WINTER-2017 EXAMINATION

Model Answer **Subject Code:- 17556**

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.

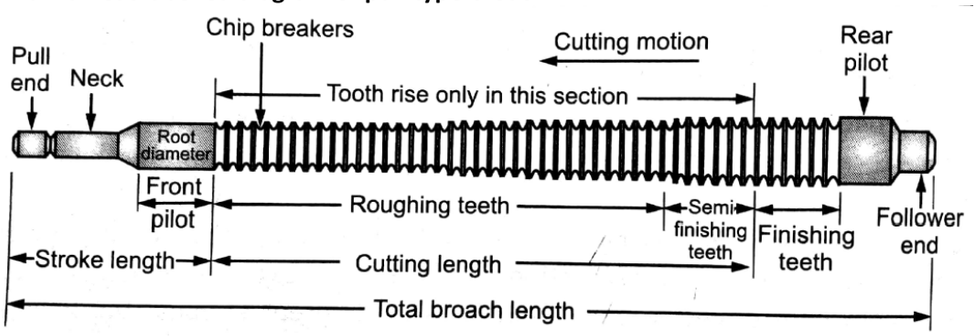
Q.No.	Answer	Marks	Total Marks
01	**Attempt Any Five of the following.**	**20 M**	**20M**
a.	**Define Non-Traditional Machining Process. State fur reason for the need of development of Non Traditional Machining.** ***Definition:-*** Non Traditional manufacturing process is defined as a group of processes that cut material by utilizing mechanical, Electrical or Chemical energy or combination of these energies but do not use a sharp and hard cutting tools as required for traditional manufacturing processes. ***Need of Non-Traditional Machining Processes:-*** 1. To machine the exotic material those were difficult to machine by conventional machining process. 2. To fulfil the requirements of new age like innovative design, tighter tolerances, micromachining and economy. 3. To obtain intricate shapes. For example, a square blind hole of 15mm x 15mm x 30mm. 4. Overcome difficulty to machine the material. For example Inconel, Ti alloy, Carbide, Ceramics. 5. To fulfil the requirements of low stress grinding. (If done by conventional then it reduces productivity). 6. Drilling deep hole with small hole diameter (for example 15 mm diameter holes with length / diameter ratio of 20). 7. Machining of composites.	**04M**	**02M (Def.)** **02M (Need)**
b.	**State objectives of machine tool maintenance. Enlist the types of maintenances.** ***Objectives of Machine Tool Maintenance:-*** 1. To minimize the number of breakdown. 2. To keep plant in good working condition at the lowest possible cost. 3. To minimize the hindrance and interruption of work. 4. To carry out the work of all the machines smoothly. 5. Minimizing the loss of production because of equipment failure. 6. Prolong the life of capital assets by minimizing the rate of wear and tear. 7. To minimize accidents through regular inspection and repair of safety devices. 8. To improve the quality of products and to improve productivity.	**04M**	**01 M (for each point)**

C. **Compare Up Milling process with down milling process.**

Sr. No.	Up Milling	Down Milling
1	There is a tendency to lift the work piece so extra clamping force is required	Forces are enough on job to press to press down. So no need of extra clamping forces
2	Cutter rotates against direction in which the work being fed.	Cutter rotates in similar direction in which the work being fed
3	Cutting force varies from Zero to max.	Cutting force varies from max to zero
4	Chip thickness varies from minimum to maximum	Chip thickness varies from max to minimum
5	Higher surface finishing can be obtained	Obtains lower surface finish
6	Use of cutting fluid is difficult	Use of cutting fluid is easy
7	Job and tool movement is opposite direction	Job and tool movement in same direction

04M — **01 Marks for each point**

d. **Draw a neat labelled diagram of pull type broach.**



04M — **02M (Fig.)** **02M (Proper Labelling)**

e. **State the purpose of providing dry run facility and jog mode for CNC machine.**

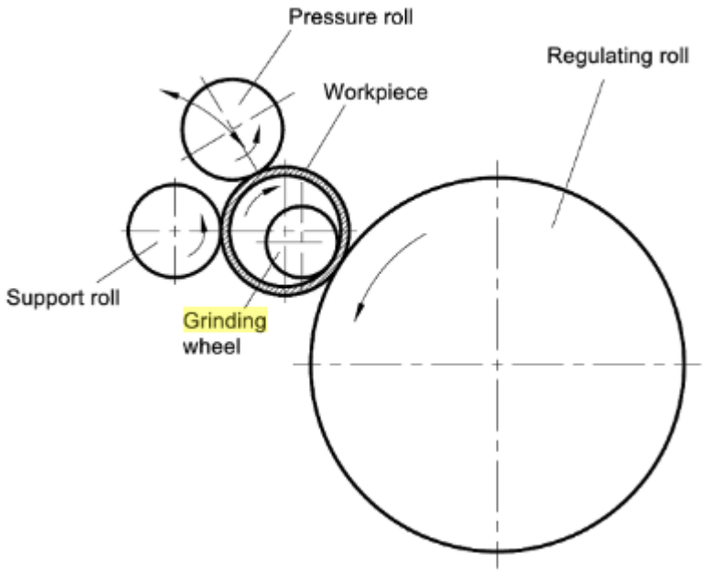
DRY Run:-

- A dry run is a testing process where the effects of a possible failure are intentionally mitigated.
- In computer programming, a dry run is a mental run of a computer program where the computer programmer examines the source code one step at a time and determines what it will do when run.
- It is a special kind of override it is activated from the control panel by the dry run switch.
- No actual machining takes place when dry run switch is in effect. Its purpose is to test the program before CNC operator cuts the first cut.
- During dry run part is normally not mounted in the machine.
- During dry run program can be checked for all possible errors except those that relate to actual contact of cutting tool with material.

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-axis.
- 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.

