, or other artistic creations, within a 150 x 100 mm border. To run the output data file through the AutoLISP program called “digitize.lsp”

Text Books:

1. Numerical Control and Computer aided Manufacturing, By Kundra, Rao and Tewari.

2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P.Groover.

MAINTENANCE ENGINEERING (DME-506)

Discipline core (DC): Credit 4(3-0-2)

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

COURSE OUTLINE:

1. Introduction

1.1 Necessity and advantages of testing, repair and maintenance

1.2 Economic aspects, manpower planning and materials management

1.3 Fits and tolerances – common fits and tolerances used for various machine Parts

2. Erection and Commissioning of Machines (Installation)

2.1 Location, layout and positioning of machines

2.2 Foundation – types of foundation, foundation plan, erection and leveling, grouting, vibration damping, vibration isolation – methods of isolation, anti vibration mounts.

3. Testing of Machines

3.1 Testing equipment – dial gauge, mandrel, spirit level, straight edge, autocollimator

3.2 Testing methods – geometrical/alignment test, performance test, testing under load, run test, vibrations, noise

4. Lubrication Systems

4.1 Lubrication methods and periodical lubrication chart for various machines (daily, weekly, monthly)

4.2 Handling and storage of lubricants

4.3 Lubricants conditioning and disposal

4.4 Lubricant needed for specific components such as gears, bearings, and chains

4.5 Purpose and procedure of changing oil periodically (like gear box oil)

5. Repairing

5.1 Common parts which are prone to failure, reasons of failure

5.2 Repair schedule

5.3 Parts that commonly need repair such as belts, couplings, nuts, and bolts

6. Maintenance

6.1 Definition, advantages, limitations and types of maintenance viz. preventive, breakdown, predictive

6.2 Organization of maintenance

6.3 Introduction to computerized maintenance record

6.4 ISO standards for maintenance documentation

6.5 Introduction to machine history card – purpose and advantages

6.6 Preparation of yearly plan for preventive maintenance

6.7 Need of frequently needed spare parts inventory

LIST OF PRACTICALS

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

RECOMMENDED BOOKS

1. Industrial Maintenance by HP Garg; S. Chand and Company, Delhi.
2. Plant Maintenance Engineering by RK Jain; Khanna Publishers, Delhi.