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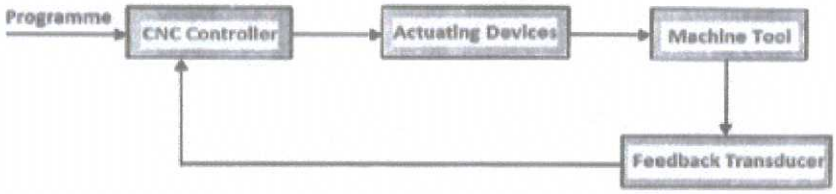
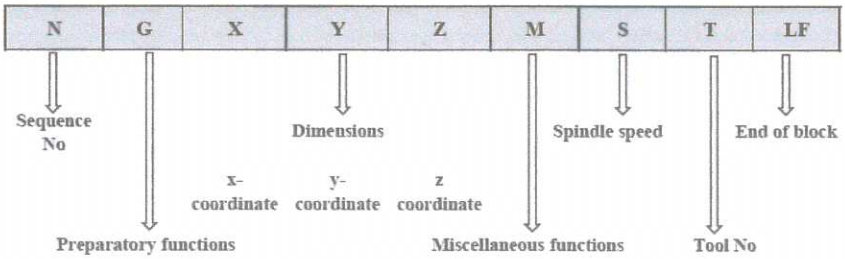
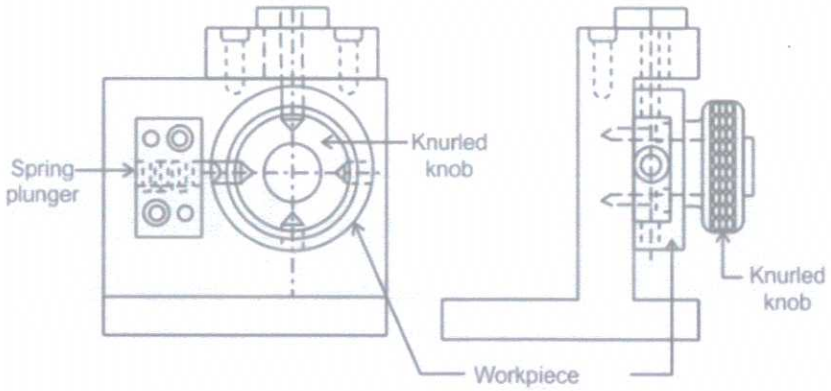
SCORING INDICATORS

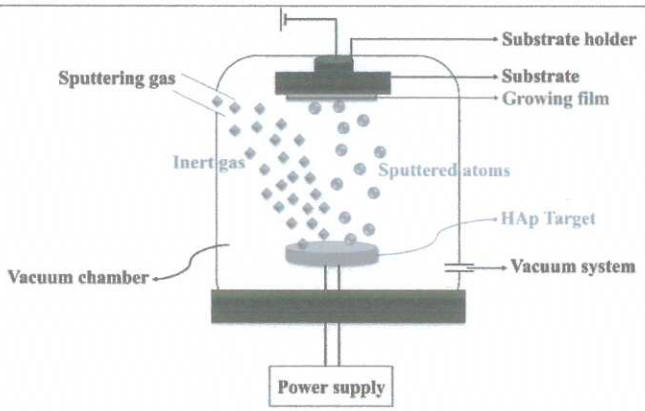
COURSE NAME: MODERN PRODUCTION PROCESSES

