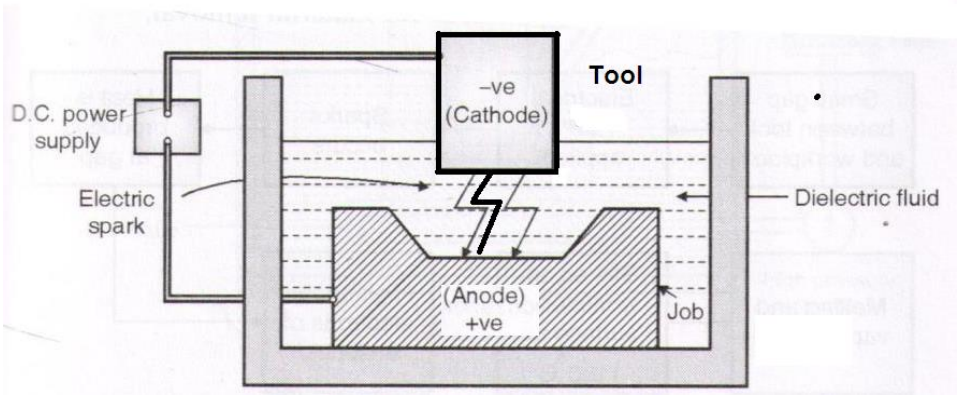
WINTER – 19 EXAMINATION

Subject Name: Advance Manufacturing Process **Model Answer** **Subject Code: 17527**

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 judgement 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.	Sub Q. N.	Answer	Marking Scheme
1	**(a)**	**(i) State the importance of nontraditional machining process** **Ans: Importance of nontraditional machining process** 1. Material removal may occur with chip formation or even no chip formation may take place. 2. In nontraditional machining, there may not be a physical tool present. 3. In nontraditional machining, the tool need not be harder than the work piece material. 4. Mostly nontraditional machining processes do not necessarily use mechanical energy to provide material removal. **5.** They use different energy domains to provide machining.	1 Mark each for any 4 correct points
		(ii) Why axis identification is necessary for CNC Machine system? **Ans: Need of axis identification in CNC Machines** 1] **To move slides and tool:** To obtain desired shape of the work piece it is necessary to move the spindle , slides in a different direction. [2] **To find coordinates as per drawing:** In part programming the requirement is to determine co-ordinates for given product as per drawing [3] **To find coordinates as per programming standards:** To It is essential to identify the machine axes to determine the co-ordinate as per the standardized system.	1 Mark each for any 4 correct points

		[4] **To prepare part program**: It is necessary for the part programming [5] **To determine relation between tool movements:** Axis identification is required for the tool movement and coordinate selection	
		(iii) Give the applications of Broaching machine. **Ans: Applications of Broaching machine.** 1. Cutting of keyways on shafts, teeth of internal gears 2. Machining of internal surfaces to enlarge holes 3. Machining of cylinder heads, connecting rods, bearing caps etc. 4. Gear manufacturing, splines on a shaft , irregular profiles, etc	1 Mark each for any 4 correct application
		(iv) Give any four applications of AJM. **Ans: Applications of AJM** 1. Machining circuit boards 2. For machining /cutting hard rocks, glass, deburring, removing deposits from surface 3. AJM can be used for cutting nonmetallic thin sheets 4. Micro-machining of brittle materials	1 Mark each for any 4 correct application
	b)	**(i) Draw neat labeled diagram of EDM and explain the process with respect to its principle, applications and limitations** **Ans:** **1. Labeled diagram**  **2. Principle:** • It works on the principle of metal removal by using combination of electrical and thermal energy. • The energy is utilized to create electrical spark ;and heat is produced for erosion of metal. The principle of spark erosion is utilized in Electro	Sketch – 3 marks Principle-1 Applications-1 limitations-1

discharge machining.

3. Applications

1. For producing very small holes (as small as 0.1 mm dia.)
2. Embossing , engraving operation on harder materials and for making holes in nozzles.
3. Internal threads and internal gears can be produced in harder material.
4. Shaping Tungsten carbide dies, press tools and to give any intricate shape.

4.Limitaions:

1. High power consumption

2. High wear rate of electrodes not possible reproduce sharp corners

3. Difficult to produce complex profiles

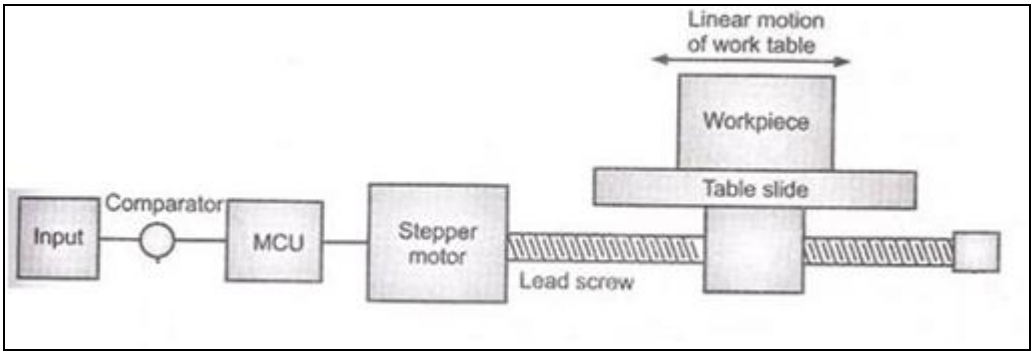
4. Excessive tool wear during machining

ii) Explain open loop and closed loop control system with their applications

Open loop- 3 marks
Closed loop- 3 marks

Ans:

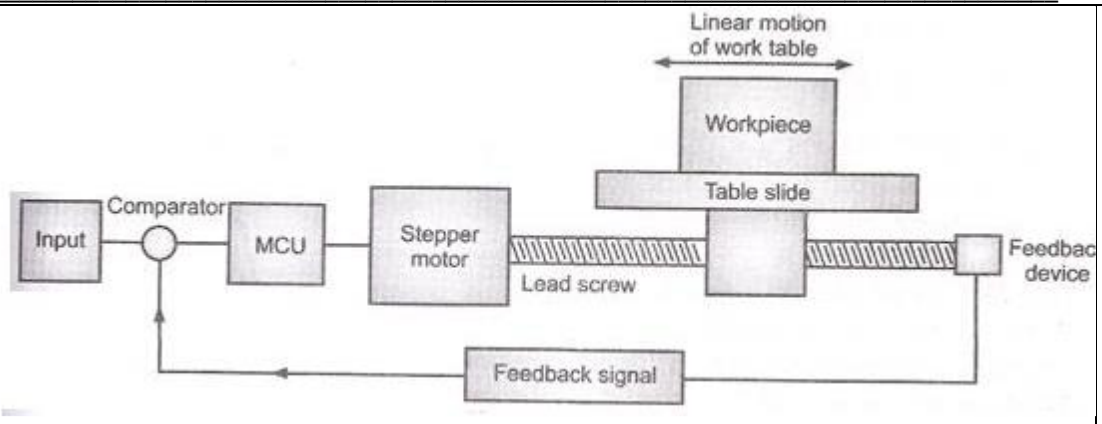
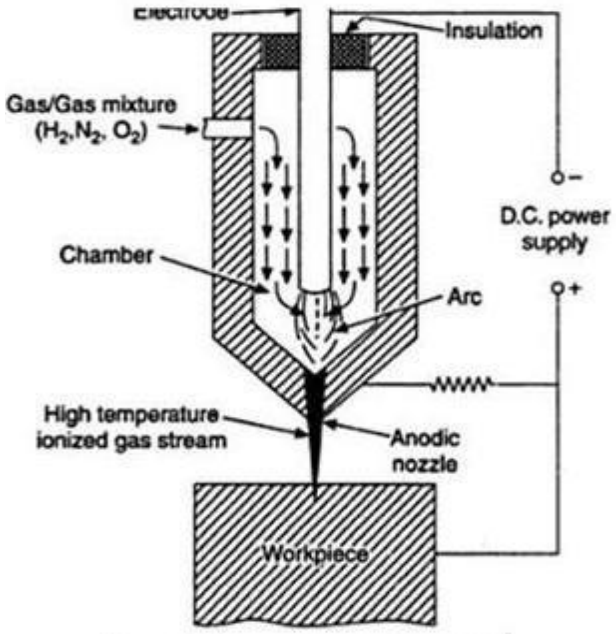
1. Open loop system



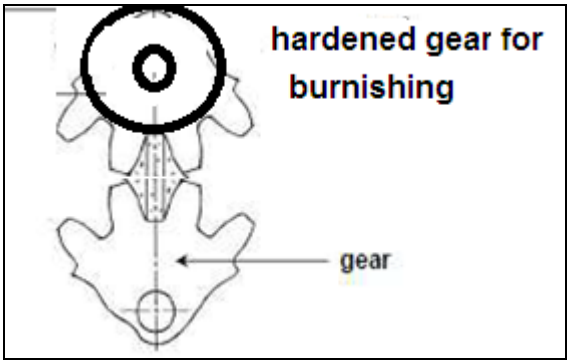
- Open loop system is suitable for simple and low accurate applications where no feedback is required.
- It is useful for simple machines like electrical cloth dryer, Conventional machines, etc

1. Closed loop system

- This system is similar to open loop control system. But it consists of two additional devices in the form of feedback transducer and a comparator as shown in Fig.
- The transducer feedbacks the actual slide displacement to the comparator.
- This system is suitable for CNC machines, where accuracy is important

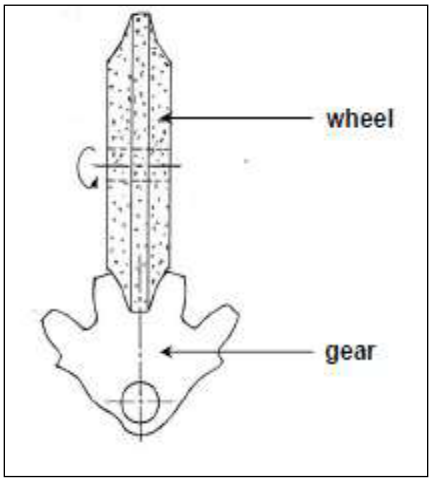
			
2	a)	**With labeled sketch, describe the principle of PAM** **Ans:**  **Principle of PAM** • The principle PAM is shown in the figure. In this process, plasma torch is used in which a volume of a gas such as H2,N2,O2 is passed through a small chamber in which high frequency spark is maintained between cathode and anode. • The high velocity electrons generated by arc collide with gas molecules results into ionization of the atoms and causing large amounts of thermal energy to be liberated. • The plasma jet melts the work piece material. The depth of hat zone depends on the work material, its thickness and cutting speed.	Labeled sketch- 2 Marks Principle-2 Marks
	b)	**Explain the concept of Jog mode** **Ans:** • It is initial setting of CNC machines using direction keys with required movement which can be operated manually. • It will help to set the cutting tool and move the tool at required reference point.	Explanation – 4 marks