04M — **02M (Dry Run 1M each)** **02M (JOG Mode 1M Each)**

f.	**Explain the internal centre less grinding with neat labelled sketch.** ***Internal Centre less Grinding:-*** • In centre less grinding the work piece is supported between the three rolls. The rolls are pressure roll, supporting roll and a regulating roll (grinding wheel). • All the three rolls rotate in the same direction and rotate the work piece with them. • The work piece and grinding wheel rotates in the same direction. • The direction of rotation of the three rolls and work piece is opposite. • The grinding wheel always contacts the work piece at the horizontal centreline of regulating wheel. • This ensures uniform wall thickness of the work piece and also ensures concentricity of the bore with the external surface of the work piece. • To load or unload the work piece, the pressure roll can be swung away. • The grinding wheel is given infeed so as to obtain the required depth of cut. • This type of machine is used for having repetitive nature. • It has advantages similar to external centre less grinding.  	**04M**	**02M (Expl)** **02M (Figure)**
g.	**Explain process characteristics of AJM. State any two applications.** ***The Important Process Parameters are:-*** **1. Abrasive:-** • The abrasive material used is Al_2O_3 or SiC. • The grain size is around 25 micron meter. • The shape of abrasive is generally spherical. • The mass flow rate is 3-20g/min. **2. Gas Carrier:-** • The type of gas used is Air, N_2 or CO_2. • The air density is 1.3 kg/m^3, velocity 150-300m/s and pressure 2-8 bar. • The flow rate around 30 L/min. **3. Nozzle:-** • The nozzle is made of tungsten carbide or sapphire. • Its shape is circular, 0.3-0.5 mm internal diameter or rectangular (0.08mm, 0.51mm to 6.61mm, 0.51mm). • The tip distance is 0.25-15mm. • The life of WC is 12-30 hour and sapphire is 300 hours. • The operating angle is 60° to 90° to the surface. • Standoff distance 0.5 to 5mm. ***Application of AJM:-*** • Fine drilling and micro welding. • Machining of semiconductor. • Frosting and abrading of glass articles. • Machining of intricate profile on hard and fragile materials.	**04M**	**02 M** **02 M**
2	**Attempt any TWO of the following.**	**16**	**8M x 2**

a **For the component shown in figure prepare part programme for CNC taper turning operation using linear interpolation and incremental mode. Raw material is M.S. bar of Φ20mm.**

(Programming with different starting point should be consider, Programme may vary from students to students).

Position	X,Z Co-ordinates	Position	X,Z Co-ordinates	Position	X,Z Co-ordinates
A	m/c home	**E**	0,-10	**H**	0,-10
B	0,2	**F**	-2,+10	**I**	0,-10
C	0,-2	**G**	0,-10	**J**	5,-10
D	18,0	**H**	-1,-10	**K**	80,50

02M for Table

Programme:-

N100 G91 G21 G94 EOB
Incremental mode, input in mm, feed in mm/min.

N110 M03 S800 M08 EOB
Spindle start clockwise direction, spindle speed, coolant on.

N120 G00 X02 Z2 EOB
Rapid travel of tool to position b.

N130 G01 X0 Z-2 F200 EOB
Movement of tool to (position c).

N140 X18 Z0 EOB
Facing operation (position d).

N150 X0 Z-10 EOB
Turning to diameter 18 mm for a lengh of 10mm (position e).

N160 G00 X-2 Z10 EOB
Rapid Travel Of Tool To (Position F)

N170 G01 X0 Z -10 F200 EOB
Movement of tool to the position g.

N180 X-1 Z-10 EOB
Turning to diameter 16 mm for a length of 10 (position h).

N190 GOO X20 Z20 EOB
Rapid Travel Of Tool To Position F

N200 G01 X00 Z-10 F200 EOB
Movement of tool to position i.

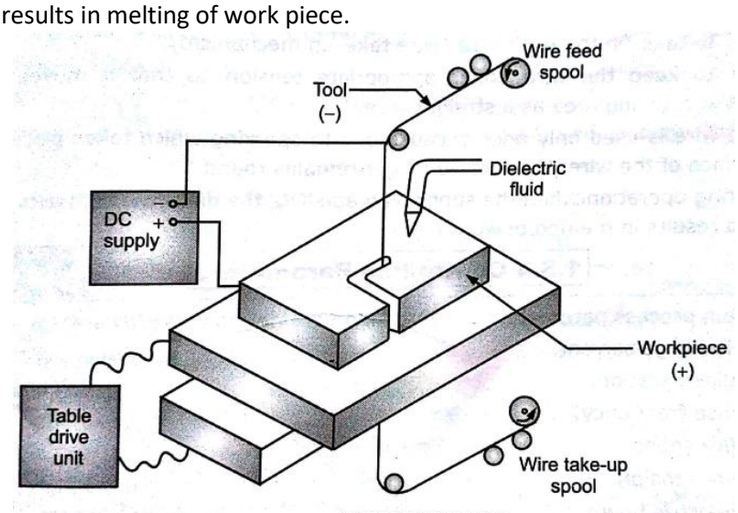
N210 X0 Z-10 EOB
Turning To Diameter 20mm For A Length Of 10mm (Postion J)

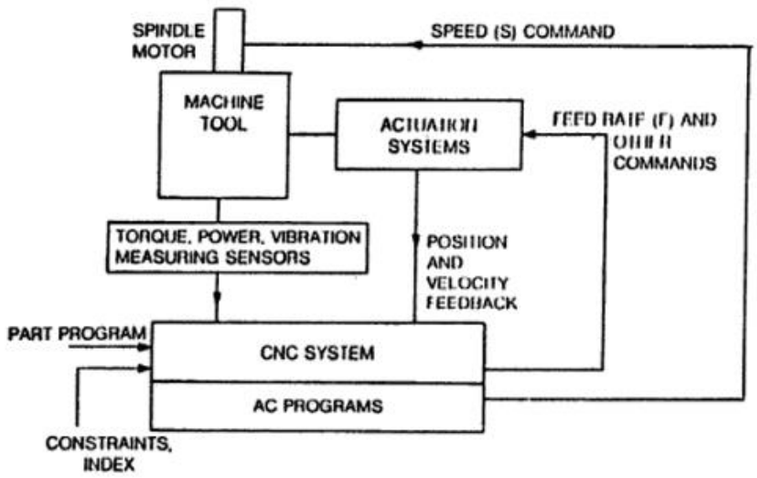
N220 X5 Z-10 EOB
Taper Turning For A Length Of 5mm Position K