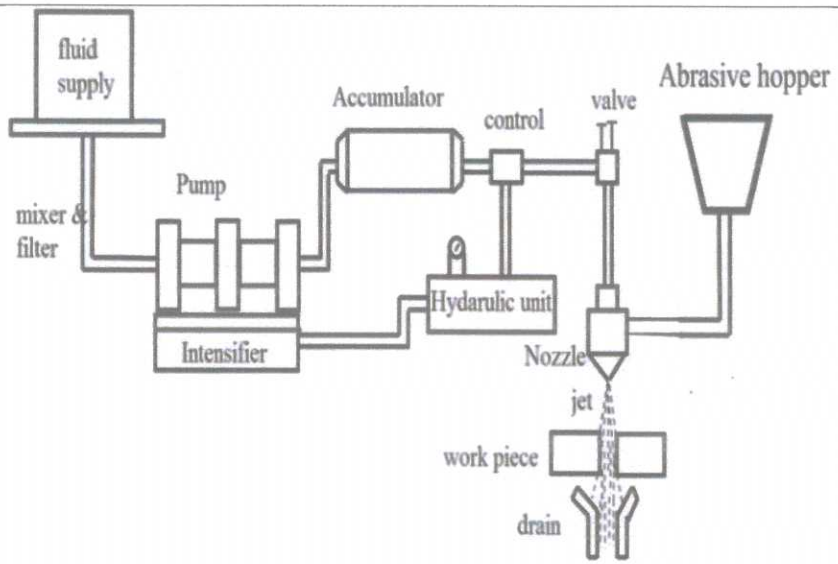
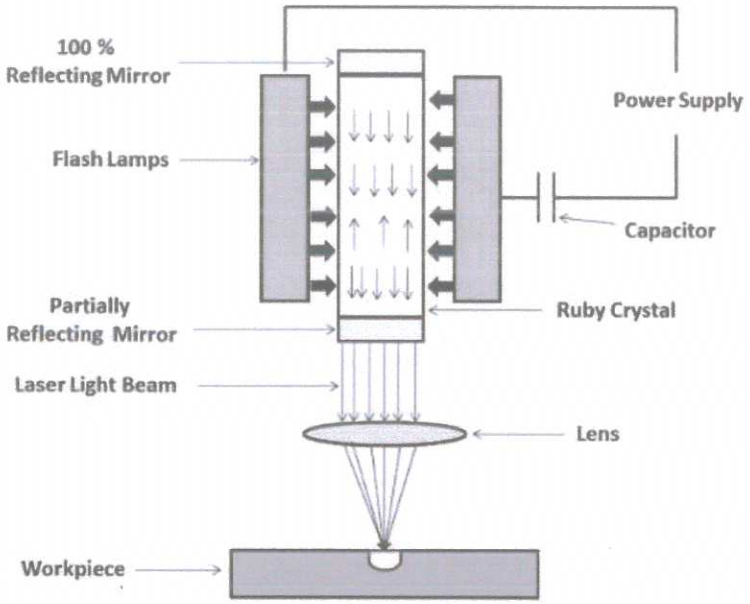
COURSE CODE: 5023 A QID: **2109230038**

PART- A

Qn. No	Scoring Indicators	Split score	Sub total	Total Score
1	Fixtures	1	1	9
2	Chemical vapour deposition (CVD)	1	1	
3	USM, WJM, AWJM	1	1	
4	Chemical reaction	1	1	
5	Wire Cut EDM	1	1	
6	Machining center	1	1	
7	Stereo-lithography	1	1	
8	Drilling, Reaming	1	1	
9	Three	1	1	
	PART-B			**24**
1	a. Increase in production b. The consistent quality of manufactured products due to low variability in dimension c. Cost reduction d. Inter-changeability and high accuracy of parts e. Inspection and quality control expenses are significantly reduced f. The decrease in an accident with improved safety standards g. Due to relatively simple manoeuvrability, semi-skilled workers can operate these tools, reducing the workforce's cost. h. Complex, rigid and heavy components can be easily machined i. Simple assembly operations reduce non-productive hours j. Eliminates the need for measuring, punching, positioning, alignments, and setting up for each workpiece, thereby reducing the cycle and setting up a time	1 X 3	3	
2	a. Powder production b. Mixing or Blending c. Compaction d. Sintering e. Secondary Operations f. Heat treatment/ Finishing	$\frac{1}{2}$ x 6	3	
3	The metal spray process involves heating the material, either wire or powder, until molten, before compressed gas blasts it onto the component. The result is a continuous layer that is well adhered to the component, with a high-quality finish and a quick turnaround due to the high deposition rate of the process.	1 x 3	3	
4	In EDM operation, a high voltage is applied across the narrow gap between the electrode and the workpiece. This high voltage induces an electric field in the insulating dielectric that is present in narrow gap between electrode and workpiece. This cause conducting particles suspended in the dielectric to concentrate at the points of strongest electrical field. When the potential difference between the electrode and the workpiece is sufficiently high, the dielectric breaks down and a transient spark discharges through the dielectric fluid, removing small amount of material from the workpiece surface	3	3	

