_____

WINTER – 14 EXAMINATIONS

Subject Code: **17556**   **Model Answer**   Page No: _____/ N

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. NO.	MODEL ANSWER	MARKS	TOTAL MARKS
1	**Attempt any five**		**20**
a)	Non-traditional machining processes is defined as a group of processes that cut material by utilizing mechanical, thermal, electrical or chemical energy or combinations of these energies but do not use sharp and hard cutting tools as required for traditional manufacturing processes. The need of non-traditional processes is justified by the following points: (i) To machine the exotic material those were difficult to machine by conventlopal machining processes. (ii) To fulfill the requirements of new age like innovative design, tighter tolerances, micromachining and economy. (iii) To obtain intricate shapes. For example, a square blind hole of 15 mm x 15 mm with a depth of 30 mm. (iv) Overcome difficulty to machine the material. For example, Inconel, Ti alloy, carbide, ceramics. (v) To fulfill the requirement of low stress grinding. (if done by conventional then it reduce productivity). (vi) Drilling deep hole with small hole diamet:r1For example, 15 mm diameter. The non-traditional machining processes has following importance (i)Any material can be machined irrespective of its hardness. (ii) Any complicated shape can be produced on the work piece. (iii) Very fine holes can be easily drilled. (iv) The parts produced are burr-free. (v) No mechanical force is exerted on the work piece, so fragile work piece can be machined. (vi) Drilling of tapered holes is Possible. (vii) Through cutting of any materials.	2m-Defn. 1m-any 2 needs 1m-any 2 imp.	4m
b)	A dielectric fluid should possess the following functions: (i) It should act as an insulator until the required breakdown voltage is attained. (ii) It should act as a conductor, once the breakdown voltage is reached. (iii) It should clean the spark gap by carrying away the molten metal. (iv) It should deionize the spark gap rapidly after the discharge has occurred. (v) It should cool the tool, work piece and the spark region. The following characteristics are required by the dielectric fluid: (i) It should have low viscosity. (ii) It should have high flash point: (iii) It should have controlled level of toxicity. (iv) It should have freedom from acid and alkaline products. (v) It should have high dielectric strength (i.e. remain electrically non-	2m-any 4 function 2m-any 4 char.	4m

	conductiveuntil the required breakdown voltage is attained). (vi) It should be cheap and easily available. (vii) It should have high fluidity.			
c)(i)	G01 Linear interpolation		1m- Each code	4m
(ii)	G04 Dwell.			
(iii)	M06 Tool Change			
(iv)	M06 Spindle Start (Clockwise)			

d)	Sr.No.	Pull Broach	Push Broach	4m- any 4 points	4m
	1	This broach is pulled out of the work piece	This broach is pushed through the work piece.		
	2	It is longer in length than push broach	It is comparatively shorter in length		
	3	It is used where a longer surface is to be broached	It is used where a short length is to be broached		
	4	It carries more number of teeth.	It carries less number of teeth.		
	5	The pull broach is in tension	The push broach is in compression		

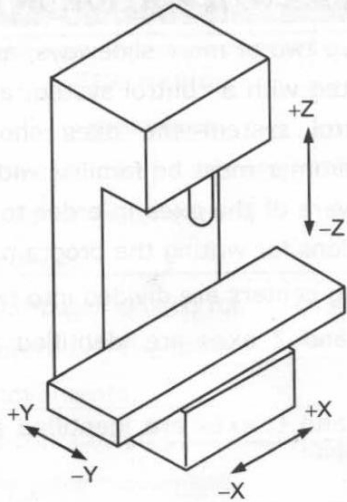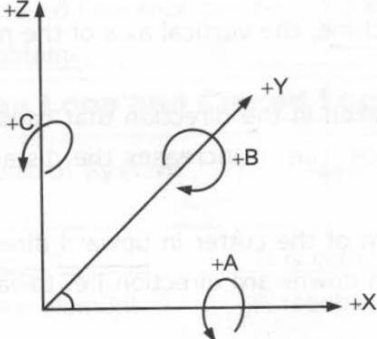|			

e)	The typical classification of milling machines is given below.
	 1.Column and knee type milling machines
	  o Plain milling machine
	  o Vertical milling machine
	  o Universal milling machine
	 2.Fixed bed type milling machine
	  o Simplex milling machine
	  o Duplex milling machine
	  o Triplex milling machine
	  o Rise and fall type milling machine
	 3.Production milling machine
	  o Rotary table milling machine
	  o Drum type milling machine
	  o Tracer controlled milling machine
	 4.Planer milling machine
	 5.Special milling machine
	  o Planetory milling machine
	  o Thread milling machine
	  o Profile milling machine
	  o Gear milling machine
	  o Cam milling machine
	  o Double end milling machine
	  o Spur milling machine.
		4m	4m

f)	Indexing is an operation of dividing a periphery of a cylindrical workpiece into equal number of divisions by the help of index crank and index plate. An indexing head, also known as a dividing head or spiral head is a specialized tool that allows a workpiece to be circularly indexed; that is, easily and precisely rotated to preset angles or circular divisions.	2m- Defn.	4m

_____

	The different methods of Indexing are: o Direct or Rapid indexing. o Plain or Simple indexing. o Compound indexing. o Differential indexing. 0 Angular indexing	2m- any 4	

g)	The advantages of centreless grinding are given below:
	   1) The rate of production is much higher in centre-less grinding than cylindrical grinding. Hence, cost of production is less.
	   2) As true floating condition exists during the grinding process rno need ofholding the work piece between the centres. Hence, axial thrust is absent.
	   3) The work piece is rigidly supported along the entire length, hence betterstability.
	   4) Large grinding wheels can be used. Wheel wear and tear is less and hence less maintenance.
	   5) The work is supported throughout its length and there is no deflection,therefore long slender workpiece can be ground easily.
	   6) The process is continuous and can be used for production work.
	   7) Size of work is easily controlled.
	   8) Semi-skilled operator can perform operation.
	
