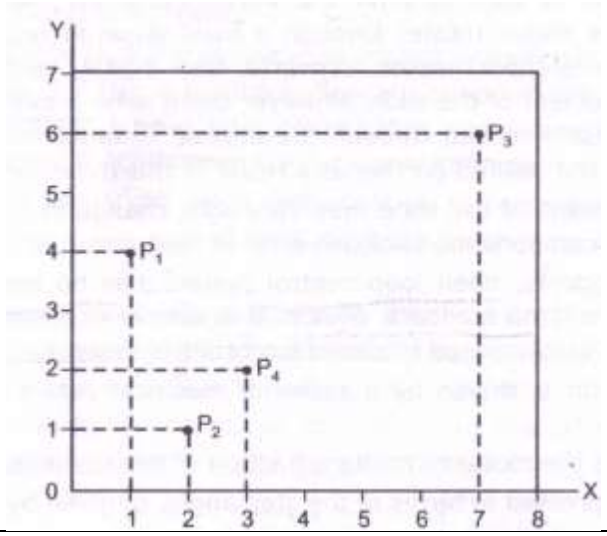
SUMMER – 15 EXAMINATIONS

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 ten**	**10 x 2**	**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 harp cutting tools as required for traditional manufacturing processes.	2m	2m
b)	The dielectric fluid used is paraffin oil, transformer oil, lubricating oils, kerosene,distilled water etc.	1m for each fluid	2m
c)	Applications of PAM: (i) For stack cutting, plate beveling, shape cutting and piercing. (ii) In manufacture of automotive and rail road components. (iii) It can cut hot extrusions to desired length (iv) In hole piercing, reproducible and high-quality holes are made rapidly	½ m for each app	2m
d)	CNC machines have many advantages. But a few important are listed below: 1) Greater accuracy of job is achieved. 2) Higher repeatability and improved product quality. 3) Less operator skill is required to run CNC machine. 4) Better machine utilization hence reduced idle time. 5) High production rate as speed, feed, depth of cut are optimum for best quality. 6) Lower tooling cost, per piece in mass production. 7) Jigs and fixtures cost can be reduced. 8) Reduced cycle time. 9) Better tool life and machineability. 10) Less scrap due to consistent accuracy, less errors. 11) Excellent reliability as dimensions are based on programes. 12) Reduced in-process inventory of parts in process. 13) Design changes are possible. Any change in design is feasible at lowest cost. 14) Productivity can be improved to great extent. 15) Tool setup time can be reduced. 16) Most suitable for continuous and better production. 17) Program can be stored and usecl"again when required. 18) Optimum speed and feed for best surface finish can be used.	½ m for each adv	2m
e)	Incremental System: In incremental system the co-ordinates of any points are calculated with reference to the previous position of the tool. In incremental systems, every measurement refers to a previously dimensioned position (point-to-point). Incremental dimensions are the distances between two adjacent points. It becomesdifficult to edit the program written in incremental mode.Its special use is in writing subroutine programs. Consider a Fig. The coordinates of the points P1, P2, p3, P4 in incremental system is taken as given below:	2m	2m