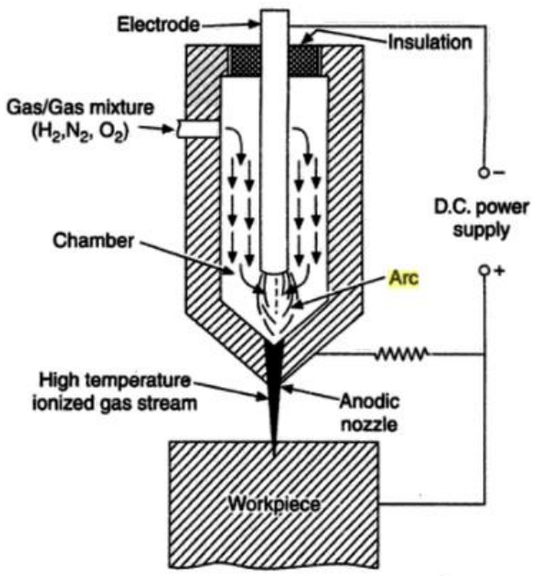
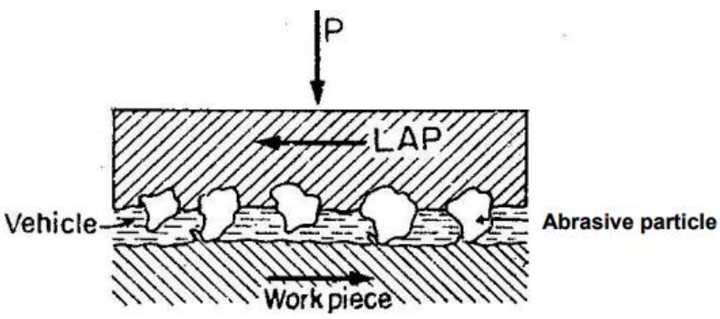
N230 G00 X80 Z50 EOB
Rapid Travel Of Tool Away From The Work Piece Position L
N240 G28 EOB
Rapid Return To Machine Reference Position
N250 M05 EOB
Spindle Stop
N260 M09 EOB
Coolant Off
N270 M30 EOB
Program End And Tape Rewind

06M Prog.

8M

b.	**Describe the construction and working of WEDM with a neat labelled sketch of showing set-up. State its application and limitation.** The basic elements in a WEDM process, as shown in figure are given below: **1. Power Supply System:-** • The work piece is mounted on the table. • The tool is connected to negative terminal, so that it becomes cathode, while work piece is connected to positive terminal and become anode. • The tool and work piece is connected to a DC power supply. • The supply is in the form of a pulse. A voltage of about 50V is applied to the system. • However because of very small wire size, it cannot carry current more than 30A. **2. A dielectric system:-** • Deionised water is used as a dielectric fluid in WEDM. It gives high metal removal rate and better surface finish. • A nozzle is employed to inject the dielectric fluid in the machining area. • Both the work piece and the wire are constantly flushed with dielectric fluid at the area being machined. • The dielectric also serves as a coolant. **3. A CNC Control System:-** • A CNC control system is used for the movement of work table. • The table has movement in two axes (direction). • The table can also be moved in both the direction simultaneously for taking contouring cuts. **4. Wire Drive System:-** • The system performs three functions:- i) To feed the fresh wire for machining (Wire fed 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. • 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. • During operation when the supply is made "ON" the dielectric fluid gets ionized and results in melting of work piece.  **A WEDM Set-up** **Application:-** 1. Punches and dies used in press tolls can be made. 2. For the of moulds and dies. 3. Used to cut out complex contours in electrically conductivity work pieces. 4. Simple, flat shape, which usually would be stamped, may be a job for wire EDM when they require a superior quality edge. 5. Cylindrical pins as small as 5mm in diameter can be machined. **Limitation:-** 1. Wire cannot be reused, because due to sparking the wire no longer remains round. 2. If proper tension in wire is not maintained, the surface finish will be poor. 3. Only electrically conductive material can be machined. 4. Residual stress is induced in the work piece during machine.	**02M (Exp.)** **02M (Fig)** **02M (Appl 01M each** **02M limit 01M each**	**08M**

c	**Define Adaptive Control System. Explain the Adaptive Control System with the help of block diagram. List four advantages of Adaptive Control System.** Adaptive control can be defined as a set of techniques for automatic adjustment of the controllers in real time, in order to achieve or to maintain a desired level of performance of the control system when the parameters of the machine tool are unknown and/or change with time. **Advantages** 1. Increased production rates 2. Increased tool life 3. Greater part protection 4. Less operator intervention. 5. Easier part programming.  Adaptive Control System for a CNC Machine Tool Adaptive control system determines the correct feed and speed are automatically found and it is not necessary to spend efforts on calculations of optimum feeds and speeds. • It takes into account the variations in work-material hardness, width or depth of cut, air gaps in part geometry and so on. • Adaptive control has the capability to respond to and compensate for these Variations during process. • By doing this the in-process time is reduced by using optimum speeds and/or feeds. • By increasing tool life simultaneously with time saving, the adaptive control system contribute to lower operating costs, which justifies the extra price of Adding AC to a conventional NC machine.	**02M (Exp.)** **04M (Adv. 01M each** **02M (Fig)**	**08M**
3	**Attempt any Four of the following**	**16M**	**4 x 4**
a	**Explain with neat sketch plasma arc machining process.** **Plasma Arc Machining Process (PAM):-** 1. This is a material removal process in which material is removed by directing a high velocity jet of high temperature ionized gas on the work piece. 2. The high temperature plasma jet melts the material of the work piece. 3. Plasma is the mixture of free electrons, positively charged ions and neutral atoms, which is obtained by heating a gas at very high temperature, so that it gets partially ionised. 4. H_2 (Hydrogen) or N_2 (Nitrogen) gas are generally used for this process, and are heated by subjecting them to electron bombardment of an electric arc produced between a cathodic electrode and an anodic nozzle. 5. The molecular gas gets dissociated due to their collision with the electrons generated by the arc and this result in ionisation of the atoms. 6. The equipment's works at 400V, 200kW output. 7. Arc current ranges from 50 to 1000 A and the rate of cutting generally 250-1800 mm/min. 8. Gases generally used for cutting are hydrogen and nitrogen, and materials generally cut are alloy steel and cast iron.	**02 M Expl**	

