DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY —APRIL, 2018

MECHANICAL ENGINEERING

CAD/CAM

(Maximum marks: 100) *Time:* 3 hours

PART —A

(Maximum marks: 10)

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. List any four CAD software packages.
   AutoCAD, Pro E(creo), CATIA, Solid edge, Solid work, etc.

2. Describe Master Production Schedule (MPS).
   The master schedule is a macro level document which sets top- level priorities for what will be manufactured and when, looking at the material that will be required over the production cycle.

3. Describe the NC tape for program storage.
   Eight columns with presence or absence of hole treated as a bit of information made up of flexible paper like material and coding done by FLEXO WRITER.

4. Differentiate GOl and GOO.
   GOO used for fast movement without any cutting action
   GO1 linear interpolation with cutting action and feed rate

5. Describe APT.
   APT -Automatically Programmed Tooling is a programming language. It has,
   *Geometry statement/definition statement
   *Motion commands
   *Post processor statement
   *Auxiliary statement

PART —B

(Maximum marks:30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Differentiate between PC based CAD system and workstation based CAD system.
   A workstation is used by professionals for the design of critical Component. A PC based system for less complex design.
   It will be having high processing power, high power graphics card, and more memory capacity than PC.
   Workstation can connect to multiple displays with different viewpoints.
   Workstation has networking facility to work with other workstations or as host.

2. Describe top down and bottom up approaches in product design with an example.

   Top down approach- the entire assembly is designed first and Individual designs are done later.

   Bottom up approach - the component design is done first and the Product is realized by assembling.

   Explanation with suitable example

3. Explain about DNC and its components.
   Direct numerical control- manufacturing system in which a number of machines are controlled by a computer through direct connection and in real time. Central computer, Bulk memory, which stores the NC part program, telecommunication lines, Machine tools

4. Describe adaptive control system.

   Improvements in CNC machine tools depend on the refinement of adaptive control, which is the automatic monitoring and adjustment of machining conditions in response to variations in operation performance. With a manually controlled machine tool, the operator watches for changes in machining performance (caused, for example, by a dull tool or a harder work piece) and makes the necessary mechanical adjustments. An essential element of NC and CNC machining, adaptive control is needed to protect the tool, the work piece, and the machine from damage caused by malfunctions or by unexpected changes in machine behavior. Adaptive control is also a significant factor in developing unmanned machining techniques.

5. Describe machine zero and work zero inCNC.

   Machine zero -origin set by machine manufacturer.

   Work zero - origin set by operator of machine for the ease of programming.

   Different work zero can be set using G54.

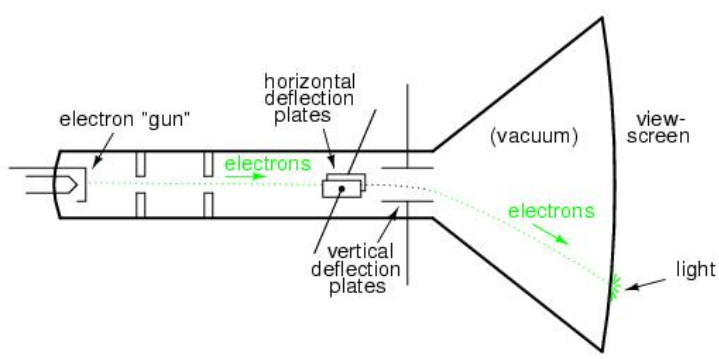
6. What is tool length compensation or offset and how this tool length compensation is applied in part programming?

   Tool length off et to accommodate different tool length in tool magazine without effecting depth of cut or to accommodate tool wear.

   Program code -G43, G44

   Initially operator should manually input the tool offset value for each tool magazine positions.

7. Explain the working of CRT with diagram.



The CRT is a display screen which produces images in the form of the video signal. It is a type of vacuum tube which displays images when the electron beams through electron guns are strikes on the phosphorescent surface. In other Words, the CRT generates the beams, accelerates it at high velocity and deflects it for creating the images on the phosphorous screen so that the beam becomes visible. The working of CRT depends on the movement of electrons beams. The electron guns generate sharply focused electrons which are accelerated at high voltage. This high-velocity electron beam when strikes on the fluorescent screen create luminous spot. After exiting from the electron gun, the beam passes through the pairs of electrostatic deflection plate. These plates deflected the beams when the voltage applied across it. The one pair of plate moves the beam upward and the second pair of plate moves the beam from one side to another. The horizontal and vertical movement of the electron are independent of each other, and hence the electron beam positioned anywhere on the screen.