<table>
<tr>
<td></td>
<td>
Point Co-ordinates
P1 1,4
P2 1, -3
P3 5, 5
P4 -4, -4


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<td></td>
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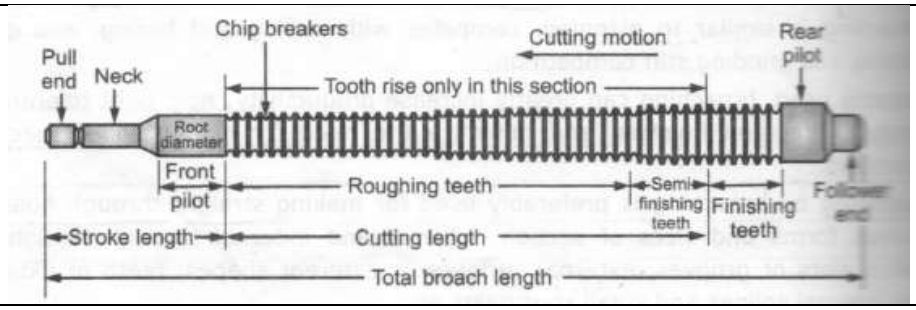
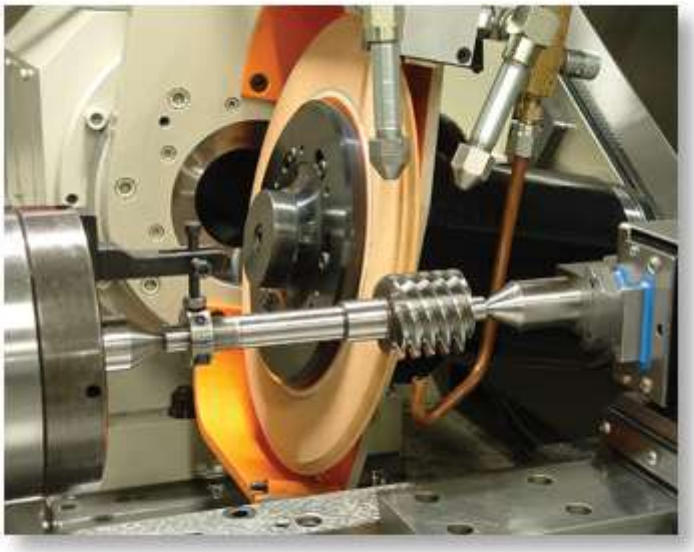
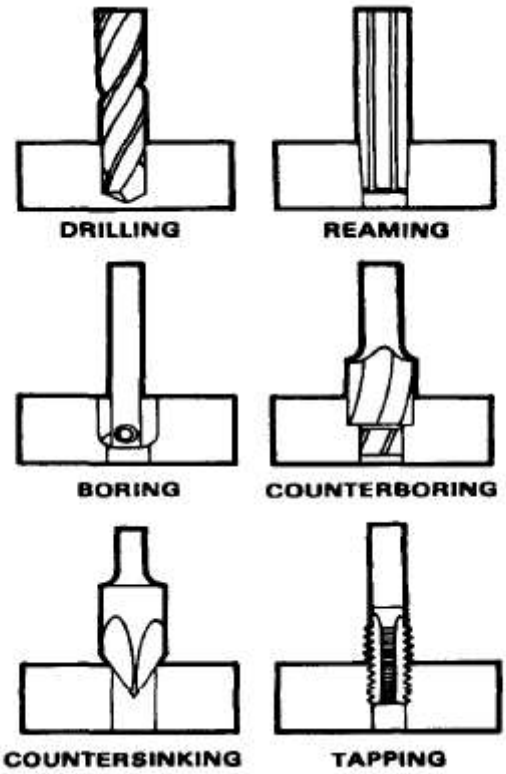
<tr>
<td>f)</td>
<td>M-codes for Machining Center
<table>
<tr><td>M-code</td><td>Meaning</td></tr>
<tr><td>MOO</td><td>Program Stop</td></tr>
<tr><td>MOl</td><td>Optional Stop</td></tr>
<tr><td>M02</td><td>Program End</td></tr>
<tr><td>M03</td><td>Spindle Start (Clockwise)</td></tr>
<tr><td>M04</td><td>Spindle Start (Counter Clockwise)</td></tr>
<tr><td>MOS .</td><td>Spindle Stop</td></tr>
<tr><td>M06</td><td>Tool Change</td></tr>
<tr><td>M07</td><td>Thru Spindle Coolant ON</td></tr>
<tr><td>M08</td><td>Coolant ON</td></tr>
<tr><td>M09</td><td>Coolant OFF</td></tr>
<tr><td>M30</td><td>End Program</td></tr>
<tr><td>M98</td><td>Call Subroutine</td></tr>
<tr><td>M99</td><td>End of subroutine</td></tr>
</table>
</td>
<td>½ m for each code</td>
<td>2m</td>
</tr>
<tr>
<td>g)</td>
<td>

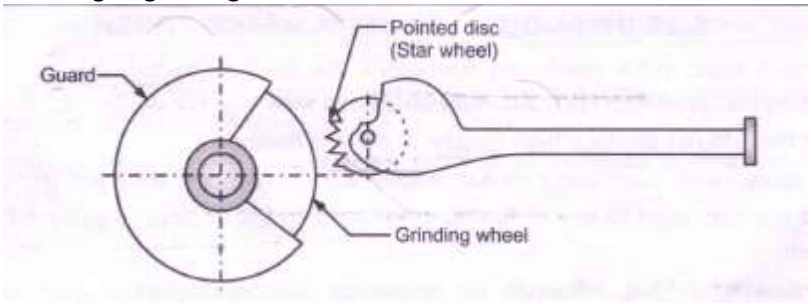
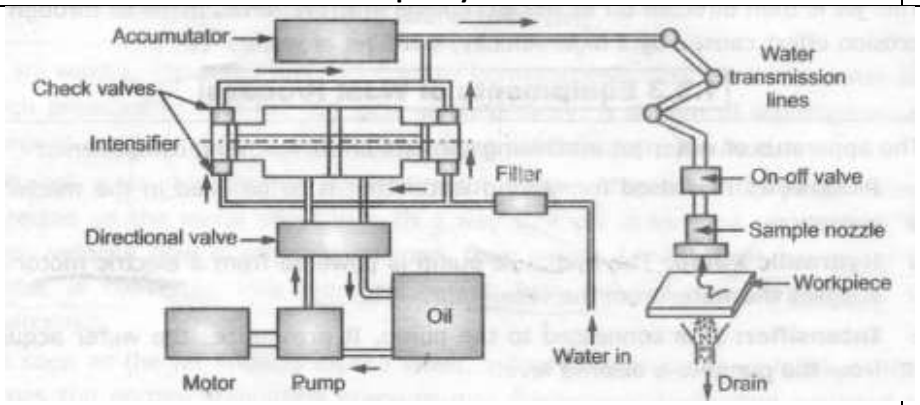
To verify the correctness of the setup with proven CNC programs that have been successfully run before (there shouldn't be anything wrong with the program's movements)
To find serious mistakes that still exist in the program. This objective only applies to new programs or programs that have been changed since the last time they were run.
Speed up cutting motions,
The effects of a possible failure can be intentionally mitigated.