5	**EDM-** Mold and die manufacturing processes, small hole drilling, Mold and Die Making, Medical components, Aerospace components. **USM-** machining hard and brittle materials like glass, ceramic, etc., drilling of non-circular and non-circular holes in hard metals, trepanning, threading and coining. **LBM-** Automobile, aerospace, shipbuilding, electronics, steel and medical industries for machining complex parts with precision	$\frac{1}{2}$ x 6	3	
6		3	3	
7	Part program is a high-level language containing the instructions for machining a part to various standard words, codes and symbols.	3	3	
8		3	3	
9	Rapid prototyping is the fast fabrication of a physical part, model or assembly using 3D computer aided design (CAD). The creation of the part, model or assembly is usually completed using additive manufacturing	3	3	
10	GT is a manufacturing philosophy in which similar part are identified and grouped together to take advantage of their similarities in manufacturing and design.	3	3	8x 3 = 24
	PART-C			**42**
III	 **Index jig** • This type of jig incorporates an indexing mechanism. • This enables the work to be indexed to required positions. • Such a requirement occurs when a number of equidistant holes are to be drilled on the circular flange of a workpiece. • The indexing device brings the work automatically to the next position of the hole under the bush after a hole is drilled. • Thus a set of equidistant holes can be drilled along a circular pitch.	Fig. 4 Expln. 3	7	7

IV	 Physical vapour deposition (PVD) is a process used to produce a metal vapour that can be deposited on electrically conductive materials as a thin, highly adhered pure metal or alloy coating. The process can be described according to the following sequence of steps. i. Evaporation ii. Transportation iii. Reaction iv. Deposition **Evaporation** During this stage, a target, consisting of the material to be is bombarded by a high energy source such as a beam of electrons or ions. This dislodges atoms from the surface of the target, 'vaporizing' them. **Transport** This process simply consists of the movement of 'vaporized' atoms from the target to the substrate to be coated and will generally be a straight-line affair. **Reaction** The PVD process can use reactive or inert gases to produce a strong bond between the coating and substrate for the best possible results. The reactive gases may be oxygen, nitrogen and methane. **Deposition** This is the process of coating build up on the substrate surface. Depending on the actual process, some reactions between target materials and the reactive gases may also take place at the substrate surface simultaneously with the deposition process. The component that is to be coated is placed in a vacuum chamber. The coating material is evaporated by intense heat from, for example, a tungsten filament.	Fig. 3 Expl 1 x 4	7	7
V	Non-conventional machining processes can be classified according to the source of energy used to generate such a machining action: mechanical, thermal, chemical and electrochemical. **Mechanical:** Erosion of the work material by a high velocity stream of abrasives or fluids (or both). Ultrasonic Machining (USM) Water jet machining (WJM) and Abrassive water jet machining (AWJM) are typical examples of single action, mechanical non-conventional machining processes. **Thermal:** The thermal energy is applied to a very small portion of the work surface, causing that portion to be removed by fusion and/or vaporization of the material. The thermal energy is generated by conversion of electrical energy. Eg: Electro discharge Machining (EDM), Electron beam machining (EBM), Laser beam machining (LBM), **Electrochemical:** Mechanism is reverse of electroplating. Eg: Electro Chemical Machining (ECM) **Chemical:** Most materials (metals particularly) are susceptible to chemical attack by certain acids or other etchants. In chemical machining, chemicals selectively remove material from portions of the workpart, while other portions of the surface are protected by a mask. Eg: Chemical Machining (CHM), Photochemical machining (PCM)	4 x 0.5 5	2 5	7

VI	 1) Hydraulic Pump: 2) Hydraulic Intensifier: 3) Accumulator: 4) Mixing Chamber or Tube: 5) Control Valve: 6) Flow Regulator or Valve: 7) Nozzle: 8) Drain and Catcher System:	4 0.5 X 6	4 3	7
VII	 Laser Machining is based on the LASER and conversion or process of Electric Energy into Light Energy and into Thermal Energy. Negatively charged electrons in the atomic model rotate around the positively charged nucleus in orbital paths. It depends on the number of electrons, electron structure, neighbouring atoms, and the electromagnetic field. Every orbital of electrons is associated with different energy levels. An atom is considered to be at ground level at absolute zero temperature at this, all electrons occupy their lowest potential energy. The electrons at the ground state move to a higher state of energy by absorbing energy like an increase in electronic vibration at elevated temperatures. High voltage is applied at the ends that leads to discharge and gas plasma will be formed. Population inversion and lasing action will take takes place due to energy transformation. The laser has one 100% reflector and the other one is a partial reflector. 100% the reflector directs the photons inside the	4		

	gas tube and the partial reflector allows only some part of the laser beam that will be used for the processing of materials. The laser beam produced is focused on the workpiece that has to be machined. When the laser strikes the workpiece, the thermal energy impinges on the workpiece. This will heat then melt, vaporize, and finally, the material will be removed from the workpiece. So, laser machining is a thermal material removal process that uses a coherent beam of light to machine the workpiece very precisely.	3	7	7

