SCHEME OF VALUATION

(Scoring Indicators)

Revision: 2015	**Course Code: 6024**			
COURSE TITLE: CAD/CAM				
Qn. No	Scoring Indicator	Split up of score	Sub Total	TOTAL
I(1)	Defined as use of computers for the creation, modelling, analysis and optimization of any component or product.	0.5X4	2	**2X5= 10**
I 2)	LAN is a group of computers that are linking to communicate with each other and share software and hardware resources through cables and interfaces , covers short distances (building, department, campus etc..)	2	2	
I(3)	Master Production 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	2	2	
I(4)	NC is a form of programmable automation in which the processing equipment is controlled by means of numbers, letters and other symbols	2	2	
I(5)	G98 – Feed per minute G99 – Feed per revolution	1 1	2	
II(1)	A workstation is used by professionals for the design of critical components. A PC based system for less complex design. It will be having high processing power, high power graphics card, more memory capacity than PC Workstation can connect to multiple display with different viewpoints Workstation has networking facility to work with other workstations or as host	6	6	**6X5=30**
II(2)	-Reduced process planning and production lead-times -Faster response to engineering changes in the product -Greater process plan accuracy and consistency			

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	- Inclusion of up-to-date information in a central database -Improved cost estimating procedures and fewer calculation errors -More complete and detailed process plans - Improved production scheduling and capacity utilization -Improved ability to introduce new manufacturing technology and rapidly update process plans to utilize the improved technology (Any six)	1X6	6	
II(3)	Also known as additive manufacturing ,is a process in which material is joined or solidified under computer control to create a three-dimensional object, with material being added together (such as liquid molecules or powder grains being fused together). 3D printing is used in both rapid prototyping and additive manufacturing. It turns digital 3D models in to solid objects by building them up in layers-Invented in 1980- has been used for rapid prototyping-In last few years,3D printing has additionally started to evolve in to next generation manufacturing technology that has the potential to allow the local, on demand production of final products or parts- it is possible to 3D print wide range of materials that include thermoplastics, thermoplastic composites, metals, metal alloys, ceramics various forms of foods etc..- coming decades in combination with synthetic biology and nanotechnology, it has a potential to radically transform many design, production and logistic processes-It encompasses a wide range of additive manufacturing technologies-Each of these build objects in successive layers about 0.1 m thin-start with CAD or digital scan-processed by slicing software that divide objects in to thin cross sections that are printed out one on top of other- 4 categories 1.printers extrude molten or semi liquid metal 2. Printers that solidify photo crucible resin 3. Printers that bind or fuse the granules of a powder 4. Printers that stick together cut sheets of paper, plastic or metal (any six points)	1X6	6	

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II(4)	Turning centers will be having rotating tools in the turrets to facilitate off-axis machining such as drilling, milling, reaming, tapping, boring etc. In addition to the conventional X and Z-axes, CNC control of the spindle rotation i.e. C-axis. Such machines are known as turning centers Live tooling-minimize set up time and production lead time	2 2 2	6	
II(5)	Greater Flexibility Increased Productivity Shorter lead time Reliability Reduced maintenance Reduced scrap and rework Complex machining operations Better management control (answer any six)	1X6	6	
II(6)	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	2 2 2	6	
II(7)	Open Loop - Programmed instructions are fed into the controller through an input device. These instructions are then converted to electrical signals by the controller and sent to the servo amplifier to energize the servo motors. The cumulative number of electrical pulses determines the distance each servo drive will move, and the pulse frequency determines the velocity. The drawback of this system is that there is no feedback system to check whether the program position and velocity has been achieved. If the system			