</td>
<td>1m for each adv</td>
<td>2m</td>
</tr>
<tr>
<td>h)</td>
<td>Broaching is the process of removi tal with a tool called as broach, which has "teeth" arranged in a row. Each toot is successively higher than the previous tooth and removes more material.</td>
<td>2m</td>
<td>2m</td>
</tr>
</table>

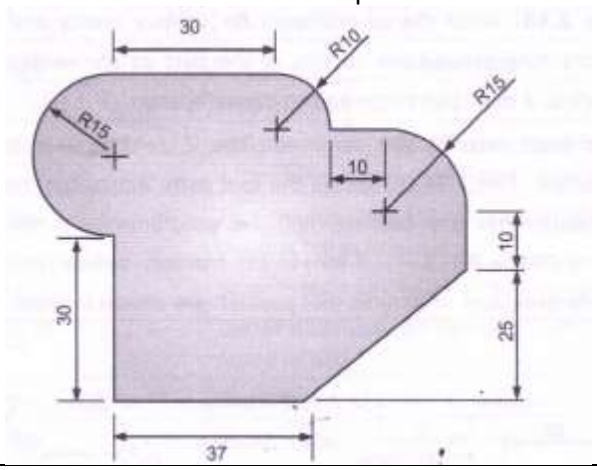
	The amount of tooth rise between the successive teeth of the broach is equivalent to the infeed given in shaping. Thus the first few sets of teeth remove most of the material, while the last few provide a finishing cut with very small amount of material removal. In broaching, one stroke or cycle of the machine produces a finished part.		
i)		2m	2m
j)	The limitations of broaching process 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.	1m for each limt	2m
k)	four types of planer machines are • pit type planer • divide type planer • double housing planer • edge type planer • open side planer	½ m for each type	2m
l)	The boring tools used on the boring machines are of mainly two types (i)single point borig tool. (ii) metal boring tool (iii) rotating type (iv) non rotating type	½ m for each type	2m
m)	Corrective maintenance is defined as maintenance work that involves the repair or replacement of components that are about to fail or have failed or broken down.Corrective maintenance is the result of a regular inspection that identifies the failure in time. Different sensors are connected to every machine in the workshop, to detect any change in the various parameters when they run out of the normal performance or a shutdown is produced. The objective of this maintenance is to to action before a failure occurs becausethe machine is still capable of producing satisfactory work. Therefore the maintenance work can be arranged at a time to meet the convenience of both production and the maintenance department. But such action should be taken as quickly as possible. When corrective maintenance is	2m	2m

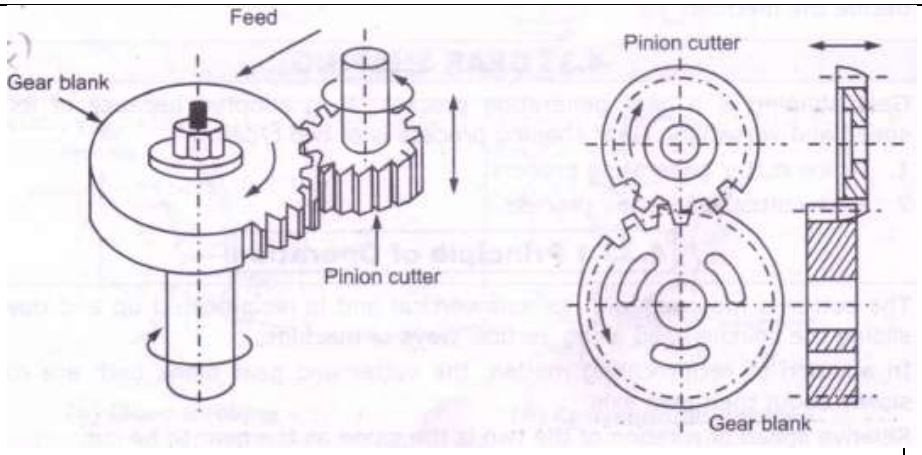
	done, the equipment should be inspected to identify the reason for the failure and to allow action to be taken to eliminate or reduce the frequency of future similar failures.		
n)	Uses of Honing: 1) It is used to correct some out of roundness. 2) It is used to superfinish internal bore or-holes. 3) It is used to correct axial distortion. 4) It is used to remove tool -marks-and-scratches. 5) It is used to reduce frfcticn between mating parts by increasing surface finish. 6) To obtain better fit on mating parts	1m per purpo se	2m
o)	basic parts of column and knee type milling consist of: • Base • Column • spindle • Guideways • Knee • Saddle • Table	½ m for each type	2m
2	**Attempt any four**	**4 x 4**	**16**
a)	Type of Bond: 1) Vitrified bond 2) Silicate Bond 3) Shellac bond 4) Resinoid bond 5) Rubber bond	1m per type	4m
b)	Thread grinding is done on a grinding machine using specially dressed grinding wheels matching the shape of the threads. The process is usually used to produce accurate threads or threads in hard materials; a common application is ball screw mechanisms[1] There are three types: *center-type grinding with axial feed*, *center-type infeed thread grinding* and *centerless thread grinding*. Center-type grinding with an axial feed is the most common of the three. It is similar to cutting a thread on a lathe with a single-point cutting tool, except the cutting tool is replaced with a grinding wheel. Usually a single ribbed wheel is used, although multiple ribbed wheels are also available. To complete the thread multiple passes are commonly required. Center-type infeed thread grinding use a grinding wheel with multiple ribs that is longer than the length of the desired thread. The grinding wheel is fed into the blank to the full thread depth. Then the blank is slowly rotated through approximately 1.5 turns while axially advancing through one pitch per revolution. Finally, the centerless thread grinding process is used to make head-less set screws in a similar method as centerless grinding. The blanks are hopper-fed to the grinding wheels, where the thread is fully formed. Common centerless thread grinding production rates are 60 to 70 pieces per minute for a 0.5 in (13 mm) long set screw.	3m exp 1m sketch	4m