PART -C

(Maximum marks: 60)

(Answer one full question from each unit. Each Full question carries 15 marks.)

UNIT - I

III (a) Explain output devices in CAD.

An output device is any device used to send data from a computer to another device or user. Most computer data output that is meant for humans is in the form of audio or video. Thus, most output devices used by humans are in these categories. Examples include monitors, projectors, speakers, headphones and printers.

Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer.It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

Cathode-Ray Tube (CRT)

Flat-Panel Display

*Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter ‘e’ in the word help.

***Printers**

Printer is an output device, which is used to print information on paper. They produce hard copy output. Computer printers vary widely in their technologies and capabilities.

***Plotter**

A plotter is a special kind of output device that like a printer produces images on paper but does so in a different way. Plotters are designed to produce large drawings or images, such as construction plans for buildings or blueprints for mechanical objects. A plotter can be connected to the port normally used by a printer.

(b) Explain secondary storage devices.

Alternatively referred to as external memory, secondary memory, and auxiliary storage, a secondary storage device is a non-volatile device that holds data until it is deleted or overwritten.

*Floppy disks.

*Hard disks.

*Optical Disks.

*Magnetic Tapes.

*Solid State Devices

Floppy Disks

Floppy disks often referred to as diskettes have been and are still being widely used to store data of small size. They are very easy to use and are portable. They consist of a flat Mylar plastic disk that rotates within a hard plastic casing.

Hard Disks

Hard disks differ from floppy disk in that they have been designed to store very high volume of data. Currently hard disks can store gigabytes of data (e.g. 200GB) and they are an integral part of the computer. Most operating systems are stored in hard disks and all materials (application software, documents, images, music files etc.) that you save on your computer is stored in the hard disk.

Optical Disks

Music CDs (compact disks) form part of a category of storage devices called optical disks. The latter make use of light energy to store information and are very suitable to store information of relatively high capacity (700MB).

IV (a) Explain various LAN topology.

*Bus Topology

The physical bus topology is the simplest and most widely used of the network designs. It consists of one continuous length of cabling (trunk) and a terminating resistor (terminator) at each end. The data communications message travels along the bus in both directions until it is picked up by a workstation or server NIC.

*Ring Topology

As its name implies, the physical ring topology is a circular loop of point-to-point links. Each device connects directly or indirectly to the ring through an interface device or drop cable. Messages travel around the ring from node to node in very organized manner. Each workstation checks the messages for a matching destination address.

*Star Topology

The Physical star topology uses a central controlling hub with dedicated legs pointing in all directions – like points of a star. Each network devices has a dedicated point-to-point link to the central hub. This strategy prevents troublesome collisions and keeps the line of communication open and free of traffic.

(b) Explain different geometric modeling techniques.

***Wireframe modeling**

A wire-frame model is a visual presentation of a 3-dimensional (3D) or physical object used in 3D computer graphics. It is created by specifying each edge of the physical object where two mathematically continuous smooth surfaces meet, or by connecting an object's constituent vertices using straight lines or curves.

***Surface modeling**

Surface modeling is a more complex method for representing objects than wireframe modeling, but not as sophisticated as solid modeling. Surface modeling is widely used in CAD (computer-aided design) for illustrations and architectural renderings. It is also used in 3D animation for games and other presentations.

***Solid modeling**

Solid modeling (or modeling) is a consistent set of principles for mathematical and computer modeling of three-dimensional solids. Solid modeling is distinguished from related areas of geometric modeling and computer graphics by its emphasis on physical fidelity.[1] Together, the principles of geometric and solid modeling form the foundation of 3D-computer-aided design and in general support the creation, exchange, visualization, animation, interrogation, and annotation of digital models of physical objects**.**

UNIT – II

V (a) Explain CAPP and 2 types of process planning.

Based on the features of a given part, the software automatically generates the sequence of manufacturing operations. Generated production routings which are consistent and perhaps even optimal. Reduces the skill required of a planner, Reduces the process planning time.