VIII

Sl No	Conventional Machining Processes	Non-Conventional Machining Processes
1	Generally macroscopic chip formation by shear deformation.	Material removal may occur with chip formation or even no chip formation may take place.
2	There may be a physical tool present.	There may not be a physical tool present.
3	The cutting tool is harder than the workpiece.	Cutting tool not harder than work piece
4	Material removal takes place due to the application of cutting forces – energy domain can be classified as mechanical	Mostly Non-Conventional Machining processes do not necessarily use mechanical energy to provide material removal. They use different energy domains to provide machining. For example, in USM, AJM, WJM mechanical energy is used to machine material, whereas in ECM electrochemical dissolution constitutes material removal.
5	Conventional machining involves the direct contact of tool and workpiece.	Does not require direct contact of tool and workpiece.
6	Lower accuracy and surface finish compared to NCM.	Higher accuracy and surface finish conventional machining.
7	Suitable for every type of material economically	Not Suitable for every type of material economically
8	Tool life is less due to high surface contact and wear.	Tool life is more
9	Higher waste of material due to high wear.	Lower waste of material due to low or no wear.
10	Noisy operations mostly cause sound pollutions.	Quieter operation mostly no sound pollutions are produced.
11	Lower capital cost	Higher capital cost
12	Easy set-up of equipment.	Complex set-up equipment.
13	The skilled or un-skilled operator may be required	Skilled operator required.
14	Generally, they are manual to operate.	Generally, they are a fully automated process.

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IX

Seq. No	Programme	Explanation
N 10	G21	Select metric
N 20	G40	Cancelling G41 & G42. (Tool radius compensation OFF)
N 30	G30 P3 U0 W0	Home position.P3-position, U=X axis, W=Y axis.
N 40	G54	Work coordinate.
N 50	G92 S1000	Limiting speed.

	N 60	G95 F0.2 T0101	Feed & Tool.			
	N 70	G96 S250 M04	Cutting speed & spindle rotation.			
	N 80	G00 Z3.0	Safety distance for Z axis.Tool will move rapidly to Z3.0.That is tool will stop at a distance 3.0 from face.			
	N 90	G00 X46.0	Safety distance for X axis. Tool will move rapidly to 46 diameter. As the diameter of raw material is 45.			
	N 100	G01 X30.0 M08	Tool will move in feed to 50 diameter. M08-Coolant ON.			
	N 110	G01 Z-40.0	This is the turning movement of tool upto Z-40.0 as per drawing.			
	N 120	G01 X46.0	Tool will return to safety postion with feed.			
	N 130	G00 X200 M09	Tool will move to a safety distance of 200 diameter. M09- Coolant ON.	7	7	7
	N 140	T0	Tool wear cancel.			
	N 150	G30 P3 U0 W0	Home position.			
	N 160	M01	Optional stop.			
	N 170	M30	Program stop and recycle.			

X

Seq. No	Programme	Explanation
N 10	T1 M06	Tool change to tool no.1, Automatic tool change
N 20	G00 Z1	Rapid positioning, Z= 1 mm (1 mm above work piece)
N 30	G90 G54 G00 X30 Y30	Drilling cycle (G90) Tool rapidly mo (G00) to first drilling position (G X=30mm Y=30mm while taking into acco Zero-offset-no. 1
N 40	G01 Z-52 S1200 F100 M03	Drill starts rotating clockwise with 1200 rp feed= 100 mm/min, drill depth 52 mm 92 r excess)
N 50	G00 Z1	Rapid positioning, Z= 1 mm (X= 30 mm, 30 mm)
N 60	G00 Y120	Rapid positioning, Y= 120 mm (X= 30 m Z=1mm)
N 70	G01 Z-52	Drilling second position hole
N 80	G00 Z1	Rapid positioning, Z= 1 mm (X= 30 mm, 120 mm)
N 90	G00 X120	Rapid positioning, X= 120 mm (Y= 120 m Z=1mm)
N 100	G01 Z-52	Drilling third position hole
N 110	G00 Z1	Rapid positioning, Z= 1 mm (X= 120 mm, 120 mm)
N 120	G00 X120	Rapid positioning, Y= 30 mm (X= 120 m Z=1mm)
N 130	G01 Z-52	Drilling fourth position hole
N 140	G80 G00 Z1. M09	Drilling cycle is cancelled with C command, Coolant is turned off.
N 150	G28 G91 Z0. M05	As operation for this component is finish so cutting tool is taken to reference positi and cutter rotation is stopped.