		• The area of the machine control that allows an operator to move a selected axis. Jog keys are often called axis direction keys. • In JOG mode, the continuous movement of a tool in a direction along a selected axis. • Jog mode is mostly used to travel the CNC machine table slide for movement of table along X-axis and Z-axis. CNC machine works manually like conventional machines.	
	c)	**Give the classification of milling machine** **Ans:** **1.According to position / location of spindle** o Horizontal milling machine o Vertical milling machine o Special purpose milling machine. **2. According to design :** **a. Column and knee type milling machine** o Hand milling machine o Plain milling machine o Universal milling machine o Vertical milling machine **b. Fixed bed type milling machine** o Simplex milling machine o II. Duplex milling machine o III. Triplex milling machine **c. Planer milling machine** **d. Special type of milling machine** o Rotary table milling machine o Planetary milling machine o Profiling milling machine o Duplicating milling machine o Pantograph milling machine o Tracer contour milling machine	Classification - 4 marks
	d)	**Explain following gear finishing methods 1. Burnishing 2. Grinding** **Ans:** **Gear burnishing:** o The operation consists essentially of rolling the work gear with one or several burnishing gears whose teeth are very hard, smooth and accurate. The latter gears are driven by a motor. o It is used to remove burrs and improves the smoothness of gear tooth profile.	Burnishing – 2 marks Grinding- 2 marks



Gear Grinding

- Gear 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.
- The properly formed and dressed wheel finishes the gear teeth flanks by fine machining or abrading action of the fine abrasives.
- Form grinding may be used for finishing straight or single helical spur gears, straight toothed bevel gears as well as worm and worm wheels



e) **Explain need and importance of maintenance activity.** — Need- 2 marks, Importance- 2 marks

Ans:

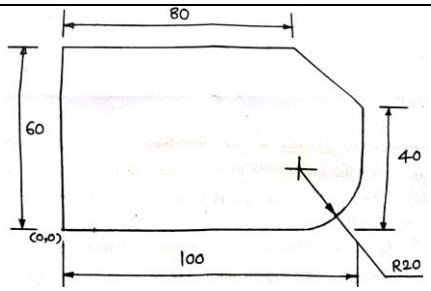
Need of maintenance

• Maintenance should be planned at regular intervals to prevent uncalled breakdown.

• If proper attention is not given to the machine tool then it will fail.

• The maintenance of machine tool is needed to keep them in working condition at all the times.

• The maintenance of machine tool is important to minimize the hindrance and interruption of work

		Importance - To minimize the number of breakdown. - To keep plant in good working condition at the lowest possible cost. - To minimize the hindrance and interruption of work. - To carry out the work of all the machines smoothly.	
3		**Attempt any TWO of the following:**	**16**
	a	**Prepare a part programme for the component as shown in Fig. No. 1.** **Use following machining data,** **(i) End Mill Cutter Diameter 10 mm.** **(ii) Depth/Thickness of part is 4 mm.** **(iii) Feed Rate is 120 mm/ min** **(iv) Spindle speed is 800 rpm.**  **Also use the cutter radius compensation and assume suitable machining data if required.**	**08**
	Ans	**Main programme:** O111; N10 G90 G94; N20 T01 G54 G41; N30 S800 M03 M08 F120 ; N40 G00 X0 Y0 Z0; N50 M98 L111 P8; (0.5 DEPTH OF CUT x 8 REPITATIONS = 4 MM DEPTH) G00 Z10; G40; M05; M09; M02 **Sub- programme:** L111 N05 G91 G01 Z-0.5; N10 G90 G01 X80; N20 G03 X100 Y20 R20; N30 G01 Y40; N40 G01 X80 Y60; N50 G01 X0; N60 Y0; N70 G00 X0 Y0 Z0; N80 M99;	**Correct Answer** **08** **Marks**
	b	**How are non-traditional machining processes classified? Explain with neat sketch LBM and WJM.**	**08**
	Ans	**Classification of Non-Traditional Machining Processes:** **1. Mechanical** (a) Abrasive Jet Machining (AJM) (b) Ultrasonic Machining (USM) **2. Chemical** Chemical Machining (CHM) **3. Electro-Chemical** (a) Electro-Chemical Machining (ECM) (b) Electro-Chemical Grinding (ECG) **4. Thermo-electric.** (a) Ion-beam Machining (IBM) (b) Plasma Arc Machining (PAM) (c) Electrical Discharge Machining (EDM) (d) Electron-Beam Machining (EBM) (e) Laser-Beam Machining (LBM) **LBM:**	**02 marks**

LBM Sketch 01 Mark & Working 02 Marks

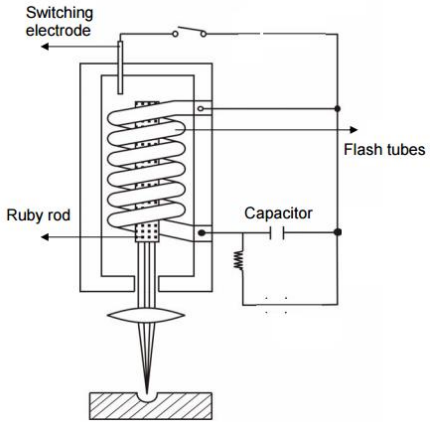


Figure: LBM

Laser beam machining (LBM) is an unconventional machining process in which a laser is directed towards the work piece for machining. Since the rays of a laser beam are monochromatic and parallel it can be focused to a very small diameter and can produce energy as high as 100 MW of energy for a square millimeter of area. It consists laser rod in the form of cylindrical crystal with 10 mm diameter and 150 mm long, its ends are well finished with close tolerances. It also has coil flash tube which is placed around ruby rod.

It is especially suited to making accurately placed holes. It can be used to perform precision micro-machining on all microelectronic substrates such as ceramic, silicon, diamond, and graphite.