	 Plasma Arc Machining (PAM).	**02 M Fig.**	**04 M**
b	**State the four safety precautions to be followed in CNC machines.** **safety precautions in CNC Machines are:-** 1. Always keep the area around the machine clear of obstacles. 2. Always stack material where you can reach it but where it is clear of the moving parts of the machine. 3. Always check that tools are sharp and set correctly. 4. Always check that the correct tool data is entered into the CNC program. 5. Always make sure that all guards are in position while the machine is in operation. 6. Always make sure spindle direction is correct for right-hand or left-hand operation. 7. Always conduct a dry run to ensure the program is correct. 8. Do not use compressed air to blow chips from the parts of the machine, machine surfaces, cabinets, controls or floor around the machine.	**½ m each point**	**04 M**
c	**Describe the working principle of Lapping process with a neat sketch. State its two important applications.** Lapping is an abrading processes employed for improving the surface finish by reducing roughness, waviness, and other irregularities on the surface. • The principle of lapping is an abrasive rubbing process in which loose abrasive with vehicles function as cutting points taking momentary support of the lap. • The basic purpose of lapping is to minimize the extremely minute irregularities left on the surface after some machining operation. • A very thin layer of metal around 0.005 to 0.01mm usually removed by lapping.  *Scheme of lapping process*	**02M Def.** **01M Fig**	

	• The lap material should be softer than work piece, so that abrasive gets embedded in the lap until it fractures from the pressure of lapping action. Cast iron is the best lap material but brass, lead and soft steel can also be used. The abrasive used for lapping operation are aluminium oxide for soft ferrous and nonferrous materials, silicon carbide is used for hard steel. Diamond used for lapping cemented carbide and precious stones. • Lubricant to hold and retain the abrasive grains during lapping is known as ***vehicle***. The purpose of vehicle is to suspend abrasive grains separated as well as lubricate the work. The vehicle is used is machine oil, water soluble oil, vegetable oil, mineral oil, petroleum jelly ad grease. • The speed and pressure for lapping soft material 0.7 to 0.2kg/cm_2 and for hard material up to 0.7 kg/cm_2 is applied, and normal speed is used for lapping is between 1.5 m/s to 4 m/s. • Lapping may be carried out by hand or by machine lapping. **Application:-** 1. Press work dies. 2. Limit gauges. 3. Mould for casting. 4. Surface plate. 5. Piston rings. 6. Slip gauges. 7. Engine valve and valve seat.	**01M App**	**04 M**
d	**Define Preventive maintenance. State its advantages.** Preventive maintenance is predetermined work performed to a schedule with the aim of preventing the wear and tear or sudden failure of equipment components. Preventive maintenance helps to: Protect assets and prolong the useful life of production equipment • Improve system reliability • Decrease cost of replacement Decreases system downtime. • Reduce injury. Mechanical, process or control equipment failure can have adverse results in both human and economic terms. In addition to down time and the costs involved to repair and/or replace equipment parts or components, there is the risk of injury to operators, and of acute exposures to chemical and/or physical agents. Preventive maintenance, therefore, is a very important on going accident prevention activity, which you should integrate into your operations/product manufacturing process.	**04 M**	**04 M**

e **Differentiate between Capstan and Turret Lathe *(Four Important Points).***

Sr. No.	Capstan lathe	Turret lathe
01	It is light duty machine	Turret lathes are relatively more robust and heavy duty machine.
02	The turret head is mounted on the ram and the ram is mounted on the saddle and moves on the guide ways	The turret head is directly mounted on the saddle and the saddle slides over the bed ways
03	The saddle will not be moved during machining	The saddle is moved along with the turret head during machining.
04	The lengthwise movement of turret is less	The lengthwise movement of turret is more.
05	Only short work pieces can be machined	Long work pieces can be machined.
06	Collet is used to hold the work piece	Jaw chuck is used to hold the work piece.
07	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.
08	The turret head cannot be moved crosswise	The turret head can be moved crosswise in some turret lathes.
09	As the construction of lathe is not rigid heavy 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 work pieces 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 in capstan 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 multipoint chasing tool being mounted on the front slide and moved by a short lead screw and a swing type half nut.
14	The turret of capstan lathe is called as a capstan head which may be circular or hexagonal.	The turret of turret lathe is called as a turret head which may be square, octagonal or hexagonal.

1M each point | **04 M**

f **Explain the process parameters of WJM.**

a. Stand-off Distance:-
1. It is the gap between the jet nozzle and the work piece.
2. MRR increase with the increase of stand-off distance up to a certain limit after which it remains unchanged for a certain tip decrease and then falls gradually.