	The disadvantages of centreless grinding are given below:
	   1) The work piece having multiple diameters of steps and shoulders cannot be handled.
	   2) The work piece having flat surfaces and key ways can be ground.
	   3) In case of hollow work piece, shape may change
		2m-
		any 4
		adv.
		
		2m-
		any 2
		disadv.
			4m

2	**Attempt any four**		**16**
a)	Preventive maintenance is the planned maintenance of machine tools at regular inetrvals in order to prevent or minimize breakdown.It is the Systematic inspection, detection, correction, and prevention of incipient failures, before they become actual or major failures. Advantages of Preventive Maintenance (i) Flexibility allows for the adjustment of maintenance periodicity. (ii) Reducedequipment or process failure and increased equipment life. (iii) Reduced-breakdown and connected downtime. (iv) Greater safety for workers. (v) Fewer large scale and repetitive repairs. (vi) Identification of equipments requiring high maintenance cost. (vii) Reduceddown time as the machine work smoothly. (viii) Minimized loss of production due to breakdown. (ix) Greater control and supervision can be obtained. (x) Inventory of standard spare parts of the machine is reduced.	2m- Defn. 2m- any 4 adv.	4m
b)	Trueing Dressing	4m-	4m

_____

			any 4 points	
	1.It is the process making the periphery concentric to bore dia	1. It is the process of cleaning and opening the face of the wheel		
	2. It removes glazing defect.	2. It removes loading defect		
	3. It is done with a diamond tool.	3.It is done with a start wheel dresser.		
	4.Profiles can be obtained on the wheel face.	4. Profiles cannot be obtained		
	5. It is done to recover the lost shape of the face.	5.It is done to recover proper cutting action of the wheel		
c)	The principle of gear hobbing • Gear hobbing is a machining process in which gear teeth are progressively generated by a series of cuts with a helical cutting tool (hob). • All motions in hobbing are rotary, and the hob and gear blank rotate continuously as in two gears meshing until all teeth are cut. • For hobbing the spur gear, the hob and gear blank are connected by means of proper change gears. • The gear blank is first moved in towards the rotating hob until the proper depth is reached. • As soon as the properdepth is reached, the hob cutter is fed across the face of the gear blank until the tooth is completely cut. • During cutting operation both gear blank as well as hob (tool) rotates simultaneously during the entire process		4m	4m
d)	Compound indexing • Compound Indexing is used when the available capacity of the index plates is not sufficient for the given indexing job. • In other words when the work piece periphery cannot be divided by simple indexing method, compound indexing is used. • It is trial and error method. The method consists of two basic operations. 1. First operation is to turn the index crank through a required amount as it is done in case of simple indexing. 2. Second operation involves turning the index plate and crank both either in same or reverse directions, thus adding or subtracting the further movement,from that obtained in the first operation. Index crank movement = $40/N = n_1/N_1 \pm n_2/N_2$ where, N = Number of divisions required. N_1= Hole circle used by crank pin. N_2 = Hole circle used by lock pin. N_1 = Holes moved by crank pin in Ni hole circle plate. n_2 = Holes moved by plate and crank pin in N_2 hole circle		4m	4m

_____

e)	 1. Hopper 2. Mixing Chamber 3. Regulator 4. Pressure gauge 5. Gas Supply 6. Vibrating Device 7. Hose 8. Nozzle 9. Regulator Control valve for jet flow 10. Pressure gauge 11. Abrasive Jet 12. Workpiece **Abrasive Jet Machining**	2m-Diagm.	4m
	•The abrasive particles are held in the hopper through which it is fed into the mixing chamber. • A regulator controls the flow of abrasive particles. • Gas at high pressure is supplied to the mixing chamber through a pipe line • A pressure gauge and a regulator is incorporated in the pipeline to control the gas flow and its pressure. • The mixing chamber, carrying the abrasive particles is vibrated by the device and the amplitude of these vibrations controls the flow of abrasive particles. • These abrasive particles travel through the hose and enter into the nozzle. • The control valve and pressure gauge controls the flow of abrasive particles. • This outgoing high speed steam that comes out of the nozzle is known as abrasive jet. • When such jet impinges on the workpiece, the erosion caused by their impact enables the removal of metal.	2m-Expln.	
f)	The advantages of broaching are listed below: 1. The process can be done for both internal and external machining. 2. It is simple operation, hence does not require highly skilled operator. 3. As loading and unloading is rapid, the rate of production is high. 4. As both roughing and finishing can be done in one pass, so broaching is	2m-any 4 adv.	4m