Examples of microelectronic micro-machining include cutting, scribing & drilling all substrates, trimming any hybrid resistors, patterning displays of glass or plastic and trace cutting on semiconductor wafers and chips. A pulsed ruby laser is normally used for developing a high power.

Water Jet Machining:

WJM Sketch 01 Mark & Working 02 Marks

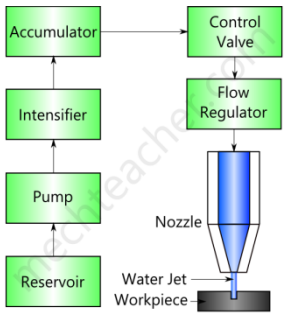


Figure: WJM

Principle:-The material is removed with the help of high velocity fluid i.e. water.

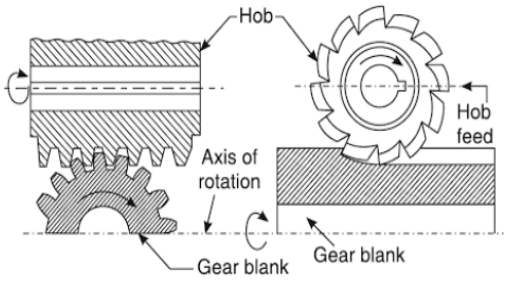
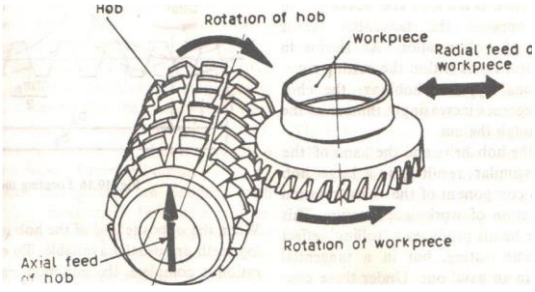
Set Up:-The water jet machining set up includes reservoir, pump, intensifier, accumulator, control valve, flow regulator, nozzle. Pump is connected to the reservoir and gives its output to the intensifier. Intensifier is connected to the accumulator. Then Water is supplied to the flow regulator trough the control valve. Water is then allowed to flow through the nozzle which is directed over the work piece. The components and their functions are as follows,

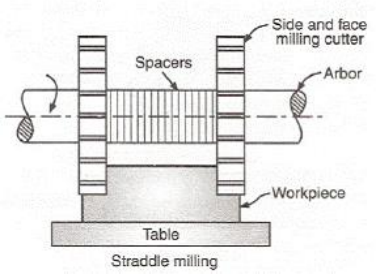
[1] Reservoir: It is used for storing water.

[2] Pump: It pumps the water from the reservoir.

[3] Intensifier: It is connected to the pump. It pressurizes the water acquired from the pump to a desired level.

[4] Accumulator: It is used for temporarily storing the pressurized water. It is connected to the flow regulator through a control valve.

		[5] Control Valve: It controls the direction and pressure of pressurized water that is to be supplied to the nozzle. **[6] Flow regulator:** It is used to regulate the flow of water. **[7] Nozzle:** It renders the pressurized water as a water jet at high velocity.	
	c	**What is gear cutting? Explain the gear hobbing operation with neat sketch and give advantages, disadvantages and applications.**	**08**
	Ans.	**Gear Cutting**: A gear is a rotating machine part having cut teeths , which mesh with another toothed part to transmit torque. Gear is cut from round blank carrying teeth along its periphery. Gear cutting is specialized job . Gear cutting is any machining process for creating a gear. The most common gear-cutting processes include hobbing, broaching, milling, and grinding. Such cutting operations may occur either after or instead of forming processes such as forging, extruding, investment casting, or sand casting. **Gear Hobbing:**	**01**
		 **OR**  **Figure : Gear Hobbing**	**Gear Hobbing Sketch 02 Marks & Process 02 Marks**
		In this process of gear generating a tool is used known as hob. Hob teeth are shaped to match the tooth space and are interrupted with grooves to provide cutting surfaces. It rotates about an axis normal to that of the gear blank, cutting into the rotating blank to generate the teeth as shown in figure. It is the most accurate of the roughing processes since no repositioning of tool or blank is required and each tooth is cut by multiple hob-teeth, averaging out any tool errors. Excellent surface finish is achieved by this method and it is widely used for production of gears. **Advantages:** 1. It's a versatile process. It can cover a variety of work including spur, helical, worms and worm wheels, splines and serrations, and a variety of special forms. 2. The indexing is continuous and there is no intermittent motion to give rise to errors. 3. There is no loss of time due to non-cutting on the return stroke. 4. It is also possible to generate internal gears. 5. The rate of production is high as compare to other generating processes. 6. The process is applicable for small as well as large scale production.	**01**
		Disadvantages; 1. Not adopted to generate internal gears. 2. Restricted adjacent shoulders larger than root diameter of the gear. 3. Splines and serrations are not suitable for hobbing.	**01**
		Applications: 1. It is widely used to produce spur, helical gears, worms and worm wheels. 2. It can also be used for producing internal gears for which the machine should have facility for fitting a special head.	**01**
4	**a**	**Attempt any THREE of the following:**	**12**
	i	**Explain with neat sketch following milling operation.** **(1) Straddle Milling. (2) Slot Milling.**	**04**
	Ans	**(1)Straddle Milling:**	**02**



OR

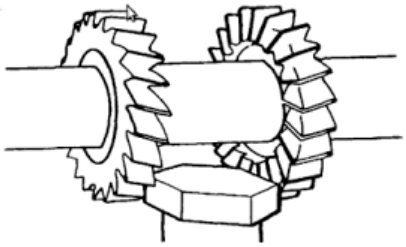


Fig- Straddle Milling Operation

This is similar to the side milling operation. Two side milling cutters are mounted on the same arbor Distance between them is so adjusted with the help of spacing collars such that both sides of the work piece can be milled simultaneously. Hexagonal bolt can be produced by this operation by rotating the work-piece only two times as this operation produces two parallel faces of bolt simultaneously.