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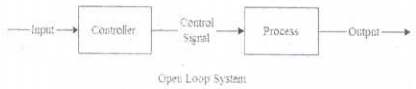
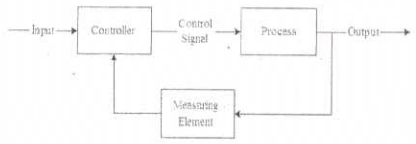
	performance is affected by load, temperature, humidity, or lubrication then the actual output could deviate from the desired output.  Open Loop System  Closed Loop System This system is generally used in point-to-point systems where the accuracy requirements are not critical. - The closed-loop system has a feedback subsystem to monitor the actual output and correct any discrepancy from the programmed input. The feedback system could be either analog or digital. Closed-loop systems are very powerful and accurate because they are capable of monitoring operating conditions through feedback subsystems and automatically compensating for any variations in real-time. Closed-looped systems require more control devices and circuitry in order for them to implement both position and velocity control. This makes them more complex and more expensive than the open-loop system	Fig=3 Any 3 point in each=3	6	

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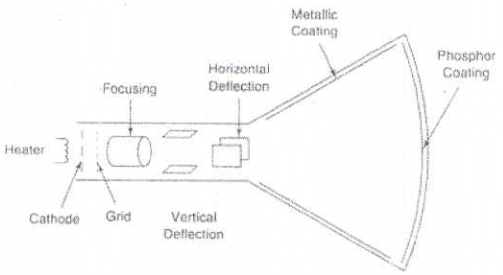
III (a)	 The CRT is a display screen which produces images in the form of the video signal. It is a type of vacuum tube which displays images when the electron beam through electron guns are strikes on the phosphorescent surface. CRT generates the beams, accelerates it at high velocity and deflect it for creating the images on the phosphorous screen so that the beam becomes visible. The CRT consists Electrons Gun Assembly, Deflection Plate Assembly, Fluorescent Screen, Glass Envelope, and Base The working 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 creates luminous spot, After exiting from the electron gun, the beam passes through the pairs of electrostatic deflection plate, which deflects the beams when the voltage applied across it. The working parts of a CRT are enclosed in a vacuum glass envelope so that the emitted electron can easily move freely from one end of the tube to the other The cathode is cylindrical in shape, and at the end of it, the layer of strontium and barium oxide is deposited which emit the high emission of electrons at the end of the tube. Control grid is made up of nickel material with a centrally located hole which is coaxial with the CRT axis. The electrons emitted from the electron gun passes through the control grid have high positive potential which is applied across the pre-accelerating and accelerating anodes.	Fig=4 Explanation=5	9	**15X4=60**

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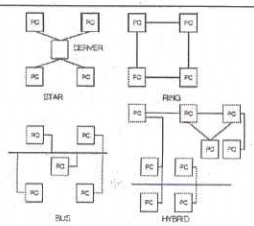
III (a)	The deflection plate produces the uniform electrostatic field only in the one direction. The electron beam entering into the deflection plates will accelerate only in the one direction, The front of the CRT is called the face plate. The face plate of the CRT is made up of entirely fibre optics The internal surface of the faceplate is coated with the phosphor. The phosphorous converts the electrical energy into light energy.			
III (b)	**2D CAD** is used to create flat drawing of product and structures.-Objects created in 2D are lines, circles, ovals and cuves-2D CAD programs usually include a library of geometric images, the ability to create Bezier curves, splines –ability to define hatching patterns-ability to provide bill of materials generation-popular 2D are Auto CAD,CAD key, CADDS, CATIA **3D CAD** Three Dimensional-wide variety of types, intended for different applications and levels-It create a realistic model of what the design object will look like, allowing designers to solve potential problems easier and lower production cost-some 3D Cad are Autodesk, SolidWorks, Unigraphics Inventor, Pro/Engineer, Solid Edge etc.. **3D Wire frame and surface modeling** Cad program which feature 3D wireframe and surface modeling create a Skelton like inner structure of objects being modeled-A surface is added on later-These are difficult to translate in to other software and rarely used **Solid Modeling**- the program is often able to calculate the dimensions of the objects it is creating	1.5 X2=6	6	
IV (a)				