			
c)	causes of break down in machine tool (i) No specialized maintenance staff. (ii) Maintenance is done by persons who operate the machine. (iii) Have less demand in excess of normal operating capacity. (iv) Downtime cost is less. (v) Unpredictable equipment operation.	1m per causes	4m
d)		1m per sketch	4m

e)	Dressing of grinding wheel:  It is the process of cleaning and opening up of the face of the wheel.It removes warm out grains from the wheel face and the sharp abrasive particles are again presented to the work.It removes loading defect.It ts carried out by a start wheel dresser.A dresser consists of a number of hardened steel wheels with point on their pertphery. The dresser is held against the face of the revolving wheel and moved across,the face to dress the wheel surface.	1m diag 3m exp	4m
f)	The important process parameters are: 1.Abrasives: The abrasive material used is Al_20_3 or SiC.The grain size is around 25 µm.The shape of abrasive is generally spherical.ifhe mass Flow rate is 3-20 g/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 150-300 m/s and pressure 2-8 bar.The flow rate is around 30 t/rnin. 3. Nozzle; The nozzle is made of Tungsten carbide or sapphire.Its shape is circular, 0.3-0.5 mm internal diameter or rectangular (0.08 mm0.51 mm to 6.61 mm 0.51 mm).The tip distance is 0.25-15 mm.The life tungsten is 12-30 hour and sapphire is 300 hours.The operating angle is 60^0 to 90^0 to the surface.Stand-off distance - 0.5 to 5 mm.	1m per param eter	4m
3	**Attempt any two**	**2 x 8**	**16**
a)	 	2m for diag 6m for exp	8m

	• Water from the reservoir is pumped to the intensifier using a hydraulic pump. • The intensifier accepts the water at low pressure and pressurizes it to around 400 MPa. • Pressurized water is then sent to the accumulator. The accumulator temporarily stores the pressurized water during the idle period and given out during cutting. • Pressurized water then enters the nozzle by passing through the control valve and flow regulator. • Control valve controls the direction of water and limits the pressure of water under permissible limits. • Flow regulator regulates and controls the flow rate of water.Pressurized water finally enters the nozzle. Here, it expands with a tremendous increase in its kinetic energy. • High velocity water jet is produced by the nozzle.The jet stream coming out of the nozzle strikes the workpiece and induces stresses. These stresses are used to cuts the workpiece.The water is then collected in a drain system.no heat is required.		
b)	• It is also called as cutter offset by some controller manufacturer.A workpiece is machined by the periphery of the cutting tool and not by the center of the cutter (tool tip). • A part program has to be developed for the exact size of the cutter to be used on the machine.But during actual machining, if a smaller diameter cutter is selected, it will result in a larger workpiece. Similarly a larger diameter cutter will result in smaller workpiece. • It is therefore necessary to compensate for the different diameter cutter by using cutter radius compensation. • When cutter compensation is used, the cutter diameter can be ignored and the tool path can be developed for the center line of the tool rather than the point on the periphery. • Compensation is done by offsetting the tool path by the distance equal to the radius of the cutter. • This value is entered into the memory of the control system under the address D01 or D02 etc • .When the offset file is called, the tool path will automatically be offset by the tool radius. • For any change in the cutter diameter, this offset can be changed. There is no need to make any change in the part program. • Cutter compensation can be made to the right or to the left of the part to be machined. • The direction in which 'the cutter path has to be shifted is decided by the direction of cut. • For example in Fig., the direction of cut i~ clockwise so compensation should be provided to shift the cutter path towards left. Because	2m for diag 6m for exp	8m