Slot Milling:

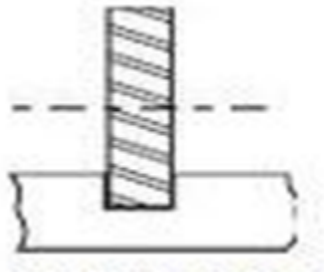
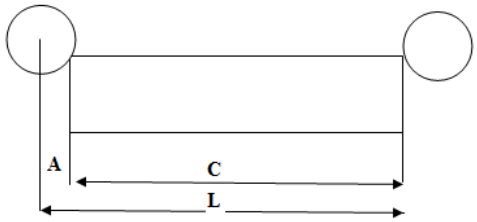


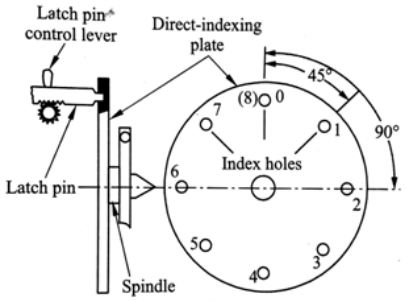
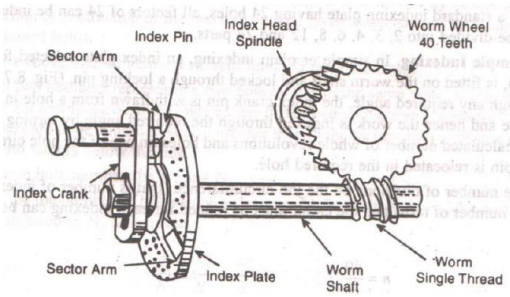
Figure : Slot Milling

It is the operation of producing the narrow slots or grooves on a workpiece by using a saw milling cutter. The slot milling can also be used for parting off operation. The cutter and workpiece are set in a manner so that the cutter is directly placed over one of the T slots of the table. The open slots can be made by plain milling cutter, sitting saw, side milling cutter.

02

	ii	**Explain the various cutting parameters of Milling.**	**04**
	Ans	**Cutting Parameters of Milling:** **Cutting Parameters:-** **1) Cutting Speed:-** The speed of the milling cutter is its peripheral linear speed resulting from rotation. It is expressed in meters per minute. $V = \frac{\pi d n}{1000}$ Where, V = the cutting speed in m per min. d = the diameter of the cutter in mm n = the cutter speed in r.p.m. **2) Feed:-** The feed in the milling machine is defined as the rate at which the workpiece advances under cutter. The feed in milling machine is expressed by the following methods a) Feed per tooth (Sz) b) Feed per revolution (Srev) c) Feed per minute (Sm) **a) Feed per tooth (Sz):-** The feed per tooth is defined by the distance the work advances in the time between engagement by the two successive teeth. It is expressed in mm/tooth of the cutter. **b) Feed per revolution (Srev):-** The feed per cutter revolution is the distance the work advances in the time when the cutter turns through one complete revolution. **c) Feed per minute (Sm):-** The feed per minute is defined by the distance the work	**01 mark for each parameter**

		advances in one minute. It expressed in mm/min. **3) Depth of cut:-** The depth of cut in the milling machine is the thickness of the material removed in one pass of the work under the cutter. It is the perpendicular distance measured between the original and final surface of the work piece and is expressed in mm.  **Calculation of Machining Time:-** **T= L/Sz X Z X n** Where, T = the time required to complete the cut in minutes L= the length of the table travel to complete the cut in mm Sz = the feed per tooth in mm Z = the number of teeth in the cutter n = the rpm of the cutter Approach "A" is the distance through which the cutter must be moved before the full depth of cut is reached.	
	iii	**Give the advantages and applications of honing.**	**04**
	Ans	**Advantages:** 1. High geometrical and dimensional accuracies are obtained 2. High surface finish is achieved. 3. Suitable for through as well as blind holes **Applications** 1) Finishing automobile crankshafts journals 2) Finishing round holes 3) Finishing hollow cylindrical parts	**02** **02**
	iv	Explain the basic maintenance practices for 'Bearing' and 'Shaft'	**04**
	Ans	**Maintenance Practices for Bearings:** (i) Never spin the bearing with compressed air. (ii) Do not try to disassemble the bearing. (iii) Avoid direct fire or fumes contact with bearing. (iv) Do not hit the bearing with metal part/use bearing pullers while assembling or dismantling. (v) Store the bearing away from moisture. (vi) Check the clearance between bearing cap and bearing using plasti gauge before assembly. (vii) Do not run the bearing over its specified speed. (viii) Do not throw away broken bearing, it may help you to know type of failure for corrective actions. **Maintenance Practices for Shafts:** [1] Inspection of shaft for performance [2] Cleaning of shaft using [3] Oiling / Greasing / Lubrication of shaft [4] Inspection for performance after minor maintenance [5] Repair / Replacement of shaft if required [6] Inspection for performance of shaft after major maintenance	**02** **02**
4	**b**	**Attempt any ONE of the following:**	**06**