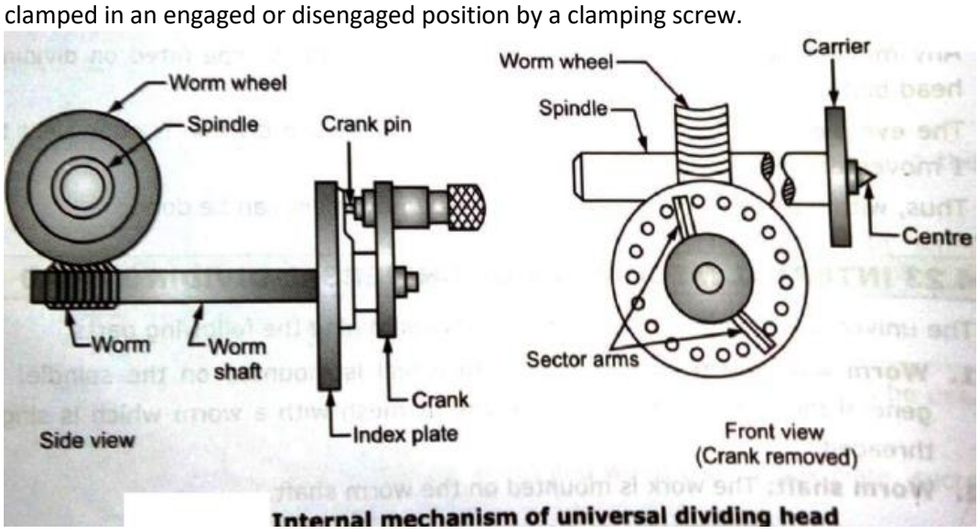
b. Water rate of the nozzle:-
1. It depends on the hardness of the nozzle material, pressure (hence, velocity) of the jet and nozzle design.

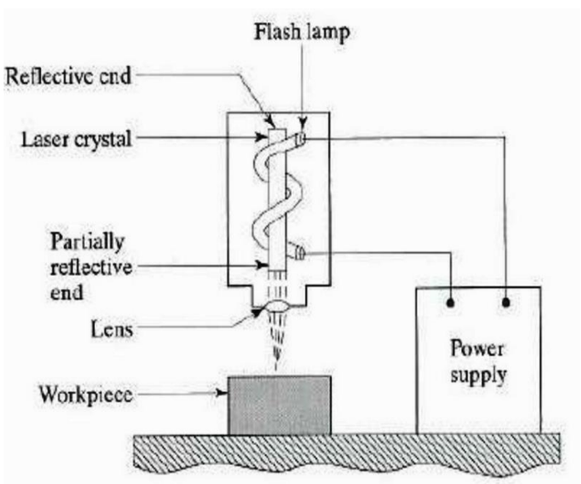
c. Fluid Pressure:-
1. The increase in pressure allows more power to be used in the machining process, which in turn increase the depth of the cut.
2. The quality of cutting improves at higher pressure by widening the diameter of the jet and by lowering.
3. The traverse speed, moreover, the larger the pump pressure, the greater will be the depth of the cut.

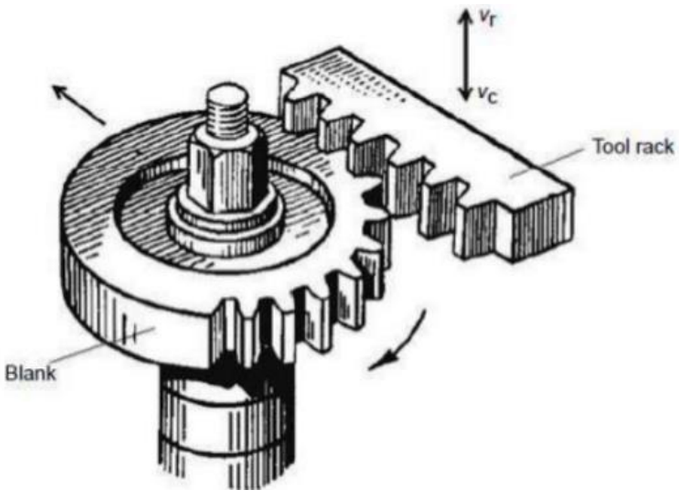
d. Jet Fluid:-
1. The fluid used must possess low viscosity to minimize the energy losses and be non-corrosive, non-toxic, common, and inexpensive.
2. Water is commonly used for cutting alloy steels.

e. Target Material:-
1. Brittle materials will fracture, while ductile ones will cut well.
2. Material thickness range from 0.8 to 25mm or more.

1M Per parameters | **04 M**

4	**Attempt any TWO of the following:**	**16 M**	**08 M x 2**
a	**i) An indexing device uses 3 plates made by Brown and Sharp. A gear is to be cut with 83 teeth. Calculate index crank movement using simple indexing and write interference.** **NOTE :- This problem is not possible by simple indexing. If suitable method is used by the students and tried to attempt the question, appropriate marks should be given.** 83 divisions are indexed by differential indexing method. Where, A is any number closer to required division N. Thus, N=83 assume A=86 (Generally select higher no. $$Gear\ Ratio = \frac{(A-N)40}{A}$$ $$Gear\ Ratio = \frac{(86-83)40}{86}$$ $$Gear\ Ratio = 3 \times \frac{40}{86}$$ $$Gear\ Ratio = \frac{3 \times 24}{24} \times \frac{40}{86}$$ $$Gear\ Ratio = \frac{72}{24} \times \frac{40}{86}$$ $$Driver = 72, 40$$ $$Driven = 24, 86$$ $$Index\ Movement = \frac{40}{86} = \frac{20}{43}$$ For indexing the index crank will have to be moved by 20 holes in 43 hole circle.	**04M**	
	ii) Draw a neat labelled sketch of Universal Dividing head showing working mechanism. **Universal Dividing Head:-** Universal dividing head is an important work holding and indexing device used on a milling machine. With the help of the dividing head the work pieces can be accurately index to any fraction of revolution enabling the correct spacing of the grooves that can be machined on the periphery of the work piece. Universal dividing head find wide use in the production of spur gears, helical gears and other indexing requirement on the milling machine. The normal positional accuracy that can be obtained using a universal dividing head is 1 minute. The work pieces are usually held between the centres of the dividing head and the tail stock. Suitable supporting blocks can be used in the case of long work pieces. The housing of the unit can be swivelled up to 110° about the horizontal axis and the angle can be read on the graduated scale. The spindle is driven normal by a 1:40 worm and worm wheel carried in an eccentric housing. The eccentric housing can be clamped in an engaged or disengaged position by a clamping screw.  **Internal mechanism of universal dividing head**	**04M**	