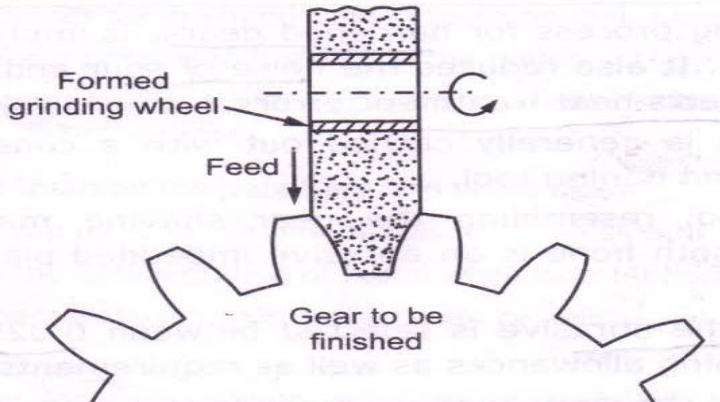|			
	fast operation. 5. Broaching is faster than any other machining process. 6. High accuracy and higher surface finish can be obtained. 7. The cutting force of the broach serves to clamp the work piece and hold it firmly in position. 8. Any form that can be produced on a broaching tool can be produced by the tool. The disadvantages of broaching are as follows: 1. It is a single purpose tool. 2. Tool cost is very high, so the process is justified only for mass production. 3. In some cases, it is not suited for low production rates 4. The parts to be broached must be strong enough to withstand high cutting forces. 5. Surface to be broached must be accessible. 6. Blind holes cannot be easily produced. 7. Tool sharpening is difficult and expensive process.	2m- any 4 disadv.	
3	**Attempt any four**		**16**
a)	 **(a) Linear Axes on CNC Milling Machine** **(b) Rotational Axes on CNC Machining Center** The axis on the machining centers are divided into two types.	2m- Diagm.	4m

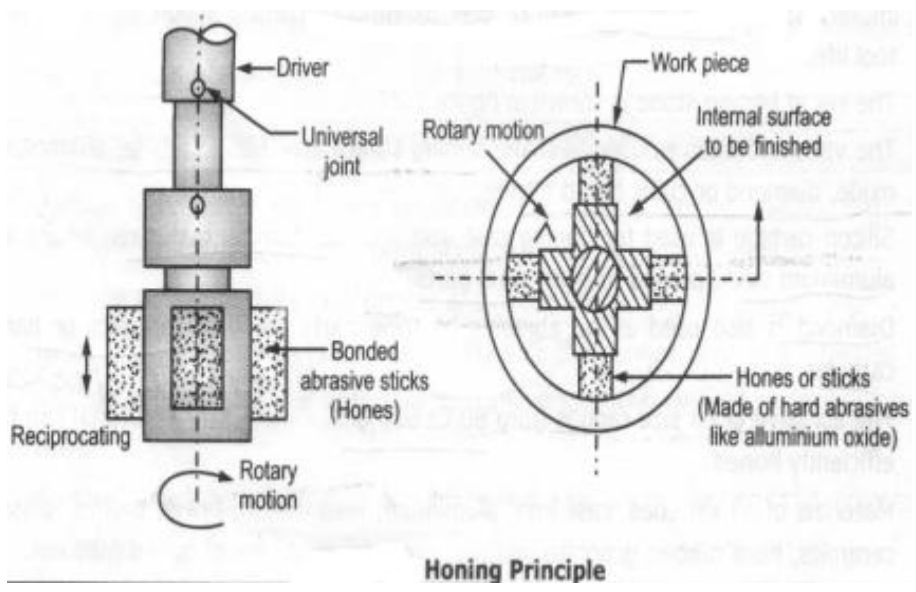|	

(i) Linear axes: X, Y and Z axes are identified as linear axes.
(ii) Rotary axes: A, Band C axes are identified as rotary axes
Z-axis:
• First the Z-axis is fixed for the machine tool. It is the main spindle axis.
• In a vertical milling machine, the vertical axis of the machine spindle is set as the Z-axis.
• The positive Z-axis is taken in the direction that causes the cutting tool to move away from the workpiece. (i.e. it increases the distance between the workpiece and the tool.
• It means that movement of the cutter in upward direction is positive Z-axis. The movement of the tool in downward direction i.e. towards the workpiece is set as negative Z-axis.
• On vertical machining centers Z-axis is vertical and on horizontal machining centers Z-axis is horizontal.
X-axis:
• It is always horizontal and parallel to the workpiece/holding surface.
• It indicates the longitudinal travel of the work table.
• When looking from the tool spindle to the column, the positive X direction is identified as being to the right in vertical milling machine.
Y-axis:
   • It is perpendicular to both X and Z-axes.
   • It is also horizontal and indicates the cross travel of the table.
   • The positive Y direction is the direction which completes with the +X and +Z motions a right hand cartesian co-ordinate system as shown in Fig. (b).
A-axis:
• It is the axis of rotary, motion of a tool along X axis
• Clockwise rotation is considered as positive movement looking in +X direction.
B-axis.
• It is the axis of rotary motion of a tool along Y-axls.
• Clockwise rotation is considered as positive movement looking in +Y direction.
C-axis:
• It is the axis of rotary motion of a tool along Z-axis.
• Clockwise rotation considered as positive movement and is identified by looking in +Z direction.
	2m-explan.

b)			1m-Diagm.	4m

Theatoms of a medium (for example, a ruby crystal rod) are at ground state. When a quantum of energy from a light source is made to fall on this medium, it causes absorption of radiation by the atoms of the medium. This results in electron of the atoms of the medium to jump to the upper energy level. The atoms in the upper energy level are then said to be in an excited state. The atom in an excited state immediately begins to drop spontaneously to the metastable (intermediate) state. From the metastable state the atom emits photon at random before it falls to the original energy level. This radiation of photons is known as spontaneous emission which is extremely rapid. In the presence of light of the appropriate frequency stimulated emission will occur in the upper energy level when the atoms will begin to emit and chain reaction will occur by causing more to emit and the whole avalanche would dump down together. This is called losing action.