Variant process planning - existing parts coded and classified to family matrix. Standard process plan stored for each family matrix. Unknown part first coded then found the family matrix and hence the standard process plan. Applicable where there is moderate number of part families.

Generative process planning - a system that synthesizes process information m order to create a process plan for a new component automatically. Process plans are created from information available in manufacturing data base without human intervention. Applicable where there are high number of part families.

(b) Compare sequential engineering and concurrent engineering.

Concurrent engineering, also known as simultaneous engineering, is a method of designing and developing products, in which the different stages run simultaneously, rather than consecutively. It decreases product development time and also the time to market, leading to improved productivity and reduced costs.

Sequential engineering, also known as Traditional engineering, is the process of marketing, engineering design, manufacturing, testing and production where each stage of the development process is carried out separately, and the next stage cannot start until the previous stage is finished.

OR

VI (a) Explain product development cycle with diagram.

A product's development begins with a design concept and moves through each stage until it is launched into the market. With each stage come more crucial product information, fine-tuned details and required documents for a successful launch.

The product development cycle consists of six main stages:

Design Concept - An idea is formed. You must identify and assess critical marketing and manufacturing barriers, along with the ability to fully communicate the concept.

Technical Feasibility - You know what you want it to do, now you need to confirm if that target is attainable. You will also verify that there are no technical or economic limitations to implementation that cannot be overcome by development.

Product Development - By verifying the product performs how it should, you will be able to make necessary improvements in materials, designs, components and processes.

Product Validation - Validating your product and understanding its reliability helps you establish the market validity. In this stage, you will also validate your warranty period.

Full Production - Your product has been launched.... now what? Why not find out just how your product stands against the competition? This will give you the opportunity to make improvements on the next revision... or really boost your sales by exposing your competition!

Support - Things have been going fairly well since you've launched your product. Now failure data is coming back from the field.... what does this mean? Why is this happening?

(b) Explain CAM.

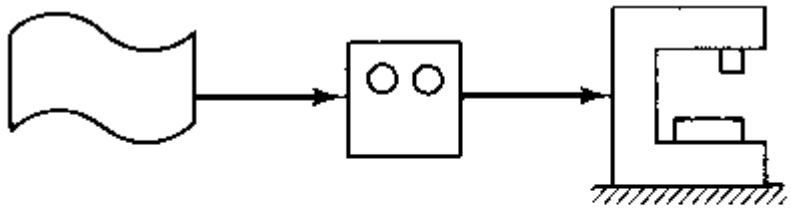
Computer-aided manufacturing (CAM) is an application technology that uses computer software and machinery to facilitate and automate manufacturing processes. CAM is the successor of computer-aided engineering (CAE) and is often used in tandem with computer-aided design (CAD). CAM reduces waste and energy for enhanced manufacturing and production efficiency via increased production speeds, raw material consistency and more precise tooling accuracy. CAM uses computer-driven manufacturing processes for additional automation of management, material tracking, planning and transportation. CAM also implements advanced productivity tools like simulation and optimization to leverage professional skills. Depending on enterprise solution and manufacturer, CAM may present inadequacies in the following areas:
*Manufacturing process and usage complexity.
*Product Lifecycle Management (PLM) and modern enterprise integration.
*Machine process automation.

UNIT – III

VII (a) Explain the principle of operation of NC machine with suitable diagram.

Numerical control, popularly known as the NC is very commonly used in the machine tools. Numerical control is defined as the form of programmable automation, in which the process is controlled by the number, letters, and symbols. In case of the machine tools this programmable automation is used for the operation of the machines.

In other words, the numerical control machine is defined as the machined that is controlled by the set of instructions called as the program. In numerical control method the numbers form the basic program instructions for different types of jobs; hence the name numerical control is given to this type of programming. When the type of job changes, the program instructions of the job also change. It is easier to write the new instructions for each job; hence NC provides lots of flexibility in its use.



7.1 Three basic components of a numerical control system.

The NC technology can be applied to wide variety of operations like drafting, assembly, inspection, sheet metal working, etc. But it is more prominently used for various metal machining processes like turning, drilling, milling, shaping etc. Due to NC all the machining operations can be performed at the fast rate resulting in bulk manufacturing becoming quite cheaper.

(b) Explain four disadvantages of NC.