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	In the **bus network** topology, every workstation is connected to a main cable called the bus. Therefore, each workstation is directly connected to every other workstation in the network. In the **star network** topology, there is a central computer or server to which all the workstations are directly connected. Every workstation is indirectly connected to every other through the central computer. In the **ring network** topology, the workstations are connected in a closed loop configuration. Adjacent pairs of workstations are directly connected. Other pairs of workstations are indirectly connected, the data passing through one or more intermediate nodes. **Hybrid** topology included the features of more than one topology to achieve the optimal trade-off reliability, performance, flexibility and cost	Fig=4 Explanation=4	8	
IV (b)	-Decrease the error percentage -Decrease the human effort -Saves time -Easy to edit -Improved accuracy -Reduced storage space -Corrections can be made easily -Repetitive parts of the drawing can be saved and imported as part of a "CAD library" -CAD systems can be linked with CAM machines to produce objects straight from the drawings	Any seven 1X7=7	7	

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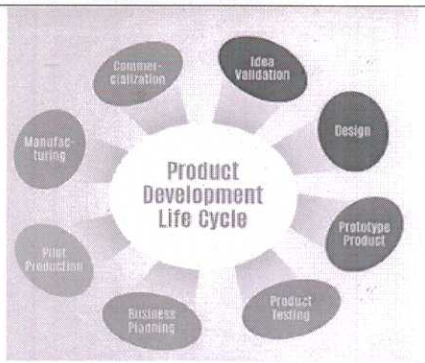
	-3D CAD designs can be made to look realistic by using the material library for clients to see -CAD designs can be easily shared between companies or department			
V(a)	 **Idea validation** • Assessment of market potential • Focus group with target customers or subject matter experts (SMEs) **Design** • Define initial specifications • Assess design drawings **Prototype Product** • Match developer with a prototyping facility **Product Testing** • Field testing with end users • Report of strengths and weaknesses **Business Planning** • Develop marketing and business plans • Perform benchmarking studies **Pilot Production** • Match developer with a limited-scale manufacturing facility **Manufacturing** • Identify long-term manufacturing solution • Optimize plant or line layout **Commercialization** • Develop branding strategy • Website design and hosting • Marketing and communications	Fig=4 Explanation=5	9	
V(b)	-Computer-aided Manufacturing (CAM) is the term used to describe the use of computerized systems to control the operations at a manufacturing			

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	plant. These computerized systems assist manufacturers in various operations such as planning, transportation, management, and storage. CAM helps manufacturers improve their time to market capabilities, -In addition to materials requirements, modern CAM systems include real-time controls and robotics. 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. 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 Modern CAM solutions are scalable and range from discrete systems to multi-CAD 3D integration. -CAM is often linked with CAD for more enhanced and streamlined manufacturing, efficient design and superior machinery automation.	Any six points= 6	6	
VI(a)	**In variant CAPP approach**, a process plan for a new part is created by recalling, identifying and retrieving an existing plan for a similar part and making necessary modifications for the new part. Sometimes, the process plans are developed for parts representing a family of parts called 'master parts'. The similarities in design attributes and manufacturing methods are exploited for the purpose of formation of part families. The variant process planning approach can be realized as a four step process;			

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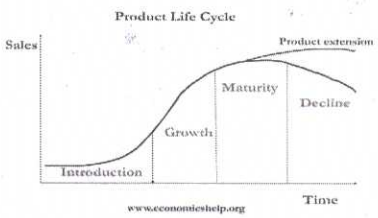
	1. Definition of coding scheme 2. Grouping parts into part families 3. Development of a standard process plan 4. Retrieval and modification of standard process plan **In the generative CAPP**, process plans are generated by means of decision logic, formulas, technology algorithms and geometry based data to perform uniquely many processing decisions for converting part from raw material to finished state. There are two major components of generative CAPP; a geometry based coding scheme and process knowledge in form of decision logic data. The geometry based coding scheme defines all geometric features for process related surfaces together with feature dimensions, locations, tolerances and the surface finish desired on the features. The level of detail is much greater in a generative system than a variant system. For example, details such as rough and finished states of the parts and process capability of machine tools to transform these parts to the desired states are provided.	4+4	8	
VI(b)	 Every product goes through a cycle from birth, followed by an initial growth stage,a relatively stable matured period, and finally into a declining stage that eventually ends in the death of the product as shown **Introduction stage**: In this stage the product is new and the customer acceptance is low and hence the sales are low. **Growth stage**: Knowledge of the product and its capabilities reaches to a g rowing number of customers.	Fig=3 Explanat ion=4	7	

