WINTER– 16 EXAMINATION

Model Answer

Subject Code: 17527

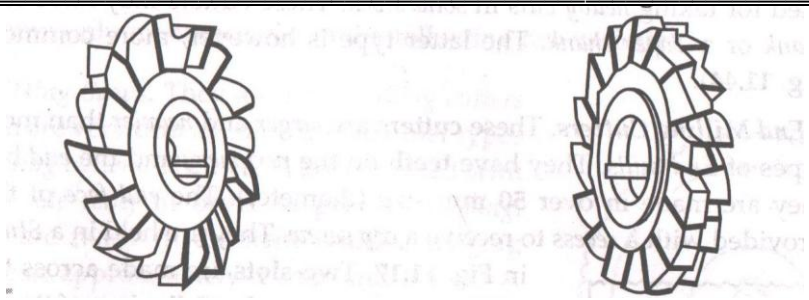
Important Instructions to examiners:

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
1A	a	Needs of non traditional machining processes are :- - Traditional machining processes are not suitable for machining greater hardness ,high strength, heat resistant alloys. The following are the reasons for the need of the non traditional machining process. - 1. To machining High Strength ,heat resistant Alloys. - 2.To produce desired intricate shapes and components like dies, molds, long holes of small sizes and, machining complex surfaces. -3. To obtained High accuracy and high degree of surface finish. 4. To machining new innovative materials like exotic materials due to technology advancement. 5. To manufacture innovative geometric design products and processes.. Any four of the above or others.	01 mark each
	b.	Indexing methods in gear cutting are classified into four types :- - Direct or Rapid indexing - Simple or Plain indexing - Compound indexing - Differential indexing	01 mark each

	c	Gear shaping process Advantages :- 1. Most Accurate gear tooth profiles are generated by this method. 2. Rate of production of gear is higher than form cutter mrthod.. 3.The same cutter of any given pitch can cut gears of any number of teeth of same pitch. Disadvantages :- - Not Suitable for internal gears Owing to the reciprocating action of cutter, there is no cutting on the return stroke in gear shaper. - Worms & Worm wheels cannot be generated on gear shaper. - The rate of production is lower than gear hobbing process due to periodical indexing hence More machining time.	Any 02 advantages 01 mark each Any 02 disadvantages 01 mark each
	d	Differentiation between EDM & W- EDM	Any four or other points 01 mark each
B	a	Sketch milling cutters for following: i) side milling (any one of below or similar)	

EDM	W-EDM
1. Complicated cutout cannot be easily machined. Mirror shaped tool is used to produce desired shape.	Complicated cutout can be easily machined.Small diameter thin wire is used to cut desired profile
2. Electrode wear is more as compare to W-EDM	Electrode wear is negligible
3. Surface roughness is more	Surface roughness of machined part is less
4. Surface micro structure may be distorted	No distortion in surface micro structure
5. Tolerances are relatively open	Geometrical & dimensional tolerances are tight.