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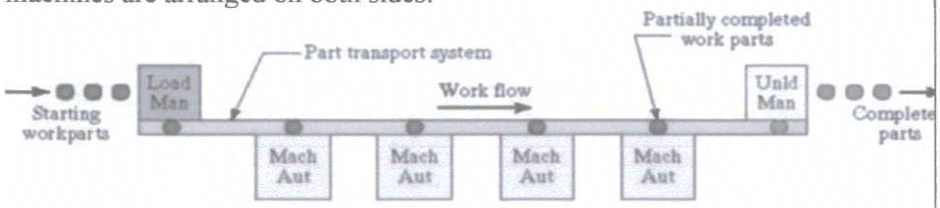
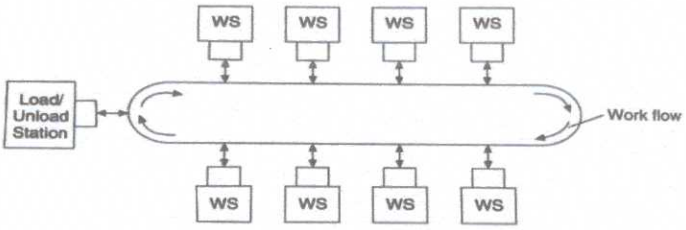
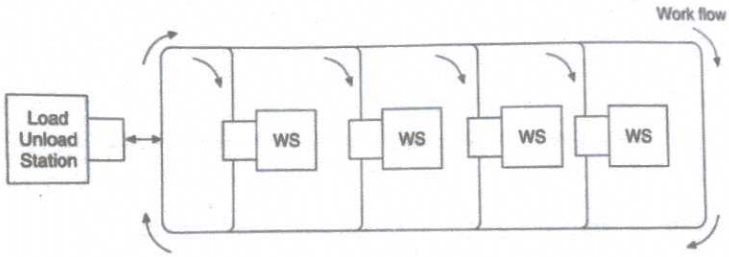
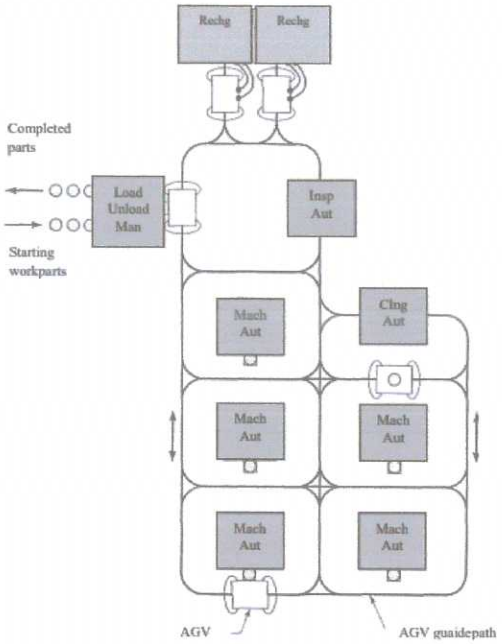
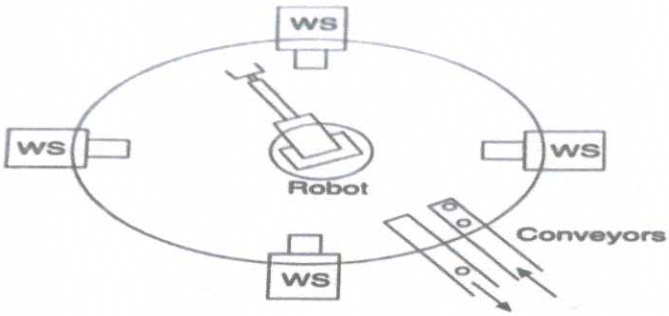
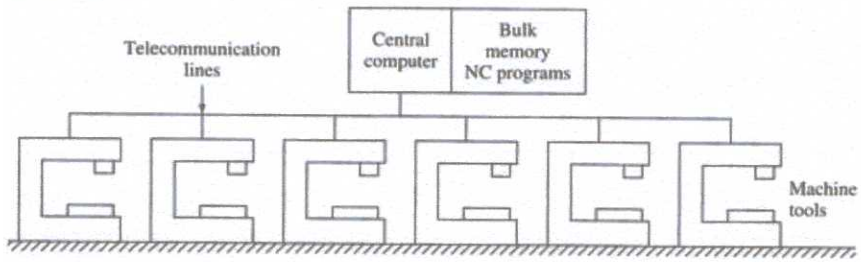
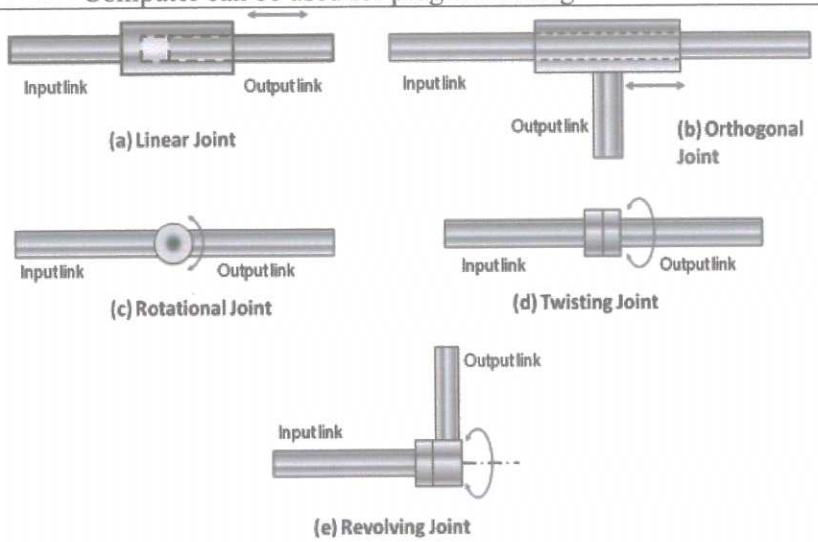
1. Increased efficiency