b	**Describe working principle of LBM with neat sketch.** **Working Principle of LBM:-** Laser beam Machining (LBM) is based on the conversion of electrical energy into light energy and then to thermal energy. • In the beginning in atom all the crystal are in ground state. • • When the light is flash over the crystal, most of the atoms are raised to the excited state. Some light waves incline to the axis of the crystal will leave the box either after only a few reflections or without strike on mirror. • Some of the waves that travel parallel to the axis of the crystal will spontaneously emit photon from chromium ions. These photons stimulate another atom to contribute a second photon. These processes continue as the photons are reflected to and fro between the mirrors. • At the each reflection a certain loss occurs. • It is very interesting that laser has to be used on materials where it absorbs laser energy. • Upon absorption of the laser energy, there is rapid rise in the temperature leading once again to melting and vaporization and material removal. • Although several types of laser exist, all laser produce (emit) intense, coherent, highly collimated beam of single wavelength light. In material processing applications, this narrow beam is focused by an optical lens to produce a small, intense spot of light on the work piece surface.  **Fig. Laser Mechanism**	**02 M** Explain **02 M** Figure	**04 M**

c	**Explain the rack cutter gear shaping with the help of neat sketch. Compare rack gear shaping with gear hobbing. (*Four points each).*** **Rack Cutter Gear shaping Process:-** • In this method, the cutter has a rack form for the gear to be generated. • The gear blank is rotate slowly and uniform about the vertical axis. • The rack cutter reciprocates with the required cutting speed to remove the material from the gear blank. • The cutter is radically fed to obtain the correct teeth depth by means of cam. • The cutter removes the material only during cutting stroke and relieved during return stroke. • Thus, because of reciprocating motion of cutter and angular relative motion of gear blank, gear teeth is generated on the gear blank. • The main limitation of this method is that once the full length of rack is utilized the cutting operation in required to stop. • In such case the blank is indexed next and the cut started as usual.  **Features / Hobbing / Shaping** Accuracy: Better with respect to tooth spacing and run out. Equal so far lead accuracy is required. / Better with respect to tooth frame. Surface finish: Hobbing produces a series of radial flats based on feed rate of hob across the work. / Shaping produces a series of straight lines parallel to the axis of the gear. Surface finish may be better. Versatility: Cannot be used for internal gears. / Can be used for internal gears. Limitation: Faster for gears with larger face width. / Time cycle will be 2-3 times of hobbing for wider gears. Production rate: Stacking can make hobbing faster than shaping even for gears with narrow face width / With high speed stroking, narrow width job can be finished in lesser than by hobbing.	**02 M** Exp. **02 M** Fig. **04 M** 1M for each	**04 M**
5	**Attempt any FOUR of the following**	**4x4**	**16**

a **Differentiate between Plain Milling and Universal Milling Machine.** ***(Four Points)*** — **1 M** each for any 4 correct points — **4M**

Sr.No	Plain Milling Machine	Universal Milling Machine
1	Table has 3 movements Cross, longitudinal, vertical	Table has 4 movements Cross, longitudinal, vertical, Swivelling.
2	Helical milling cannot be performed without using spiral milling attachment.	No such attachment is required
3	It is more rigid and heavier in construction.	It is less rigid and light in construction
4	Its overarm is fixed.	It overarm can be pushed back or removed
5	No auxiliaries are provided	Number of auxiliaries are provided
6	Table has 3 movements Cross, longitudinal, vertical	Table has 4 movements Cross, longitudinal, vertical, Swivelling
7	Helical milling cannot be performed without using spiral milling attachment	No such attachment is required

b **How grinding wheel is specified? Explain it with a suitable example.** — **2M Expl.** — **4M**

Designation of Grinding Wheel:-

- It is also referred as specification of the grinding wheel or marking scheme of grinding wheel.
- Method of grinding wheel specification differ with the manufacture and country, in order to bring the uniformity, Bureau of Indian Standard has suggested the marking scheme consisting of following six characters in sequence.
- This codification is as per Bureau of Indian Standard Code IS 551: 1989.

0	1	2	3	4	5	6
Prefix	Abrasive Type	Abrasive Grain	Grade	Structure (Use optional)	Nature of Bond	Manufacturer's symbol (Type of Bond)

Prefix:-

- Manufacturer may use a suitable prefix preceding the type of abrasive notation to indicate his own trade brand of the abrasive used.
- Use of prefix is optional.