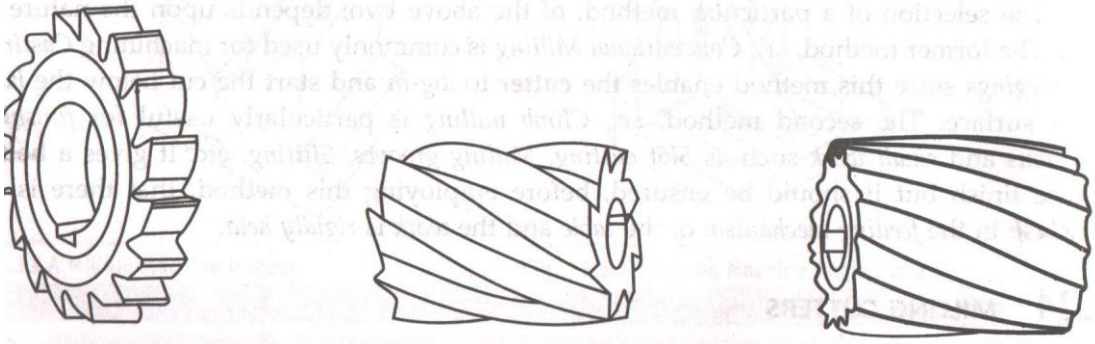


02

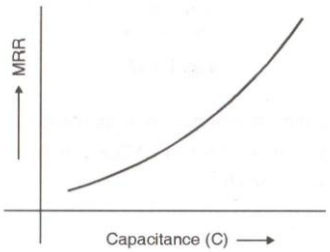
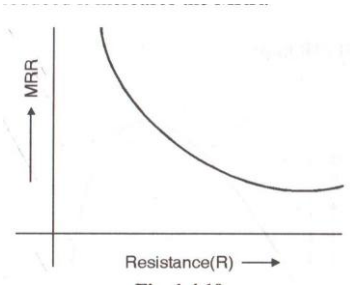
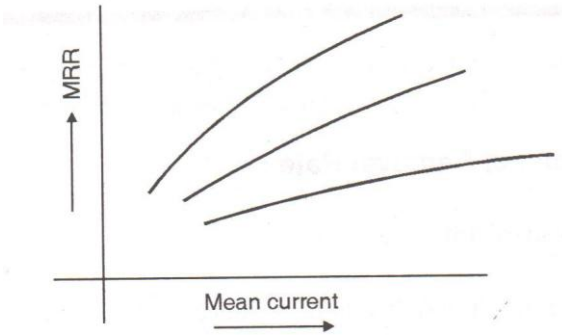
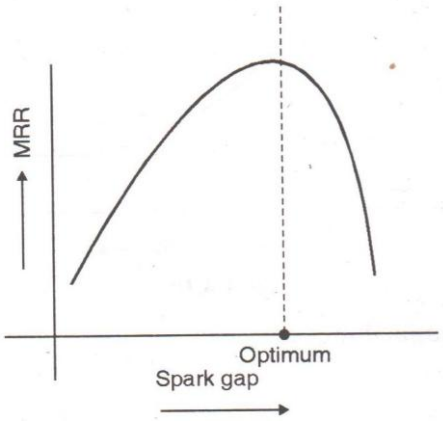
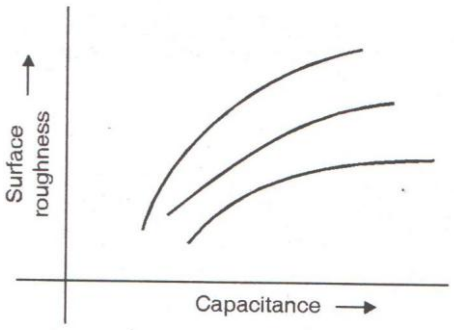
ii) Facing (any one of below or similar)

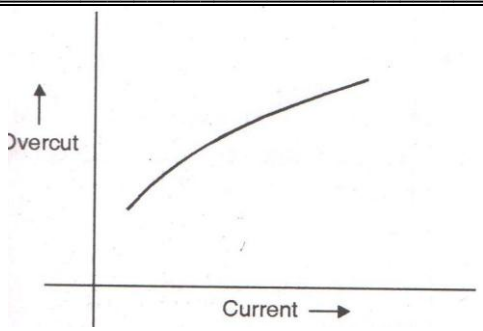
02

iii) Plain (any one of below or similar)



02

	b	Output characteristics of EDM     	01 mark each



2 a list advantages and disadvantages of LBM

Advantages

- Machining of any material including non –metals is possible, irrespective of their hardness and brittleness.
- Wide range of applications Micro drilling,welding,engraving,trimming and cutting are possible.
- There is no direct contact between tool and work piece. Hence There is no tool wear problem.
- The properties of machined materials are not affected by LBM.
- Easy control of beam configuration and size of exposed area.
- Extremely small holes can be machined.
- During LBM process no chip/burr are produced.
- In LBM laser can be sent and focussed at longer distance.