	shifting the cutter path towards right would result in a small size workpiece. • Cutter compensation direction is controlled by G-code. The following three • G-codes are used for cutter radius compensation. • G-40 Cutter compensation cancel. • G-41 Compensation applied to shift the programmed cutter path to left. • G-42 Compensation applied to shift the programmed cutter path to right. • The format of cutter compensation will look like – N050G41 001 EOB 		
c)	Pinion Cutter Generating Process: • In this method instead of rack cutter a pinion cutter having formed similar to gear to be produced is used. • The pinion cutter reciprocates along vertical plane. Gear blank is mounted on a vertical shaft and rotates very slowly. • The depth of cut is given during the cutting stroke (Downward stroke) and during return stroke work is relieved and cleared from cutter. • During the process the cutter is fed radially to the gear blank to obtain required tooth depth. • The use of pinion makes the process continuous and rate of production is more.	1m adv 1m disadv 1m diag 5m exp	8m

	 • advantages: • It is a continuous process. • It is a faster process. • It can cut internal gears • disadvantages: • worm and worm wheel cannot be produced • For cutting helical gears special guide called as helical guide is required • cutting takes place only in forward stroke and return stroke is idle so time is wasted		
4	**Attempt any four**	**4 x 4**	**16**
a)	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-con ductive until the required breakdown voltage is attained). (vi) It should be cheap and easily available. (vii) It should have high fluidity]	1m per chara	4m
b)	safety precautions in CNC Machines are: • Always keep the area around the machine clear of obstacles. • Always stack material where you can reach it but where it is clear of the moving parts of the machine. • Always check that tools are sharp and set correctly. • Always check that the correct tool data is entered into the CNC program. • Always make sure that all guards are in position while the machine is in operation. • Always make sure spindle direction is correct for right-hand or left-	½ m each point	4m

hand operation.

- Always conduct a dry run to ensure the program is correct.
- Do not use compressed air to blow chips from the parts of the machine, machine surfaces, cabinets, controls or floor around the machine.

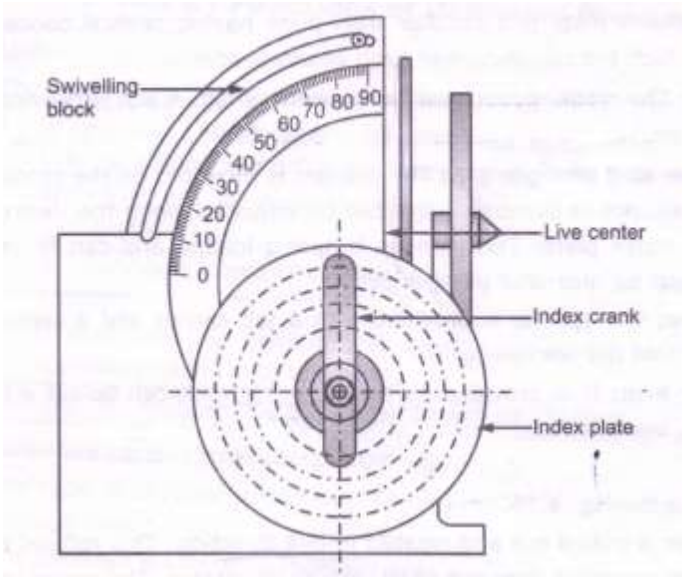
c)

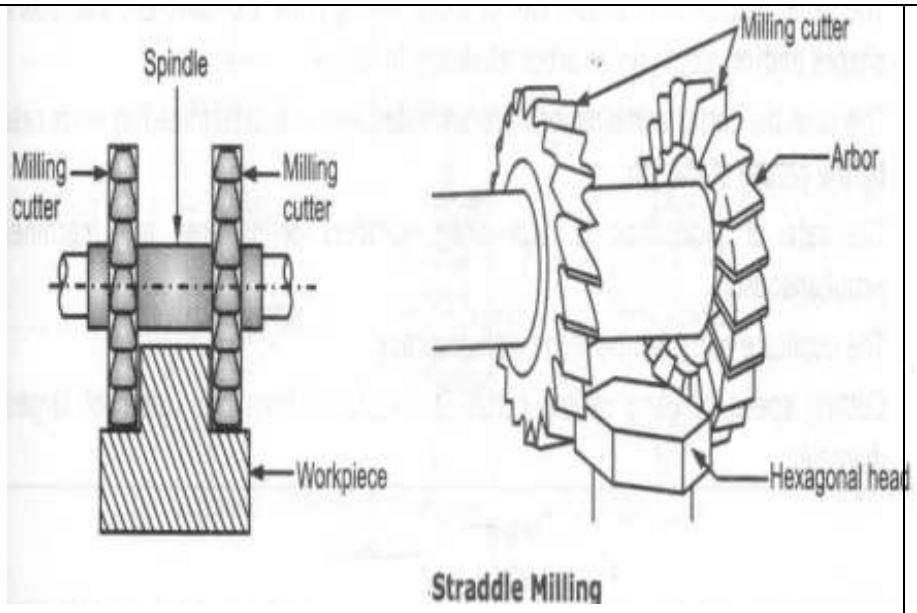
Sr. No.	Capstan lathe	Turret lathe
1	It is a light duty machine.	Turret lathes are relatively more robust and heavy duty machine.
2	The turret head is mounted on the ram and the ram is mounted on the saddle and moves on the guideways.	The turret head is directly mounted on the saddle and the saddle slides 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	In turret lathes external threads are cut by a single