3m-explan.

c)	Sr.No.	Capstan lathe	Turret lathe	4m-any 4 points	4m
	1	It is a light duty machine.	Turret lathes are relatively more robust and heavy duty		

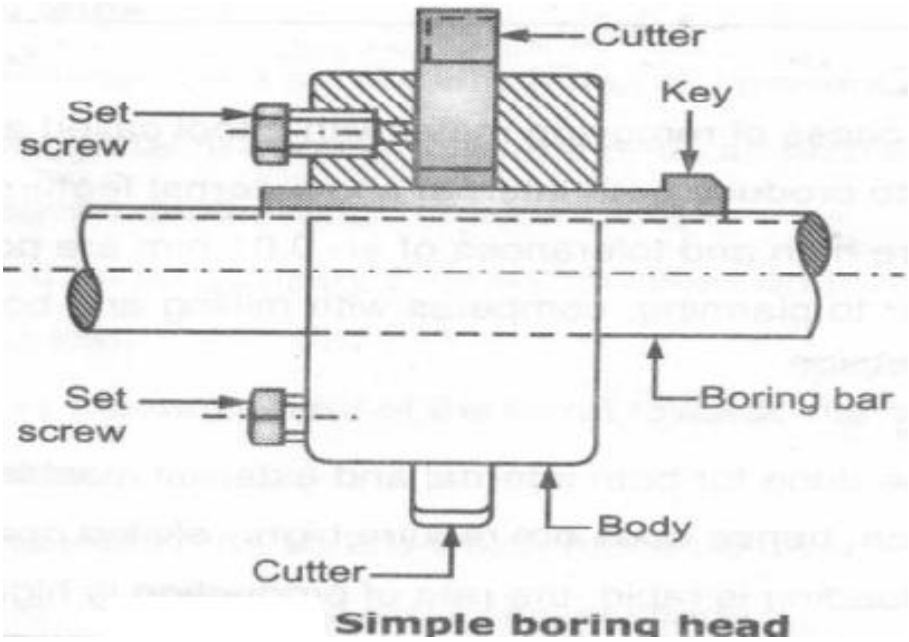|	Sr.no.				
		machine.			
	2	The turret head is mounted on the ram and the ram is mounted on the saddle and moves on the guideways.	The turret head is directly mounted on the saddle and the saddle slides over the bed ways.		
	3	The saddle will not be moved during machining	The saddle is moved along with the turret head durinq machining		
	4	The lengthwise movement of turret is less	The lengthwise movement of turret is more.		
	5	Only short workpieces can be machined	Long work pieces can be machined.		
	6	Collet is used to hold the workpiece	Jaw chuck is used to hold the workpiece		
	7	It is easy to move the turret head as it slides over the ram	It is difficult to move the turret head along with saddle.		
	8	The turret head cannot be moved crosswise.	The turret head can be moved crosswise in some turret lathes		
	9	As the construction of lathe is notriqid, heavv cut cannot be given,	As the construction of lathe is rigid,heavy cut can be given.		
	10	It is used for machining work pieces up to 60 mm diameter	It is used for machining workpieces up to 200 mm diameter.		
	11	Capstan lathes generally deal with short or long rod type blanks held in collet.	Turret lathes mostly work on chucking type jobs held in the quick acting chucks.		
	12	The turret travels with limited stroke length within a saddle type guide block, called auxiliary bed, which is clamped on the main bed	In turret lathe, the heavy turret being mounted on the saddle which directly slides with larger stroke length on the main bed		
	13	External screw threads are cut incapstan lathe using a self opening die being mounted in one face of the turret.	In turret lathes external threads are cut by a single point or multi point chasing tool being mounted on the front slide and moved by a short leadscrew and a swing type half nut		
	14	The turret of capstan lathe is called as a capstan head which may be circular or hexaqonal.	The turret of turret lathe is called as a turret head which may be square octagonal or hexagonal		
d)	Sr.no.	Up Milling	Down Milling	4m-any 4	4m
	1	In conventional milling the	In climb milling, the cutter		