Any 02 advantages

01 mark each

Disadvantages

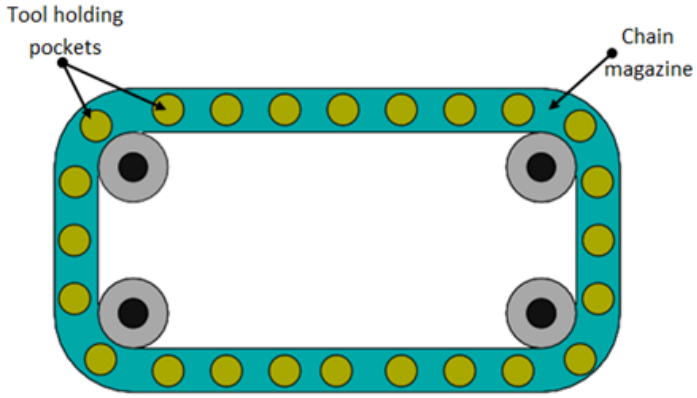
- LBM has very low material removal rate.Its overall efficiency is extremely low (10- 15%)
- Process is limited to thin sheet plates
- Machined holes may became taper. are not round and straight.
- Life of the flash lamp is short.
- Effective safety procedures are required.
- High initial and maintenance Cost .

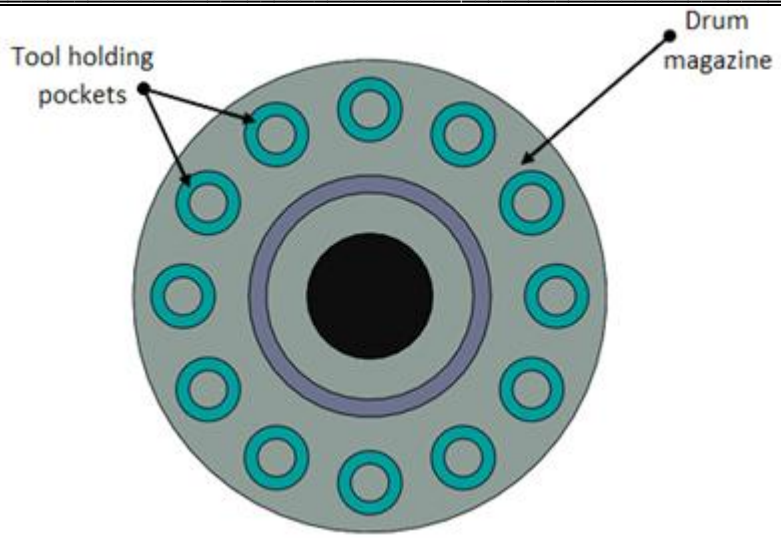
Any 02 disadvantages

01 mark each

b Applications of AJM

- Machining of essentially brittle and heat sensitive materials like glass,quartzs,ceramics.etc.
- It is used for drilling holes, cutting slots, polishing,cleaning hard surfaces, such as removal of

		smudges is also possible. - Used to removal of metallic smears on ceramics ,oxides, resistive coating different materials. Applications of WJM - Used to cut thin non metallic sheets. - Used to rubber, wood, ceramics and many other soft materials. - Machining of circuit boards. - Used in food industry.	Any 02 applications of AJM , 01 mark each Any 02 applications of WJM 01 mark each
c		Sketch of CNC Tool magazines :  Chain type tool magazine	02 marks each