1m per point

4m

			opening die being mounted in one face of the turret.	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	1m per point	4m
		1	In conventional milling the cutter rotates in a direction opposite to that in which the work is fed	In climb milling, the cutter 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)	The dividing head is of three types: 1) Plain or Simple dividing head. 2) Universal dividing head. 3) Optical dividing head 1)Plain or Simple Dividing Head : Plain dividing head consists of cylindrical spindle housed in a frame, and base bolted to table.Index crank is connected to tail end of spindle directly. The crank and spindle rotates as one unit.The index plate is mounted on spindle				1m for types 3m for any one exp	4m

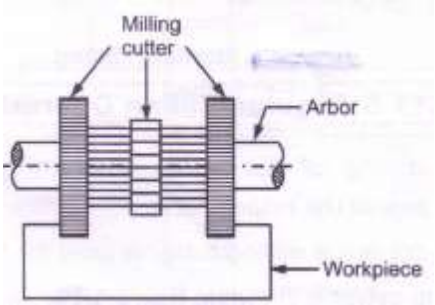
	and rotates along with it.The spindle can be rotated through desired angle and clamped by inserting the clamplnq lever in one of the hole cut on index plate.This type of indexing head is used for dividing the work periphery by small number of divisions. OR 2)Universal Dividing Head:  It is the most common type of arrangement used in work shop which can be used for all forms of indexing.The universal dividing head consist of worm and worm gear, index plate, sector arm, change gears and spindles. OR 3) Optical Dividing Head : Optical dividing head is used for precise angular indexing and for checking accuracy of various angular surfaces.The mechanism consists of worm gear keyed to the spindle. A circular glass scale graduated in 1^0division is rigidly mounted on worm wheel.Any movement of spindle is read-off by means of microscope fitted on dividing head body.The eye piece has a scale having 60 divisions and each division is equivalent to 1 movement of the circular scale. Thus, with type of arrangement precise index movement can be done		
f)	• 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.	1m for each diag 1m for each exp	4m



Straddle Milling

Gang Milling :

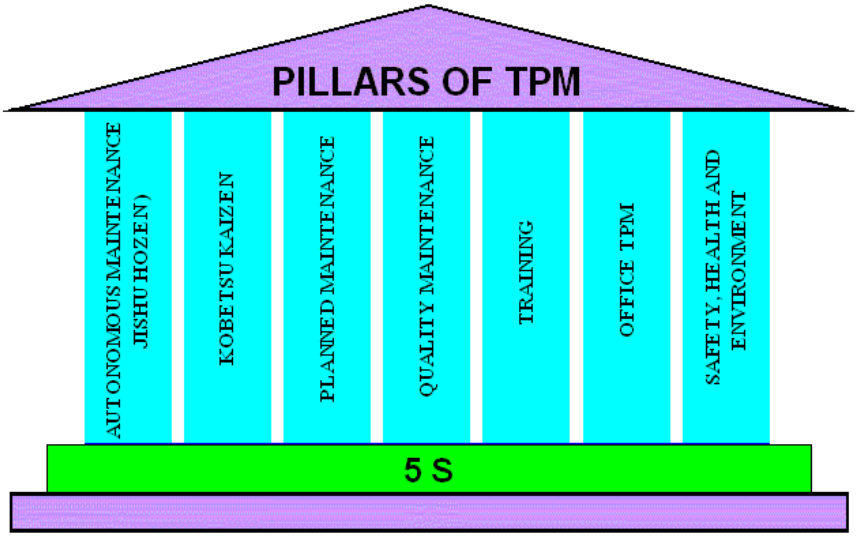
- Gang milling is the term applied to an operation in which two or more milling cutters are used together on one arbor for machining number of horizontal surfaces of a job.
- All cutters may perform the same type of operation or each cutter may perform a different type of operation.
- The diameter of cutters may be same or different.The cutters are mounted on arbor of plain milling machine.
- The distance between cutters is correctly adjusted by means of spacing collars