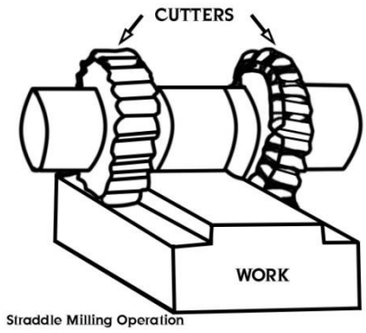
Manufacture's Symbol:-

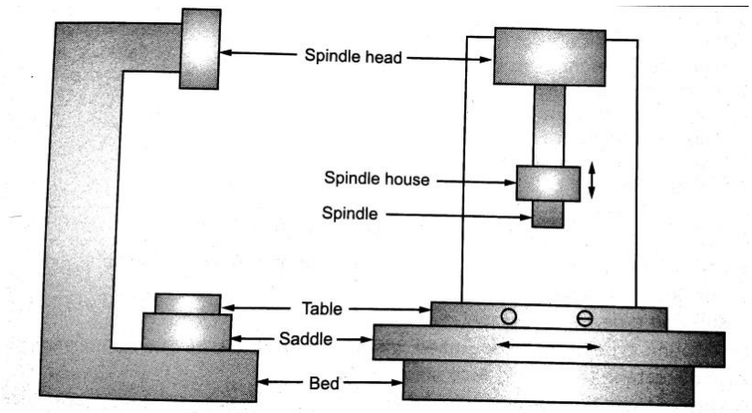
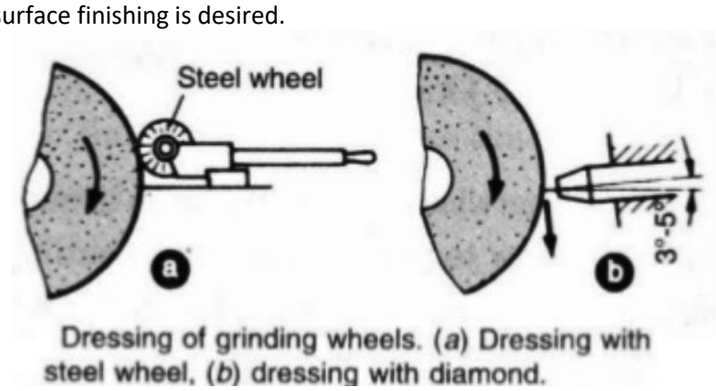
- Manufacturer may use a suitable suffix to the type of bond.

Use of suffix is also optional.

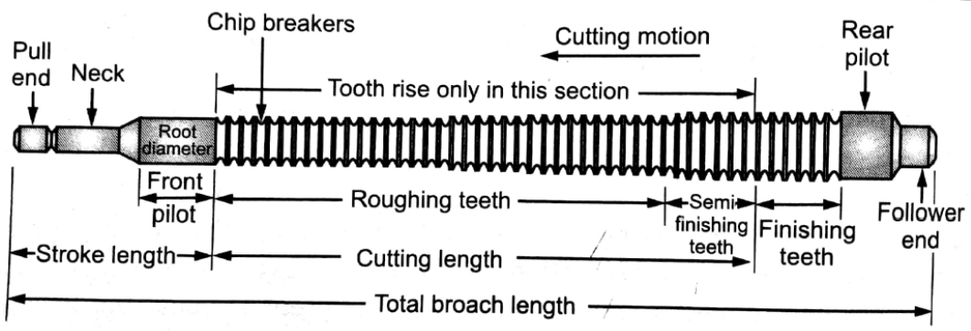
Example: **- W A 46 K 5 V 17** will have the following specification. — **2M Example**

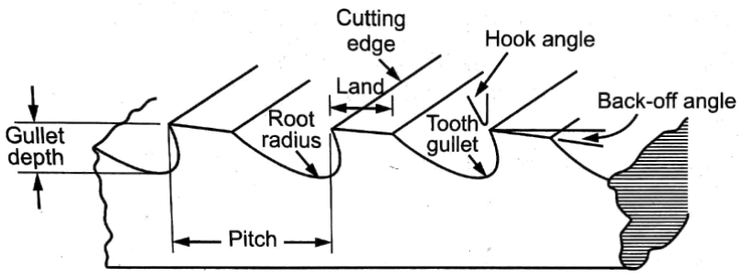
W	Manufacture's Prefix
A	Type of Abrasive (Aluminium Oxide)
46	Grain Size (medium)
K	Grade (Medium)
5	Wheel Structure (Dense)
V	Type of bond (Vitrified)
17	Manufacture's Number.

c	**Classify standard milling Cutters.** **Classification Of Milling Cutter** The milling cutter are generally classified as follows: 1. Plain milling cutter a) Light duty plain milling cutter b) Heavy duty plain milling cutter. c) Helical plain milling cutter 2. Side milling cutter a) Plain side milling cutter b) Half side milling cutter c) Staggered teeth side milling cutter d) Interlocking teeth side milling cutter 3. End milling cutter a) Solid end milling cutter b) Shell end milling cutter 4. Metal slitting milling cutter a) Plain metal slitting cutter b) Staggered teeth metal slitting cutter 5. Angle milling cutter a) Single angle milling cutter b) Double angle milling cutter 6. Formed milling cutter a) Convex form milling cutter b) Concave form milling cutter c) Corner rounding form milling cutter d) Formed gear cutter 7. Slot milling cutter a) T-slot milling cutter b) Dovetail slot milling cutter 8. Thread milling cutter 9. Fly milling cutter	**4M**	**4M**
d	**State the meaning of straddle milling. Explain the milling of bolt head using straddle milling.** **Straddle Milling:-** • The straddled is the operation of production of vertical flat surface on both side of work piece by using two side milling cutter mounted on same arbour. • The distance between the two cutters is correctly adjusted by using suitable spacing collars. • The straddle milling is very commonly used to produce square or hexagonal surface. • 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 vice is rotated 60° and other two sides of the work piece are straddle milled, then the spindle is again rotated 60° and remaining two sides of the work piece are straddle milled.  Straddle Milling Operation	**02 M Exp.** **02 Fig**	**4M**
e	**State four applications of Capstan & Turret Lathe.** ***Application:-*** 1. Used for manufacturing of small and identical parts for large production. 2. Used for manufacturing for hexagonal bolt. 3. Used for manufacturing for cut by taps and dies, making the operation easier 4. Used for manufacturing of small prototype having more number of operation.	**1 M** each for any 4 correct points	**4M**

f	**Define boring operation. Draw a neat labelled sketch of Jig Boring Machine and Sate its two applications.** Boring is the process of enlarging the already existing hole. This existing hole can be due to casting, forging, drilling, or punching. Boring can also be used for trueing and finishing the previously drilled holes.  **Jig boring machine** ***Application of Jig Boring Machine:-*** 1. Producing holes in exact location in Jig and fixtures, templates, dies gauges that need very high accuracy. 2. Producing holes in cylindrical block, liner of automobile engines.	**02M Exp.** **02M Fig**	**4M**
6	**Attempt any FOUR of the following**	**4x 4**	**16**
a	**Explain the process of dressing the grinding wheel.** **Grinding Wheel Dressing & Truing:-** Dressing removes loading and breaks away the glazed surface so that sharp abrasive particles are again presented to work. A common type of star dresser is used to dress the wheel. The dresser is held against the wheel and moved across the face of revolving wheel. Dressing is done to regain grinding wheels cutting capability. The dressing improves the surface finishing obtained while grinding. It is carried out where high degree of surface finishing is desired.  Dressing of grinding wheels. (*a*) Dressing with steel wheel, (*b*) dressing with diamond.	**4M**	**4M**