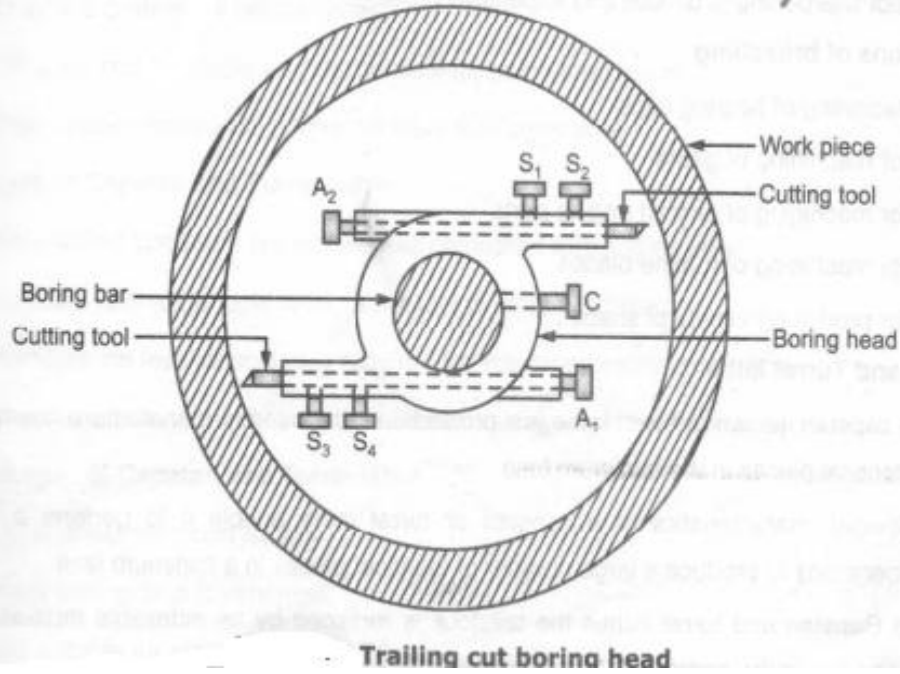|				points	
		cutter rotates in a direction opposite to that in which the work is fed	rotates in the same direction to which the work is fed		
	2	The chip thickness progresses gradually from start to cut to end of cut (i.e. chip thickness is minimum at the beginning of cut and maximum at end of the cut).	The chip thickness is maximum at the beginning of cut and minimum at end of the cut		
	3	The cutting force tends to lift the w/p away from the fixture.	The cutting force tends to seat the w/p into the fixture		
	4	It is difficult to pour coolant at the point of machining	It is easy to pour coolant at the point of machining		
	5	It is difficult to design the fixture	Fixture designer is easy		
	6	Wavy type of surface finish is obtained.	Better surface finish is obtained		
	7	The cutter does not start cutting metal as soon as it comes in contact with the workpiece	The cutter starts cutting metal as soon as it contacts the w/p.		
	8	The cutting force is down wordat beginning and reaches to upword at the end of the cut.	The cutting force is upword at beginning of cut and reaches to downward at the end of the cut		
e)		•Gear operating at high speeds and high loads are always hardened and there is distortion in gear flank. • In order to remove this distortion and to have accurate profile on gear teeth, for smooth running gear grinding is done. • Grinding is a very accurate method and is, though relatively expensive, more widely used for finishing teeth of different type and size of gears of hard material or hardened surfaces.		1m-Diagm. 3m-explan.	4m

_____

	• The properly formed and dressed wheel finishes the gear teeth flanks by finemachining or abrading action of fine abrasrves. • The grinding tool is formed by trueing the grinding wheel to the shaped and size of gear tooth to be finished. • The gear is mounted on indexed head and grinding wheel is fed to required depth. The gear is then withdrawn and indexed for next teeth.		
f)

Honing Principle

Honing Priciple:
•When honing is done manually, the honing tool is rotated and work piece is passed back and forth over the tool.
• Length of motion is such that the stones. extend beyond the work piece surface at the end of each stroke.
• For precision honing, the work is usually held in the fixture and the tool is given a slow reciprocatin motion as it rotates.
• The stones are thus given a complex motion as rotation is combined with oscillatory axial motion.
•These two motions combine to give a resulting cross hatch lay pattern.

Application of Honing:
1. Honing is mostly performed for finishing cylindrical holes like in gun barrels, cylinders of i.e. Engine, hydraulic and pneumatic cylinder bore, long tubular parts.
2. Internal finishing of bearings, ring gauges, ends of connecting rod.
3. For finishing external surfaces like gear teeth, valve seat, recess of balls and roller bearings.
4. External finishing of cylindrical parts like piston rods, piston pins, spindle Shaft. | 1m-Diagm.

2m-explan.

1m-any 2 appln. | 4m |
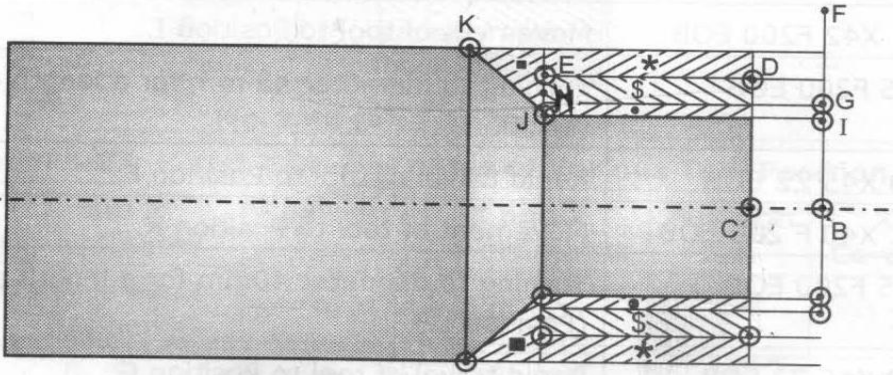| **4** | **Attempt any four** | | **16** |
| a) | REPAIR CYCLE ANALYSIS | 2m | 4m |