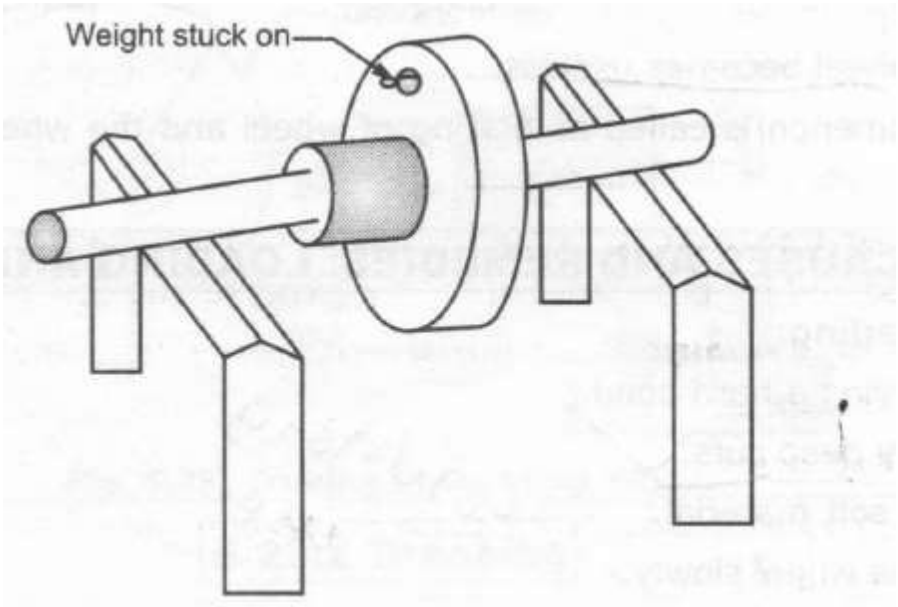
5	Attempt any two		2 x 8	16
a)	EDM	PAM	1m each point	8m
	1. it works on the principle of spark erosion	No spark is created		
	2. Metallic or non-metallic tools is used to remove the material from the work piece	Jet of plasma with help of plasma cutting maching is used to cut workpiece		

	3. Dielectric fluid like paraffin oil,lubricating oil is used as cooling agent	Water is used as cooling agent		
	4. Tool and work piece is eroded	Tool is not eroded		
	5. Metal removal rate is slow	Rate of cutting is high		
	6. Work piece and tool is immersed under dielectric fluid	It is not immersed under water		
	7. Plasma cutting torch is not used	Plasma cutting torch is used		
	8. Heat affected zone is more	Heat affected zone is less		
	9. safety precaution are not necessary for those in near by area	safety precaution are necessary for the operator and those in near by area		
b)	• Angular indexing is the process of dividing the periphery of work in angular measurement and not by number of divisions. • Plain or simple indexing can be used for machining operations when you need a certain number of division of a circle. When angular machining operations need to be done angular indexing is used. • The 360^0 of circle is equivalent to 40 revolutions of index crank. • Thus, one complete turn of crank will cause work to rotate through 360 / 40 = 9^o index an angle of $21^0 50'$ $21^0 50' = (21 \times 60) + 50$ $= (1260 + 50)$ $=1310$ Index crank movement = $1310/540 = 2\ ^{23}/_{54}$ The index crank should be moved two complete turns and 23 holes of 54 hole circle.		4m exp 4m proble m	8m
c)	• Scheduled maintenance is aimed at avoiding breakdowns.It follows the very old principle of "a stitch in time saves nine". • Breakdowns can be dangerous to life and as far as possible should be minimized.Scheduled maintenance utilizes a previously developed maintenance schedule for each machine tool. • It incorporates inspection, lubrication, repair and overhaul of certain equipments which if neglected can result in breakdown. • The scheduled maintenance may take place too soon, while the machine still operates well thereby reducing the chances of breakdown. • It is required to schedule the maintenance early because in some cases, the machine may still be running but producing unacceptable parts. • Scheduled maintenance can be considered a part of preventive		5m exp 1m for each point of adv	8m

	maintenance known as fixed-time maintenance (FTM). Advantages: (i) It prevents occurring of breakdown. (ii) It can be done at the pre-scheduledtime without distributing the production. (iii) It prevents the equipment from a large failure. (iv) It provides safety to operator. (v) It is less costly over a large period of time. (vi) Less standby or reserve equipment and spare parts.		
6	**Attempt any four**	**4 x 4**	**16**
a)	• Total productive maintenance (TPM) is a system of maintaining and improving the integrity of production and quality systems through the machines, equipment, processes, and employees that add business value to the organization. • One of the main objectives of TPM is to increase the productivity of plant and equipment with a modest investment in maintenance. • Total quality management (TQM) and total productive maintenance (TPM) are considered as the key operational activities of the quality management system. • In order for TPM to be effective, the full support of the total workforce is required. • This should result in accomplishing the goal of TPM: "Enhance the volume of the production, employee morale and job satisfaction • The eight pillars of TPM are mostly focused on proactive and preventative techniques for improving equipment reliability: Autonomous maintenance, Planned Maintenance, Quality Maintenance, Focused Improvement, Early Equipment Management, Training and Education, Safety Health Environment, TPM in Administration • TPM addresses the causes for accelerated deterioration while creating the correct environment between operators and equipment to create ownership.	1m for diag 3m exp	4m