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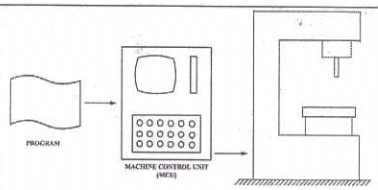
	Maturity stage: The product is widely acceptable and sales are now stable , and it grows With the same rate as the economy as a whole grows. **Decline stage:** At some point of time the product enters the decline stage. Its sales start decreasing because of a new and a better product has entered the market to fulfill the same customer requirements.			
VII (a)	 Basic Components of Numerical Control System **Program of Instruction**. The program of instruction is the detailed step by step set up of directions which tell the machine tool what to do and in what sequence. It is coded in numerical or symbolic form or some type of input medium that can be interrupted by the controller unit. The most common input medium today is punched tape. The other forms of input medium have been used, including punched cards, magnetic tape, and even 35 mm motion picture film. There are two other methods of input to the NC system The first method is by manual entry of instruction data to the controller unit. This method is called manual data input (MDI) and is appropriate only for relatively simple jobs where the order will not be repeated. The second method of input is by means of a direct link with a computer. This is called direct numerical control (DNC) **Controller Unit Also Called Machine Control Unit (MCU)**. The second basic component of the NC system is the controller unit. This consists of the electronics and hardware that read and interpret the program of instructions and convert it into mechanical actions of the machine tool. The	Fig=4 Explanation=5	9	

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VII (a)	typical elements of a conventional NC controller unit include the tape reader, a data buffer, signal output channels to the machine too feedback channels from the machine tool, and the sequence controls to coordinate the overall operation of the forgoing elements. It should be noted that nearly all modern NC system are sold with a microcomputer as the controller unit **Machine Tool or Other Controlled Equipment**. The third basic component of an NC system is the machine tool or other controlled process. It is the part of the NC system which **performs** useful work. In the most common example of an NC system, one designed to perform machining operations, the machine tool consists of the work table and spindle as well as the motors and controls necessary to drive them. It also includes the cutting tolls, work fixtures and other auxiliary equipment needed in the machining operation			
VII (b)	-Based on motion type a)Point-to –point system –b) continuous path system -Based on control loop a) Open loop system -b)closed loop system -Based on no of axes a) two axes system-b) three axes system-c) four axes system Based power supply-a)electrical-b) hydraulic-c) pneumatic	1.5X4	6	
VIII (a)	Direct numerical simultaneously control the operations of a group of NC machine tools using a shared computer. Programming, editing part programs and downloading part programs to NC machines are main responsibilities of the computers in a NC system. The capacity of stored memory and enhanced intelligence of the built-in, low cost, and dedicated computer replaced the desirable features of the DNC systems. Today DNC is utilized for machines to run very large part programs by dropping feeds			