Drum type tool magazine

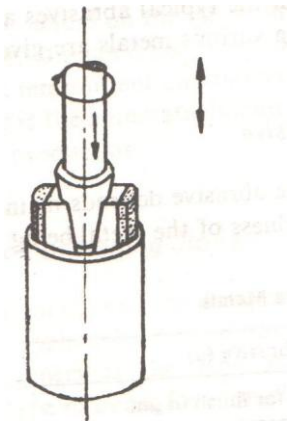
d

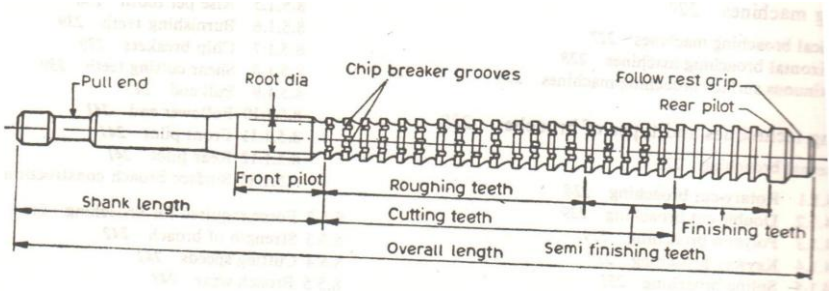
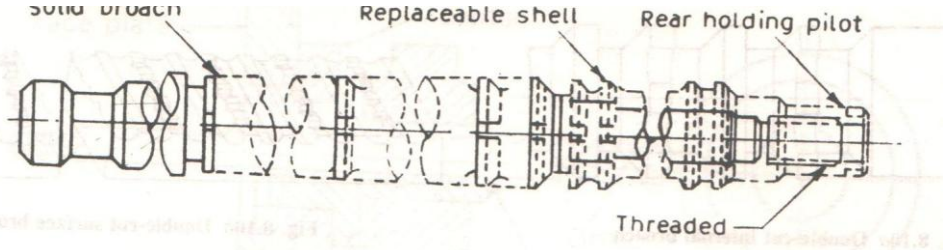
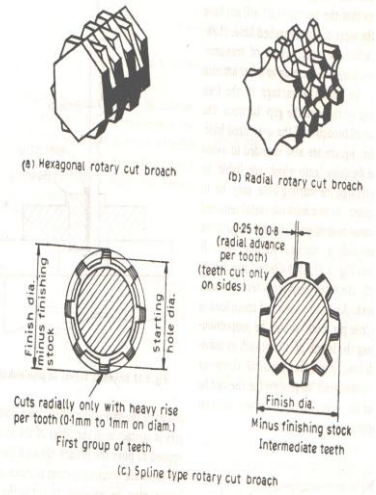
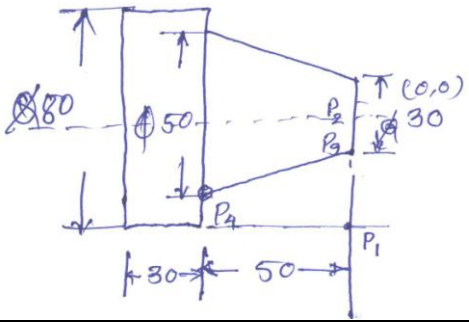
Honing process :-

Honing is a low velocity abrading process which is primarily used for finishing .ususlly applied to internal cylindrical surfaces.It is removed small amount of sockup to 0.25 mm for primary honing and about0. 01 mm for secondary. In honing simultaneous rotating and reciprocating motion is given to the stick, the surface produced will have a characteristics cross hatch lay pattern.The figure shows typical honing tool which consists of acylindrical body having four or six abrasive sticks space around the periphery.It can not only produce high finish but also corrects the out of roundness, taper and axial distortion in the work

02+02

Bores of any size can be honed.To produce any required surface finish.