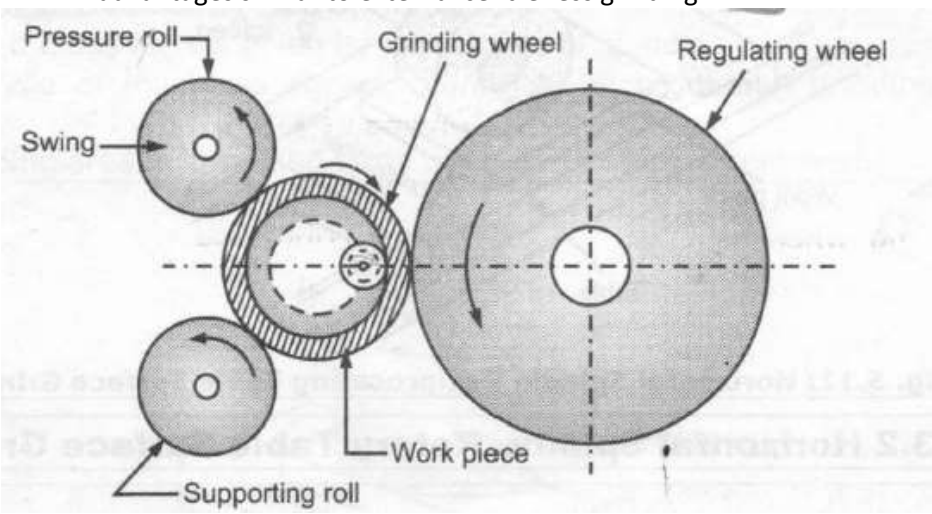


b)	i) G -43 Tool length compesnsation in positive (+)direction. ii) G- 75 Rectangular pocket milling cycle(CW) iii) G – 81 Drilling cycle(canned) iv) G -10 Tool lengh offset value.	1m per code	4m	
c)	BALANCING OF GRINDING WHEEL: In order to obtain a good surface finish, prevent-vibration and chatter and undue wear of machine parts, it is necessary that grinding wheel has good balance.Thus, the grinding wheel should be properly tested for b-alance before use. If the wheel becomes out of balance through wear it should be balanced by removing from the machine.The wheel should be trued before balancing. Balancing can be done by three ways: (a) By filling the lead: Small wheels may be balanced by milling a short recession the inside of the lange and filling it with lead. (b) By stucking weights: The wheel is mounted at the centre of a perfectly straight and round spindle, the assembly is them rested on a know edge balancing stand. Any out of balance will result in the wheel coming to test with the heavy side underneath. Correct weight can be then struck on the opposite side to balance the wheel. (c) By using a recessed flanged: The wheel inbalance is tested as in above methods. A recersed flange is used and the weights can be moved over it along the recess to balance the large wheels	1m diag 3m exp	4m	



d)

	Shaper	Planer	1m per point	4m
1.	Cutting stroke is slower than inactive stroke.	Cutting stroke is remain slower.		
2.	Shaper machine is use for small workings.	Planer machine use for large workings.		
3.	Through machining a single cutting tool is use.	Two or extra cutting tools be able to use through machining.		
4.	Cutting tool move up and down in horizontal direction as make a cutting process.	Cutting tool remains motionless.		
5.	Stroke length is small.	Stroke length is considerably bigger than that of a shaper.		
6.	Stroke length is regulated through the stroke adjust screw.	Distance of table travel is keeping pace by stops with dogs.		
7.	Cutting rate through the cutting stroke differ.	Planer has nearly stable cutting speeds.		
8.	Work-piece is held tightly on a stable bed.	Work-piece is held firmly on a horizontally moving table.		

e)	• In centre-less grinding the workpiece is supported between the three rolls. The rolls are pressure roll, supporting roll and a regulating roll (grinding wheel). • All the three rolls rotates in the same direction and rotates the workpiece with them. • The workpiece and rinding wheel rotates in the same direction.The direction of rotation of the three rolls and wor piece is opposite. • The grinding wheel always contacts the workpiece at the horizontal centerline of the regulating wheel. • This ensures uniform wall thickness of the workpiece and also ensures concentricity of the bore with the external surface of the workpiece. • To load or unload the workpiece, 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 work having repetitive nature.It has advantages similar to external centre-less grinding. 	2m diag 2m exp	4m
f)	• Regular chain maintenance is important to obtain maximum life. In a correctly sized and installed drive, chain can be expected to last for approximately 15,000 hours. • Check chain adjustment and rectify if necessary. Change oil, oil filter, and clear the sump • Check for wear on sideplates. Check for chain elongation. Check cleanliness of component. Remove any accumulation of dirt or foreign materials. Check for shaft and sprocket alignment. Check for wear on sprockets. Check the condition of the lubricant. • Check the lubrication system • Care must be taken to ensure that the lubricant reaches the bearing area of the chain • Grease must be heated until fluid and the chain are immersed and allowed to soak until all air bubbles cease to rise	4m	4m

	• Measuring Chain Wear A direct measure of chain wear is the extension in excess of the nominal length of the chain. • Chain wear can, therefore, be ascertained by length measurement in line with the instructions given below. • Always loosen tensioning devices. Support the chain to prevent uncontrolled movement of chain and parts. Do not attempt to connect or disconnect chain unless you know the chain construction • Correct assembly of a connecting link into a chain will ensure a smooth gearing action with a minimum of whipping		