	•Preventive maintenance involves carrying out inspection, repair and complete overhaul of the machine. • The inspection and repair activities are carried out on the machine tool in a particular sequence. • This sequence is determined forehand in the early life of the machine. • Thus the cycle of I, R (small or medium repair) and C (complete overhaul) repeated till three or four overhauling. • The cycle of inspection, small repair and medium repair between two comlete overhauls is called as repair cycle. • OR The cycle from machine commissioning to first complete overhaul is repair cycle. For example, (i) I1 - S1 – I2 - S2 - I3 - M1 - I4 - S3 - I5 - S4 - I6 - M2 - I7 - S5 – I8 - S6 - 19 - C is a repair cycle for a particular grinding machine. After every inspections, small repair is carried out. However, after every three inspections, medium repair is carried out and after two medium repairs, complete overhauling is carried out. (ii) C - I1 - I2 – I3- S1 - I4 - I5 - I6 - M1 - I7 – I8 - I9 - S2 - 110 – I11 - I12- C is a repair cycle for an elevator which consists of one medium repair, two small repairs and twelve inspections between two overhauls.	2m	

b)				4m- any 4 points	4m

Sr.No	Preventive Maintenance	Breakdown Maintenance
1	For preventive maintenance tasks,the machines are shut down.	Breakdown maintenance is done when machine gets shut down
2	It is done at the preset schedule.	It is done when the need occurs.
3	It is time based	It is need based.
4	Even if the performance capability of machine is good,the maintenance is done on schedule	Actual condition of the machine is not concerned at all, whether good or bad, maintenance is done only at breakdown.
5	In early life of machine preventive maintenance jobs are comparatively more in nature	In early life of machine breakdown maintenance is very rare.
6	It is more suitable for industries where large number of similar or nearly similar machines are available	It is suitable for small industries only having less number of machines. It is not suitable in big industries having more number of machines

c)	Process Parameters of WJM (a)The stand-off distance: 1.It is the gap between the jet nozzle and the workpiece. 2.MRR increases with the increase of stand-off distance upto a certain limit after which it remains unchanged for a certain tip distances and then falls	4m- any four	4m

_____

gradually.

(b)Wear rate of the nozzle:

1. It depends on the hardness of the nozzle material, pressure (hence, velocity) of the jet and,nozzle design .

c) Fluid Pressure:

1. The increase in ressure allows more power to be used in the machining process, which in turn increases the depth of'the cut.

2. The qualityt of cutting improves at higher pressures by widening the diameter of the jet and by lowerinq .

3. the traverse speed. Moreover, the larger the pump pressure, the greater will be the depth of the cut. .

(d) Jet Fluid:

1. The fluid used must possess low viscosity to minimize the energy losses and be noncorrosive, nontoxic, common, and inexpensive.

2. Water is commonly used for cutting alloy steels.

(e)Target material:

1.Brittle materials will fracture, while ductile ones well.

2. Material thicknesses range from 0.8 to 25 mm or more

d)	 **Simple boring head**	3m-any 1 boring head 1m-condn.	4m

•Fig. showa a simple boring head. Boring head can be keyed at any desired position on the boring bar it support the tool. A boring head may have number of cutters.

• The advantage of having several cutters is metal removal rate is high, hence machining time is reduced. Boring heads are always provided with two sets cutters. One set is being used for roughing and other for finishing.

OR

Trailing cut boring head

• The boring head can slide in the slot along the length of the boring bar and clamped in the desired position. The body carries arrangement for mounting of two boring tools. The tools are held firmly in position by means of sets screws. The tool can be fed into the work piece by the adjusting screw.

e)	Important factors considered for selection of grinding wheel are as follows 1. Constant Factors: (a) Work-piece Material: Work-piece material affects the choice of abrasive grain, its size, grade, structure and bond. For hard work material, soft grinding wheel and for soft work material, hard g-rinding wheel is selected. (b) Amount of Stock to be Removed: Amount of stock to be removed affects grain size and bond. Coarse grains are used for rough grinding and fine grains are used for finish cut. (c) Area of Contact: For smaller area of contact, hard and fine grinding wheel is used and for large area of contact, coarse and soft grinding wheel is used. (d) Type of Grinding Machine Used: Heavy rigid machines demand softer grade of wheel. 2. Variable Factors: (a) Wheel Speed: Depending upon qrade, and bond, maximum recommended speed is used. (b) Work Speed: For high speed of workpiece, hard grade grinding wheel is used. (c) Condition and Capacity of Machine: New and rigid machine can be mounted with softer grade wheel, and old machines are mounted with hard wheel. (d) Personal Factor: Skilled operator can handle softer wheel carefully and	4m- 2 points per factor	4m

	give better and economic production. • For smaller area of contact, hard and fine grinding wheel is used and for large area of contact, coarse and soft grinding wheel is used.		
f)	 **Straddle Milling** • When two parallel vertical surfaces are machined simultaneously by two side milling cutters mounted on--the same arbor the operation is called straddle milling. • Distance between the cutters is so adjusted that both sides of the work piece can be milled simultaneously. • The two side milling cutters are separated by spacers, washers, and shims so that the distance between the cutting teeth of the cutters is exactly equal to the width of the work piece area required. • Usually two half side milling cutters are used so that they straddle the workpiece. • The work piece is usually mounted between centers in the indexing fixture, or mounted vertically in a swivel vise. • When cutting a hexagonal head of a bolt, two opposite sides of the head are cut,then the spindle of the indexing fixture or the swivel vise is rotated 60° and other two sides of the work piece are straddle milled, then the spindle is again rotated 60° and remaining two Sidesof the work piece are straddle milled.	2m-Diagm. 2m-explan.	4m
5	**Attempt any two**		16

a)		2m-Diagm.	8m

A WEDM Set-up

| | The basic elements in a WEDM process, as shown in Fig. | 2m-Set up | |

The basic elements in a WEDM process, as shown in Fig.
(i) Power supply system.
(ii) Di-electric system.
(iii) A CNC control system (work piece positioning unit).
(iv) Wire drive system.