	i	**Define indexing. Explain the methods of indexing with neat sketch.**	**06**
	Ans	**Indexing:** Indexing is the operation of dividing the periphery of a piece of work into any number of equal parts. In cutting spur gear, equal spacing of teeth on the gear blank is performed by indexing. Indexing is accomplished by using a special attachment known as dividing head or index head. **Methods of Indexing** 1. Direct 2. Simple 3. Angular 4. Differential **[1] Direct Indexing** Simplest form of indexing. Performed by disengaging worm shaft from worm wheel by means of disengaging the drive gear – Spring-loaded tongue lock engages numbered slots in index plate. Used for quick indexing of workpiece when cutting flutes, hexagons  Figure: Rapid or Direct Indexing **[2] Simple or Plain Indexing** Work positioned by means of crank, index plate, and sector arms. Worm attached to crank must be engaged with worm wheel on dividing head spindle: 40 teeth on worm wheel which means: –One complete turn on index crank causes the spindle and work to rotate one-fortieth of a turn. Work positioned by means of crank, index plate, and sector arms. Worm attached to crank must be engaged with worm wheel on dividing head spindle: 40 teeth on worm wheel which means: –One complete turn on index crank causes the spindle and work to rotate one-fortieth of a turn  Figure: Simple or Plain Indexing **[3] Angular Indexing:** One complete turn of index crank turns work 1/40 of a turn – 1/40 of 360° equals 9 degrees Turns of the crank = Angle required/9	**02** **01 mark for each method**

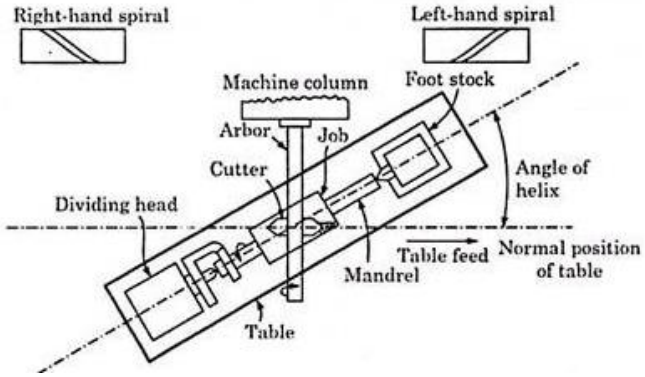


Figure: Angular Indexing.

[4] Differential Indexing:

Sometimes the plates you have will not have the combinations you need to arrive at your particular angular spacing. In this case you use Differential Indexing Instead of relying on the 40:1 worm assembly, you drive the indexing plate via a bevel gear system. The Index plate moves as the Index
Crank is turned

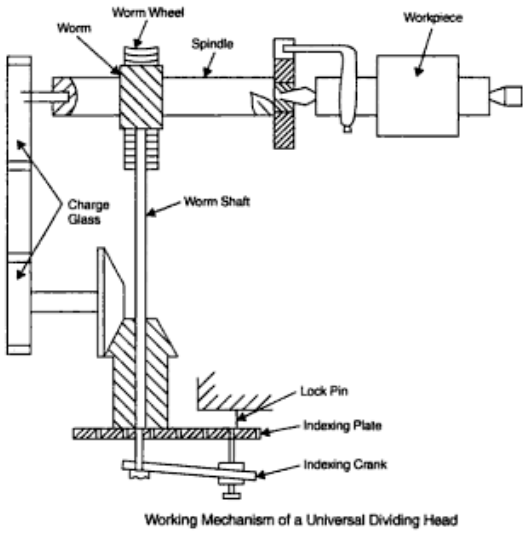


Figure : Differential Indexing.

	ii	**Give classification of grinding machines and explain working of cylindrical grinding machine with neat sketch.**	**06**
	Ans	**Classification Of Grinding Machine**:- **a) According to quality of surface finish** i) Rough and non precision grinding machines 1) Floor stand and bench grinders 2) Portable and flexible shaft grinders 3) Swing frame grinders 4) Abrasive belt grinders ii) Precision grinding machines 1) External or internal cylindrical grinding 2) Surface grinders 3) Form grinders	**02**

b) According to type of surface generated

i) Cylindrical grinder
1) Center type plain
2) Centre type universal
3) Centre less

ii) Centre less grinder
1) Through feed grinders
2) In feed grinders
3) End feed grinders

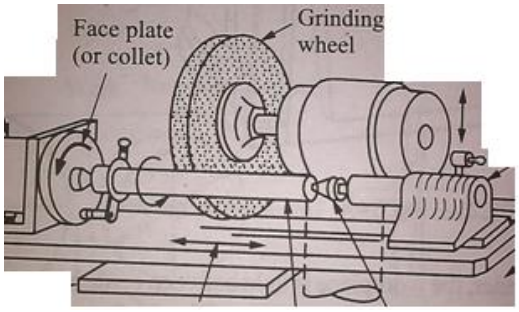
iii) Internal grinders
1) Chucking grinder
2) Planetary grinder
3) Centre less grinder

iv) Surface grinder
1) Horizontal grinders a. Reciprocating table b. Rotary tables
2) Vertical spindle a. Reciprocating table b. Rotary table

c) According to specialized application

(i) Tool and cutter grinder (ii) Form grinder (iii) Hand grinder (iv) Crankshaft grinder
(v) Thread grinder (vi) Cam grinder

Cylindrical Grinding:



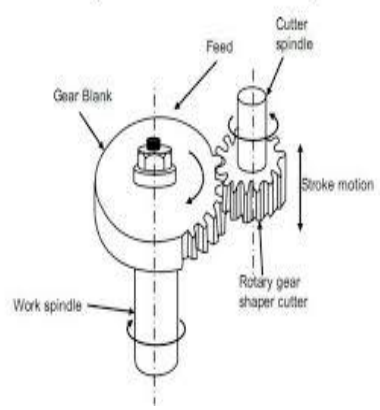
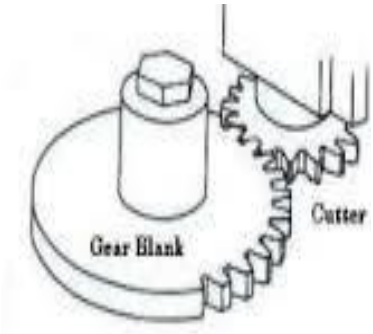
02

Cylindrical grinders are intended to primarily for grinding plain cylindrical parts although they can be used for contoured cylinders, fillets, and even cam & shafts.The work piece is usually held between dead centers and rotated about its own axis.