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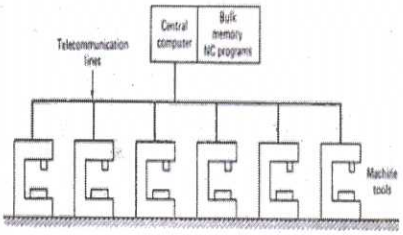
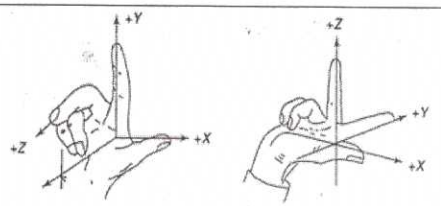
VIII (a)	codes to machine through computers and thus, enabling user to use limited storage of computers The tape reader is omitted. Involves data connection and processing from the machine tool back to the computer. 1. Central computer 2. Bulk memory which stores the NC part programs. 3. Telecommunication lines components 4. Machine Tools.  	Fig=3 Explanation=5	8	
VIII (b)	 (a) Axis Designation for Horizontal Z (b) Axis Designation for Vertical Z Hold the thumb, forefinger and middle finger at 90 ^{0} to each other Thumb (X axis) Forefinger (Y axis)and Middle finger (Z-axis) Each finger points to +ve direction of motion of the CNC tool 3-Axis CNC Milling Machine Direction of Spindle is the longest travel slide represents the X-axis The +Z-axis points into the spindle			

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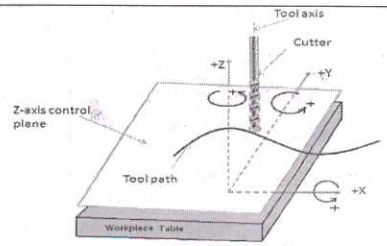
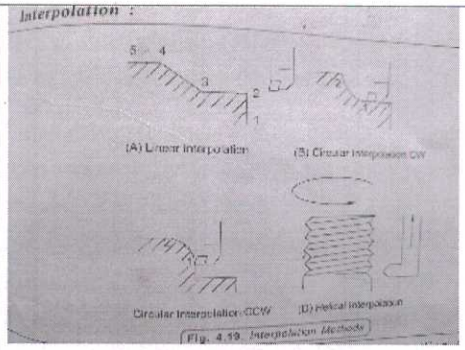
VIII (b)		Any Fig=3 Explanation=4	7	
IX (a)	 The calculation of successive increments in slide position to reach the programmable point is called interpolation. An interpolator provides two functions: It computes individual axis velocities to drive the tool along the programmed path at the given feed rate.-It generates intermediate coordinate positions along the programmed path.- There are five types of interpolation: linear, circular,helical, parabolic, and cubic **Linear interpolation** requires three parameters:-start point coordinate, end point coordinate and the speed command for each axis. linear interpolation can be used to cut all types of tool paths, including straight lines, circles,arcs, curves, and helical contours, etc	Fig=5		

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X(a)	N010 G53 To cancel any previous working zero point N020 G96 T01 S1500 N020 Sequence number T01 Select tool number –G96 Constant cutting speed -S500 Spindle speed is 1500 rpm N030 G57 G00 X26.0 Z0.0 M04 G57 To set the working zero point as saved G00 Rapid movement (no cutting) -X26.0 X . location (as a diameter; 13 form zero) Z0.0 Z . location - M04 Rotate spindle counter . . clockwise N040 G01 X25 Z-0 F10 M08 Tool moves close to work F10- Feed 10mm/min-M08coolant on N050 G01 X23.5 - 0.5mm retain for finishing cycle N060 Z-49.5 - long step N070 X26 N080 G00 X26 Z2 Go to safe position N090 G01 X21 F10 - short step N100 Z-14.5 N110 X26 N120 G00 X26 Z2 N130 G01 X19 N140 Z-14.5 N150 X26 N160 G00 X26 Z2 N170 G01 X17.5	Program=**10** Explanation=5	15	

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	N180 Z-14.5 N190G01 X21 N200 G01 X23.5 Z-30 F 10 taper turning N210 G00 X 24 Z-14 N220 G01 X 19 N230 G01 X 23.5 Z-30 N240 G00 X 24 Z-14 N230 G01 X 17 .5 N240 G01 X 23.5 Z-30 N250 G00 X 26 Z2 N260 G01X 17 Z0 F 10 Finishing cycle N270 G01 Z -15 N280 G01 X23 Z -30 N290 G01 Z-50 N300 G01 X26 N310 G00 X 30 Z30 M05 M09 Go to a safe location away from the work piece-spindle and coolant off N320 M30 End of program (Program sequence may change)			