(i) Power supply system:
o The work piece is mounted on the table.
o The tool is connected to negative terminal, so that it becomes cathode, while work piece is connected to positive terminal and become anode.
o The tool and work piece is connected to a DC power supply.
o The supply is in the form of a pulse. A voltage of about 50 V is applied to the system.
o However because of very small wire size, it cannot carry current more than 30 A.
(ii) A dielectric system:
o Deionized water is used as a dielectric fluid in WEDM. It gives high metal removal rate and better surface finish.
o A nozzle is employed to inject the dielectric fluid in the machining area.
o Both the work piece and the wire are constantly flushed with dielectric fluid at the area being machined.
o The dielectric also serves as a coolant.
(iii) A CNCcontrol system:
o A CNC control system is used for the movement of work table.
o The table has movement in two axis (direction).

_____

	o The table can also be moved in both the directions simultaneously for taking contouring cuts. (iv) Wire drive system: o This system performs three functions: (i) to feed the fresh wire for machining (wire feed mechanism). (ii) to take-up the used wire (wire take-up mechanism). (iii) to keep the wire under appropriate tension so that it moves in the machining area as a straight wire. o The wire is used only once because due to sparking which takes place at the surface of the wire, the wire no longer remains round. o During operation when the supply is made 'ON' the dielectric fluid gets ionized and results in melting of work piece. Disadvantages of WEDMI; (i)Wire cannot be reused, because due to sparking the wire no longer remains round. (ii) If proper tension in wire is not maintained, the surface finish will be poor. (iii) Only electrically conductive material can be machined. (iv) Residual stresses are induced in the work piece during machini'ng. (v) The maximum depth of work piece which can be machined is around 90' mm. (vi) A hole is necessary in the work piece for machining of surface which are not at the edges. Applications of WEDM; (i) Punches and dies used in press tools can be made. (ii) For the production of moulds and dies. (iii) Used to cut out complex contours in electrically conductive work pieces. (iv) Simple, flat shapes, which usually would be stamped, may be a job for wire EDM when they require a superior quality edge. (v) Cylindrical pins as small as 5 mm in diameter can be machined.	2m-any 2 limitns.. 2m-any 2 applns.	
b)	 **(b): Tool movement**	8m with sketch	8m

Tool sequence is A-B –C –D –E- F G- H- I-J-K

Program	Description
	Program Number
N100 G90 G21 G94 EOB	Absolute mode, input in mm, feed in mm/min.
Nll0 M03 5800 M08 EOB	Spindle start clockwise direction, spindle speed,coolant on.
N120 GOO XO Z2 EOB	Rapid travel of tool to Position B.
N130 GO1 Z 0 F 200 EOB	Movement of tool to Position C
N140 X23 EOB	Facing operation. (Position D.)
N150 Z -20 EOB	Turning to diameter 23 mm for a length of 20 mm(Position E.)
N160 GOO X28 Z2 EOB	Rapid travel of tool to Position F.
N170 GOl X21 F200 EOB	Movement of tool to the Position G.
N180 Z-20 EOB	Turning to diameter 21 mm for a length of 20 mm. Position H.
N190 GOO X28 Z2 EOB	Rapid travel of tool to Position F.
N200 GOl X20 F200 EOB	Movement of tool to Position I.
N210 Z-20 EOB	Turning to diameter 20 mm for a length of 20 mm. (Position J).
N220 X25 Z -25 EOB	Taper Turning for a length of 5 mm. Position K.
N230 GOO X80 Z50 EOB	Rapid travel of tool away from the work piece. Position L.
N240 G28 EOB	Rapid return to machine reference position.
N250 M05 EOB	Spindle stop.
N230 M09 EOB	Coolant-off.
N240 M30 EOB	Program end and tape rewind

c)		2m-Block diagm.	8m

Column and knee type milling Machine

Construction:
Two basic types of column and knee milling machines, (left) Horizontal and (right) Vertical. In its simplest form, it is shown in the above figure. It consists of a column which is hollow structure housing the driving motor, speed change gears for spindle and mechanisms for controlling the table and knee movements. Base of the machine is made hollow and is used for storing the coolant. On the front of the column, machined ways are provided, on which knee can slide up and down, with the help of elevating screw. Knee forms a base for the saddle to facilitate it in sliding towards and away from the column along with the work table fitted on the saddle. Work table can further slide lengthwise on the saddle and has the usual means provided on it for clamping of jobs or fixtures.