There are 4 main actions involve:- **02**

1) The work must revolve
2) The wheel must revolve
3) The work must pass the wheel
4) The wheel must pass the work

5		**Attempt any FOUR of the following**	**16**
	a)	**What is repair complexity? State the signification of repair**	
	Ans	**Repair complexity** It indicates how complex the problem is to be repair. Repair complexity cannot be measured by any absolute means but can be decided from relative figures of similar machines. It is relative index to give comparative idea of the complexity of the machine. It plays very important part in maintenance. Significance of Repair Cycle [1] It gives idea about staff required. [2] Number of small/minor repairs.	**2 Marks for definition** **&** **½ Mark each**

		[3] Number of major repairs. [4] Number of spare parts (quantity required for maintenance)	for any 4 correct points
	b) Ans	**State the criteria for selection of grinding wheel** 1) Material to be ground:- Grain size , grade, structure, bond 2) Amount of stock to be removed:- This involves accuracy and surface finishing, coarse grain is used for fast cutting & fine grains are used for fine finish 3) Area of contact:- Fine grain and closed grain spacing are useful where area of contact is small 4) Type of grinding machine:- Heavy rigidly constructed machine used softer wheel. 5) Wheel speed 6) Work speed 7) Condition of the machine 8) Personal factor	½ Mark each for any 4 correct points
	c) Ans	**Explain gear shaping operation** **Gear Shaping** Gear shaping is used for cutting spur and herringbone gears etc. Principle:- Teeth are produced with the help of reciprocating and rotating cutter with rotating motion of work piece   Setup:- Gear shaping cutter receives the reciprocating motion which is the principal movement. It reciprocates at a rate of 50 to 450 strokes per minutes. Both cutter and work piece rotate with same speed. The radial movement is given to cutter when it is to be fed into depth of cut. Working:- 1) Cutter is fed into full depth with cutter reciprocating and blank stationary 2) Both cutter and blank slowly rotates about their axis at high speed **3)** At same time cutter is feed to work piece	1 Mark for Principle 1 Mark for diagram 1 Mark for set up 1 Mark for working
	d) Ans	**State the advantages and application of lapping** **Advantages:-** [1] Better surface finishing can be obtained [2] Higher geometrical accuracy can be obtained [3] High fatigue life of component [4] High surface hardness **Applications** [1] Gear Blanks [2] Bearings	1 Mark each for any 2 correct point 1 Mark each for any 2 correct point

[3] Gauges
[4] Flat surfaces
[5] Ceramic Machining
[6] Glass machining

e) Ans **Differentiate between Capstan and Turret Lathe**

Sr. No.	Capstan Lathes	Turret Lathes
1	The turret of capstan lathe is mounted on slides on the saddle	The turret of the turret lathe is directly mounted on bed
2	Less rigidity provided to the tool	More rigidity provided to the tool
3	Suitable for light weight bar works	Suitable for Larger and heavier loads
4	Handy for small components	Larger works can be machined easily
5	High production rate as fast cut is possible	High production rate can not be achieve easily as larger and heavier parts do not permit fast cut

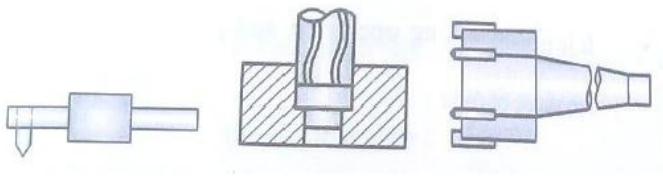
1 Mark each for any 4 correct point

f) Ans **State the types of Boring Machines and sketch any 2 boring tools**

Types :-

1) Horizontal boring machine
   a) Table type
   b) Floor type
   c) Planer type
   d) Multiple type
2) Vertical boring machine
   a) Vertical turret lathe
   b) Standard vertical boring machine
3) Precision boring machine
4) Jig boring machine
   a) Vertical milling type
   b) Planer type

(1) Light Boring Tools (2) Forged Boring Tools (4) Double Ended Boring Tool



(3) Boring Bar (6) Counter Boring Tool (5) Multiple Edged Boring Tool

½ Mark each for any 4 correct point & 1 Mark each for any 2 correct sketch

6 **Attempt any FOUR of the following** **16**

a) Ans **Explain burnishing related to the surface finishing. Give its advantages**