Non easy part program editing, punched tape fragile, problem with tape reader, hardwired controller, lesser interpolations, No MIS (explain any four)

OR

VIII (a) Describe the classification of turning centre.

•Horizontal machines -having horizontal spindle, two types chucking machine-shorter bed, additional sub spindle, bar feeding mechanism

Universal machine -both chucking and bar work, steady and follower rest, some with two turrets

•Vertical Machines (Tum mill centre) -spindle vertically, bridge configuration for large width, for heavy work piece.

(b) Compare NC and CNC.

S.no	NC Machine	CNC Machine
1.	Here NC stands for Numerical Control	CNC stands for Computer Numerical Control.
2.	It is defined as the machine which is controlled by the set of instructions in the form of numbers, letters and symbols. The set of instructions is called as program.	It is defined as the machine which is used to control the motions of the work piece and tool with the help of prepared program in computer. The program is written in alphanumeric data.
3.	In NC machine the programs are fed into the punch cards.	In CNC machine the programs are fed directly into the computer by a small key board similar to our traditional keyboard.
4.	Modification in the program is difficult.	Modification in the program is very easy.
5.	High skilled operator is required.	Less skilled operator is required.
6.	Cost of the machine is less.	Cost of the CNC machine is high.
7.	Maintenance cost is less	Maintenance cost is high.
8.	The programs in the NC machine cannot be stored.	In CNC machines, the programs can be stored in the computer and can be used again and again.
9.	It offers less flexibility and computational capability.	It offers additional flexibility and computational capability.
10.	The accuracy is less as compared with the CNC.	It has high accuracy.
11.	It requires more time for the execution of the job.	It takes very less time in the execution of the job.
12.	It is not possible to run it continuously.	It can be run continuously for 24 hours of a day.

UNIT – IV

IX (a) Explain open loop and closed loop control systems with diagrams.