b **Draw labelled sketches of a broaching tool and describe its elements.**





02 M Fig.

Elements of Broaching Tool:-

1. Pull End:-
   a. It is that end of the broach which is connected to the puller of the broaching machine.
   b. Pull end occurs only in pull broach.
2. Front Pilot:-
   a. It guides the broach in to the hole of the hole of the workpiece.
   b. It serves as a safety check to p[revent overloading of the first roughing tooth and correct axial alignment.
3. Roghing Teeth:-
   a. The teeth which take the first cuts in any broaching operation are known as roughing teeth. Genrally they take heavier cuts than the semifinishing teeth. Most of the metal removal is done by the roughing teeth.
4. Semi – Finishing Teeth:-
   a. It follows the roughing teeth and removes small amount of material.
   b. It provides smoothness to the surface of the work piece.
5. Finishing Teeth:-
   a. All the finishing teeth are of the same size.they produce exact size and finish the work piece.
6. Rear pilot:-
   a. The rear pilot maintains tool alignment as the final finish teeth pass through the work piece hole.
7. Chip breaker:-
   a. Notches in the teeth of broaches which breaks – up chip, facilitating their removal is called as chip breaker.
8. Land:-
   a. The thickness of the top of the broach tooth is called as land. It gives a slight clearance and thus form the clearance angle or back –off angle.
9. Chip space:-
   a. Space between broach teeth which accommodates chips during cut. Sometimes called the “chip gullet”. It includes the face angle, face angle radius, and back –of-tooth radius.
10. Face Angle:-
    a. Angle of the cutting edge of a broach tooth. Sometimes called the “hook” angle or rake angle forms one part of the cutting edge.
11. Face angle radius:-
    a. The radius just below the cutting edge that blends into the back of tooth radius.
12. Rise per tooth:-
    a. Progressive increase in tooth height from tooth-to-tooth of a broach. Usually greater in roughing teeth than in semi finishing teeth.
13. Back-off Angle:-
    a. It provides relief to the tooth, to prevent excessive rubbing on the work.

02M Exp.

4M

<table>
<tr><td>c</td><td>State advantages and limitations of broaching operation.
Advantages of Broaching Operation:-
1. Rate of production is very high.
2. Semiskilled operator can perform the operation.
3. High accuracy.
4. High surface finishing.
5. Both roughing and finishing cuts are performing in one pass.
6. The process can be used for internal and external surfaces.
Limitation of Broaching Operation:-
1. It is a single purpose tool.
2. Tool cost is very high, so the process is justified only for mass production.
3. Surface to broach must be accessible.
4. Blind hole cannot be easily produced.
5. Tool sharpening is difficult and expensive process.</td><td>2M Adv

2M Limitation</td><td>4M</td></tr>
<tr><td>d</td><td>Distinguish between polishing and buffing (Four Points Each).

<table><tr><th>Sr. No.</th><th>Polishing</th><th>Buffing</th></tr><tr><td>1</td><td>Polishing is done to make metal surface smoother and to produce a more uniform surface.</td><td>Buffing is a finishing operation which provides much higher lustrous and reflective surface finish that cannot be obtained by polishing.</td></tr><tr><td>2</td><td>It is done by removing deep scratches, nick, discolouration and other surface imperfections occurring due to grinding.</td><td>It is done by rotating wheel with high speed and work piece to be buffed is made to rub against the charged wheel.</td></tr><tr><td>3</td><td>It is generally used as intermediate operation done after grinding and before buffing.</td><td>Buffing is a finishing operation which is usually performed after polishing.</td></tr><tr><td>4</td><td>Polishing operation done after grinding and before buffing.</td><td>Buffing status is somewhere in between polishing and lapping.</td></tr></table></td><td>1 M each for any 4 correct points</td><td>4M</td></tr>
<tr><td>e</td><td>Explain maintenance procedure for
1) Machine Belts:-
a. Keep the belt groove clean and in good condition.
b. Check the alignment of belt drive before it is put to use.
c. Preserve the belt from conditions injurious to rubber.
d. Never use idler pulley on the top side of a V-belt.
e. The belt should not be too tight or loose it will wear quickly.
2) Coupling:-
a. 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.
b. 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.
c. All coupling are attached to the hose jacket by an expansion ring. This expansion ring is pressed outward, securing the hose jacket to the coupling.
d. Do not lubricate the gasket or seal. Replace the gasket periodically.</td><td>02M each</td><td>4M</td></tr>
</table>

f	**Explain repair cycle analysis with a suitable example.** **REPAIR CYCLE ANALYSIS** • The cycle of inspection, small repair, medium repair and complete overhaul is called as repair cycle. Inspection of machine tool is the first stage of maintenance. • Small repair carry out repairs of coolant system, replace of belts, tool holder, pumps etc. • Medium repair involves the activities like wash the parts, paint the surfaces, repair the assemblies, etc. • Complete overhauling includes disassembly, repair, replace, paint and assembly of each unit. • 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 (inspection) S, M (small or medium repair) and C (complete overhaul) is repeated till three or four overhauling. • The cycle of inspection, small repair and medium repair between two complete overhauls is called as repair cycle. OR • The cycle from machine commissioning to first complete overhaul is called as repair cycle. • e.g. Repair cycle for particular grinding machine I1 - S1 -I2- S2 - I3 - M1 - I4 - S3 - I5 - S4 -I6 - M2 - I7 - S5 - I8 - S6 - I9 - C	**4M**	**4M**