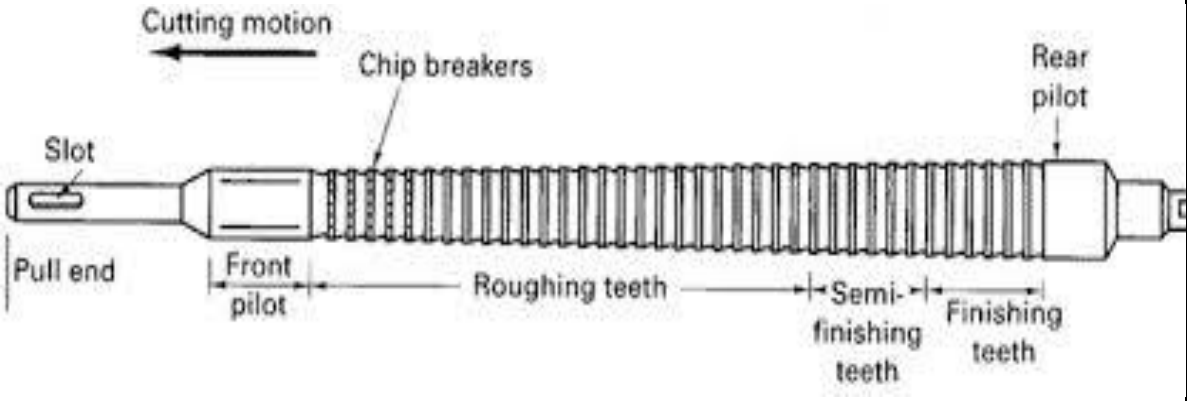
Burnishing

Burnishing operation is the process of getting a smooth and shiny surface by contact and rubbing of the surface against the walls of hard tool. It is finishing and strengthening process. Burnishing is basically a cold surface plastic deformation process

Advantages of Burnishing

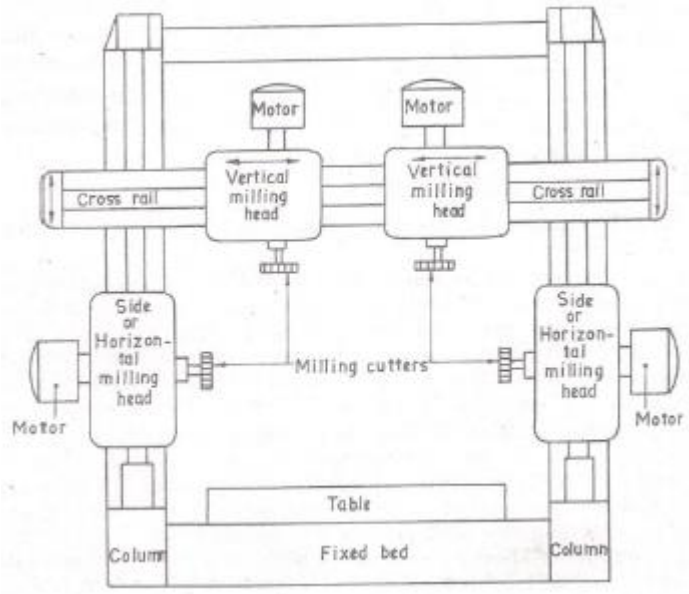
1. There is no cutting action in this process. Only rubbing and peening action takes place

2 Marks for explanation and 1 Mark

		2. It produces mirror like glazed and geometrically smooth surfaces. 3. Average 0.002 to 0.02 mm stock is removed from the surface. 4. Economical process as compare d to the other super finishing processes	**each for any 2 correct Advantages**
	b) **Ans**	**Draw the neat labeled sketch of the broach and state the functions of each element**  **Elements of Broaches:-** **1)** Pull end:- this is designed to permit engagement of the broach with the broaching machine **2)** Front pilot:- this centres the broach in the hole before teeth begins to cut **3)** Roughing and semi finish teeth:- They remove most of the stock in the hole **4)** Finishing teeth:- they are for sizing the hole and must required shape of the finishing hole **5)** Rear Pilot:- They support the broach after last teeth leaves the work piece **6)** Land :- the top portion of the tooth is called as land	**2 Marks For sketch** **&** **1 Mark each for any 2 elements**
	c) **Ans**	**What is maintenance record? Prepare typical maintenance sheet for preventive maintenance** Maintenance records are the various documents of maintenance activities carried out by staff of the maintenance section. These documents are used for improvements as well as to get the history of maintenance of a particular machine or equipment. The maintenance records include following reports 1. Machine history card. 2. Preventive maintenance chart. 3. Break down Report. By using these previous records and its analysis it is easy for fast decision making when faults occur in the machine. Preventive Maintenance Sheet 1. Company Name :-_____ 2. Department /Section :-_____ 3. Name of machine :- Lathe (HMT) Maintenance staff:-	**2 Marks for Explanation** **&** **2 Marks for sheet**

Sr. NO.	Machine Part	Check for	Status Required	Status observed	Action	Remark

	d) **Ans**	**Describe construction and working of planomillar** **Construction**	

		1. Bed: A fixed bed is considered as the base of the machine. 2. Table : A table is mounted on the bed. The table has longitudinal movement only. 3. Column : Two vertical columns, one on each side of the bed are mounted on the bed. 4. Cross rail: A cross rail is fitted on the column. It may be lowered or raised to suit the height of the workpiece. 5. Milling Head: Two vertical milling head are fitted on the cross rail which can move towards each other. Two horizontal milling head are mounted on the column which can move vertical over it. 6. **Milling cutter: Each milling head carries one cutter**  **Working** Two vertical milling head are fitted on the cross rail which can move towards each other. Two horizontal milling head are mounted on the column which can move vertical over it. At the time of operation table moves longitudinally and milling heads moves over the work piece. The material is removed with the help of rotating milling cutters.	**1 Mark for construction** **1 Mark for Diagram** **&** **2 Marks for Working**
	e) Ans	**State the significance of G01, G04,M06,M03 in part programming** **G01 :-** Linear Interpolation **G04:-** Dwell in seconds **M06:-** Tool Change **M03:-** Spindle on clockwise	**1 Mark each for correct point**