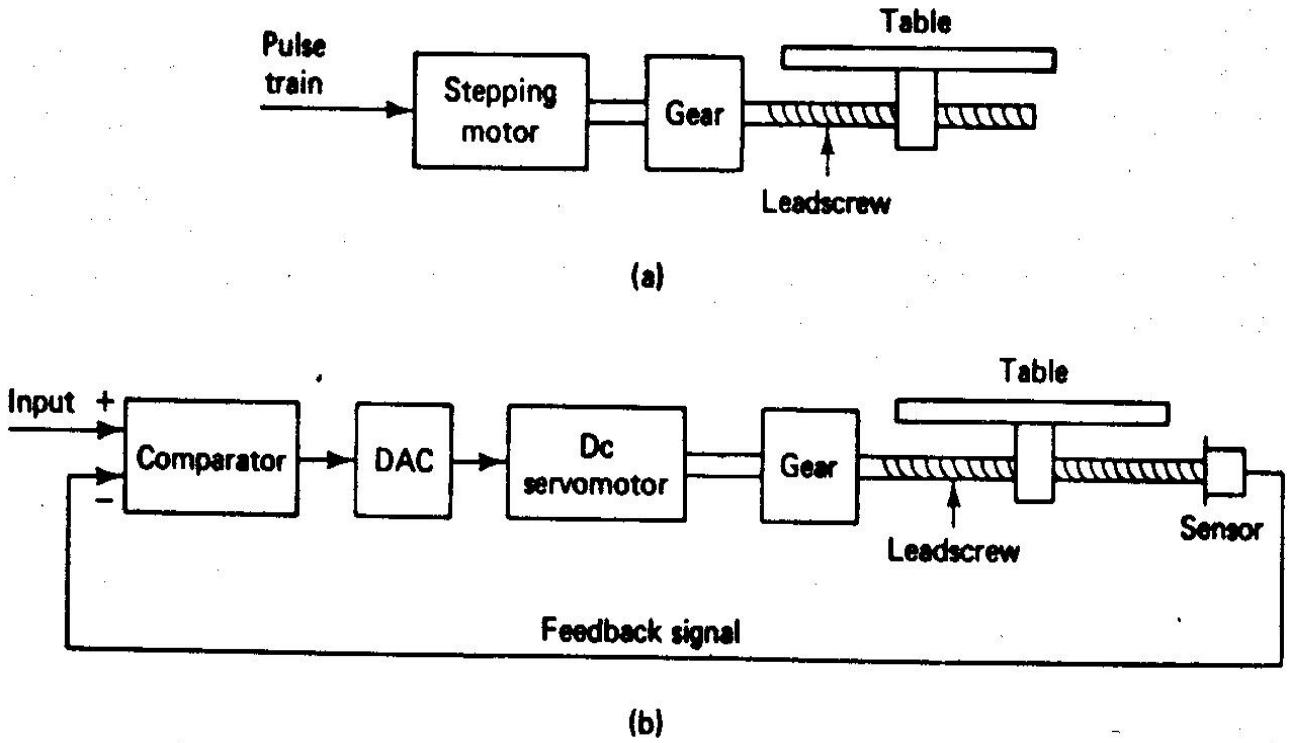


FIGURE 8.10 (a) Open-loop and (b) closed-loop control in NC.

An “open-loop system” is defined by the fact that the output signal or condition is neither measured nor “fed back” for comparison with the input signal or system set point.

A Closed-loop Control System, also known as a feedback control system is a control system which uses the concept of an open loop system as its forward path but has one or more feedback loops (hence its name) or paths between its output and its input.

(b) Explain any four miscellaneous functions.

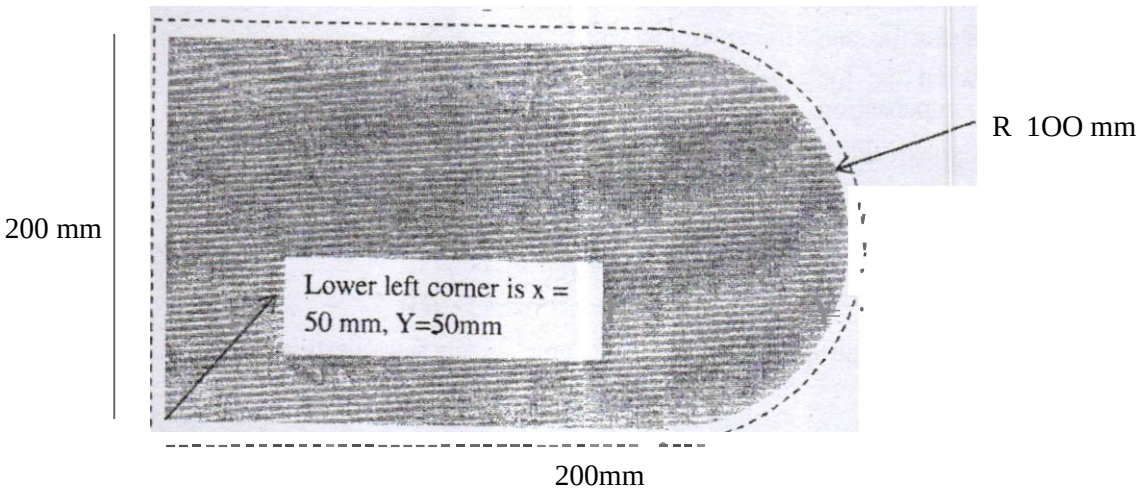
MOO Program stop
M01 Optional stop
M02 End of program
M03 Spindle CW
M04 Spindle CCW
M05 Spindle stop
M06 Tool change
M07 Tap Oil on
MOS Coolant on
M09 Coolant Tap Oil off

OR

X Write a CNC part program for the side milling without any cutter diameter compensation. Cutter diameter is 20 mm. The final dimension of the product is given and the dotted line represents the material to be removed.

Assumptions: (i) material removed in one cycle of operation (ii) top surface of the work piece is z = 0 (iii) thickness of material is 5 mm (iv) other data required may be suitably assumed.

(Explanation is to be provided on right side of each block of program)



NOOO G90; //absolute program
NOOJ G21 GOO X50 Y39 Z-5;
//metric input, rapid traverse, 1 mm thickness touching, depth of 5mm
N002 G91; //incremental programming
N003 G0l Y1 F200 M03;
// 1mm depth cutting in y direction, spindle rotation
N004 X200;
//cutting parallel to x axis
N005 G03 X200 Y220 R110;
//counter clockwise circular interpolation
N006 G01 X-200;
N007 Y-220;
N008 G90; II absolute program
N009 GOO XO YO ZO MO5;
//return to machine zero, spindle stop
NO 10 M30; //end of program

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