Working:
Thus a job fitted on the table can be given three motions, viz., vertical (up and down), cross (in and out) and longitudinal (back and forth). Cutters are

3m

3m

	mounted on the horizontal arbor which is rigidly supported by the over-arm, spindle and the braces. In the hollow casing of the column, motor drives the counter shaft by means of a belt or chain. Mechanical, electrical or hydraulic devices are used for the quick change of spindle speeds and power feeds for the job.			
6	**Attempt any four**			**16**
a)	DRY RUN Depress this switch to enter into dry run mode. When selected during AUTO/MDI operations, the feedrate specified in the program or MDI is changed to JOG feedrate set on the traverse feed dial. Depress the same switch to come out of this dry run mode.The dry run function checks a program quikly without cutting pacts.		2m	4m
	JOG MODE • The mode that allows for the manual operation of tool movement via the jog buttons is called as jog mode. • Jog mode is mostly used to travel the CNC machine table slide for movement of table along x-axis or z-axls, • These axis movements can be via a jog mode button or through the CNC machine hand wheel. It is also called as manual mode. • In this mode, the CNC machine behaves like a standard or conventional machine. • With the jog mode, the operator of a CNC machine is allowed to press buttons,turn hand wheels, and activate switches in order to attain the desired machine function. • The activation of each button or switch in the manual mode has an immediate response		2m	

b)	No.	Open loop Control System	Closed Loop Control System	4m-any 4 points	4m
	1	It is simple in desiqn.	It is complex in desiqn.		
	2	There is no feedback element	A feedback element is present in this system.		
	3	The input is directly given to the MCU.	The input and feedback signal is given to the comparator which sends the required signal to the MCU.		
	4	Time required for processing is less.	Time required for processing is more.		
	5	The output may not be as desired.	The output given is exactly as desired.		
	6	The output cannot be controlled.	It provides a controlled output.		
	7	It is cheaper as compared.	It is expensive as compared		

c)	A broaching machine is classified as below: o According to the method of operation (a) Pull broach (b) Push broach		4m	4m

_____

	(c) Stationary broach o According to the kind of operation (a) Internal broach (b) External broach o According to their use (a) Single purpose (b) Combination o According to their construction (a) Solid (b) Built up (c) Progressive (d) Inserted tooth o According to their function (a) Keyway broach (b) Spline broach (c) Sizing broach (d) Spiral broach (e) surface broach		
d)	• A horizontal broaching machine consists of power head hydraulic cylinder supporting plate,broach. • Its bed or a base a little more than twice the length of the broaching stroke, a broach pilot and the drive • mechanism for pulling the broach. • Horizontal broaching machines are used primarily for broaching keyways, splines, slots,round holes, and other internal shapes or contours.	4m	4m
e)	• Burnishing is a cold working process, by which improvement in surface finish, dimensional accuracy and work hardening can be obtained without removing themetal. • Burnishing is a non-cutting operation and uses no abrasives. • It is a process of producing bright, shining and smooth surface on metals. • It is a finlshinq operation and is normally done on parts which are turned, bored, reamed or ground. Any ductile or malleable material with hardness less than 49 HRCcan be successfully burnished. • Burnishing is done as supplementa process after metal cutting operations like turning, milling, shaping operations. • Lapping and Honing is eliminated with burnishing. • Burnishing is a metal finishing process that involves physical displacement of surface irregularities rather than cutting or grinding. • The process involves moving a set or hardened rollers or balls against the metal surface under pressure, thereby causing microscopic blemishes in the metal surface to flatten for a perfect, mirror surface. •In this process fine surface finish is produced by the planetary rotation of ardened rollers over a bored or turned metal surface. • All the machined surfaces consist of a series of peaks and valleys (surface irregularities) of irregular height and spacing. The plastic deformation created by burnishing is a disptacement of the material from the peaks	4m	4m

_____

	which cold flows under pressure into the valleys. • There is rubbing and peening action on work surface by smooth but hard tool,spreading minute surface irregularities into flat surface. • This helps to flatten the high spots by allowing plastic flow of the metal. The edges of the metal can be smoothened by pushing it through a die that will smooth out the burrs and the blanked edge caused by the die break.		
f)(i)	•Gasket should be placed in the female coupling to make the connection water tight. Gasket should be checked every time a connection is made and should be replaced if there is an indication of wear cut etc. •To facilitate making and breaking connections, couplings are furnished with rocker lugs. Rocker lugs are located on all male and female couplings with the exception of couplings found on booster hose. • All couplings are attached to the hose jacket by an expansion ring. This expansion ring is pressed outward, securing the hose jacket to the coupling. • The lug portion, the locks and the race way of the coupling should be lubricated. • Do not lubricate the gasket or seals. Replacethe-gasket periodically. • Following practice should be followed for bearing: o Coupling maintenance is generally a simple matter, requiring a regularly scheduled inspection of each coupling. o It consists of performing visual inspections, checking for signs of wear or fatigue and cleaning collplings regularly. o Checking and changing lubricant regularly if the coupling is lubricated. o This maintenance is required annually for most couplings and mores frequently for couplings in adverse environments or in demanding operating conditions. o Documenting the maintenance performed on each coupling, along with the date •They are eliminated by adopting following maintenance activities: (i) Regular scheduled inspection. (ii) Visual inspection of each element. (iii) Proper lubrication. (iv) Documenting the maintenance performed on each coupling.	2m-any 2 prob. with remedy	4m
(ii)	o Keep the belt groove clean and in good condition. o Check the alignment of belt drive before it is put to use. o Preserve the belt from conditions injurious to rubber. o Belt should not be operated close to furnaces, radiators, steam pipes or where they may get heated. o Never use idler on the top side of a V-belt. o The belt should not be too tight or else it will wear out quickly. o It should not be too loose or else it will slip out of the pulley	2m-any 2 prob. with remedy	