XI	2. Improved quality control 3. Increased flexibility 4. Reduced inventory 5. Better communication 6. Improved safety 7. Enhanced customization 8. Faster time-to-market 9. Better data management 10. Improved customer satisfaction 11. Better supply chain management 12. Reduced costs 13. Improved maintenance 14. Increased competitiveness 15. Better workforce utilization 16. Improved decision-making	1 X 7	7	7
XII	**1 Line layout** An Automated guided vehicle is most efficient when the movement is in straight-lines along the AGV path in a single-row machine layout. Machines are arranged only on one side of AGV path and in double row machine layout, machines are arranged on both sides.  **2 Loop layout** The loop layout uses conveyor systems that allow unidirectional flow of parts around the loop. A secondary material handling system is provided at a workstation which permits the flow of parts without any obstruction.  Loop FMS layout. **3 Ladder type layout** Ladder type layout consists of rungs on which workstations are located. This reduces the average travel distance thereby reducing the transfer time between workstations.  **4. Carousel layout**		6	

	In the Carousel layout configuration, parts flow in one direction around the loop. The load, unload stations are placed at one end of loop  **5 Robot centered cell** If a handling robot is used in a Flexible manufacturing system cell , the machines are laid out in a circle, such a layout is called circular layout.  	2 x3 1 for list	1	7
XIII	*DNC machine*  Direct numerical control (DNC), also known as distributed numerical control (also DNC), is a common manufacturing term for networking CNC machine tools. **Components** 1. Central computer 2. Bulk memory which stores the NC part program 3. Telecommunication lines 4. Machine tools ▪ A central computer connected to several machine tools and control them.	Fig. 3 4	7	7

	▪ Part program of all machine tools are stored in the memory of the central computer and transmitted on direct transmission lines on demand ▪ Two-way information flow takes place In real-time ▪ Various machine tools can communicate with the computer in real-time ▪ Programs in full or segment can be transferred to NC machines ▪ Computer can be used for program coding			
XIV	 **a) Linear joint (type L joint)** The relative movement between the input link and the output link is a translational sliding motion, with the axes of the two links being parallel. **b) Orthogonal joint (type U joint)** This is also a translational sliding motion, but the input and output links are perpendicular to each other during the movement. **c) Rotational joint (type R joint)** This type provides rotational relative motion, with the axis of rotation perpendicular to the axes of the input and output links. **d) Twisting joint (type T joint)** This joint also involves rotary motion, but the axis or rotation is parallel to the axes of the two links. **e) Revolving joint** In this type, axis of input link is parallel to the axis of rotation of the joint. However the axis of the output link is perpendicular to the axis of rotation.	3.5 3.5	3.5 3.5	7