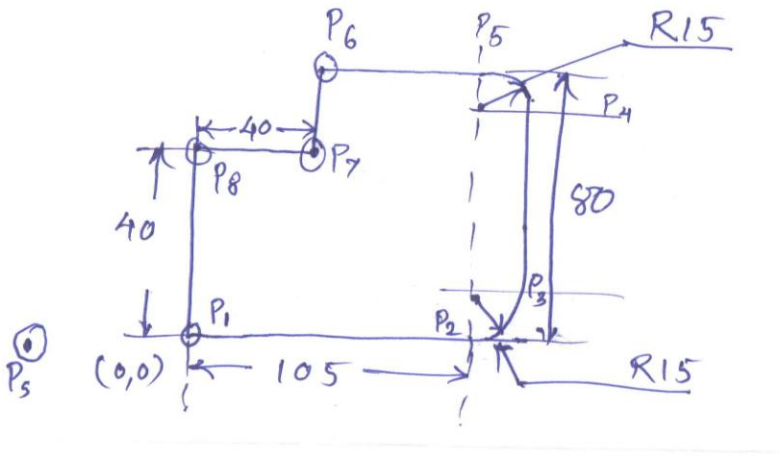


	e	Broaching tools: any two of the sketches or similar sketches Simple Broach  Replaceable Shell type broach   	02 for each
3	a	Q 3 - (a)  	02+06

Pt	X	Z
P1	0	3
P2	0	0
P3	30	0
P4	50	-50
P5	80	-50
P6	80	-80
P7	85	-80

N10 G28 U0 W0
N20 G90 G21 G99
N30 G97 S1000 M03
N40 T0101
N50 G00 X0 Z3 OR G00 X80 Z0 (If separate facing operation is done)
N60 G01 X0 Z0 F0.2
N70 G01 X30 Z0
N80 G01 X50 Z-50
N90 G01 X80 Z-50
N100 G01 X80 Z-80
N110 GO1 X85 Z-80
N120 G28 U0 W0
N130 M09 M05
N140 M30

b



02+06

Pt	X	Y	R
Ps	-10	0	
P1	0	0	
P2	105	0	
P3	120	15	15
P4	120	65	
P5	105	80	15
P6	40	80	
P7	40	40	
P8	0	40	
P1	0	0	

N10 G90 G21
N20 T01 M06
N30 S1000 M03
N40 G00 X-10 Y0
N50 G00 Z5 M08
N60 G01 Z-10
N70 G01 G42 D01 X0 Y0
N80 G01 X105 Y0
N90 G03 X120 Y15 R15 OR G03 X120 Y15 I0 J15 (If I & J method is used for arc)
N100 G01 X120 Y65
N120 G03 X105 Y80 R15 OR G03 X105 Y80 I-15 J0
N130 G01 X40 Y80
N140 G01 X40 Y40
N150 G01 X0 Y40
N160 G01 X0 Y0
N170 G00 G40 Z5
N180 G91 G28 Z0
N190 M05 M09
N200 M30

for co-ordinates of cutting points = 2 marks

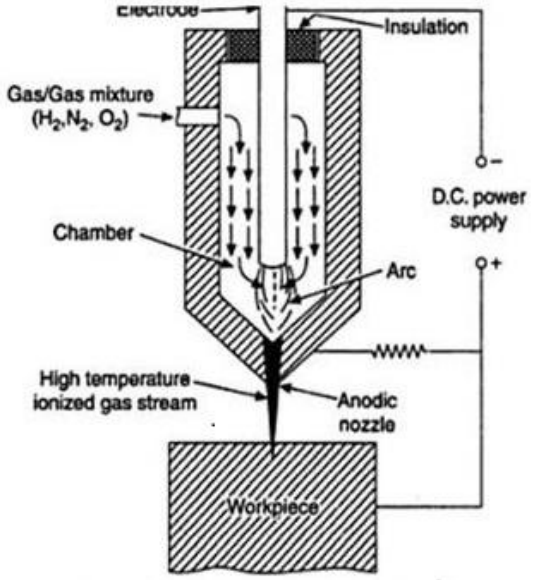
For Program = 6 marks

c

Plasma Arc Machining:-

Plasma-arc machining (PAM) is a metal removal process in which metal is removed by directing high about 11000 to 30000 degree centigrade ionized gas on the work piece. The principle PAM is shown in the figure.In this process ,plasma torch is used in which a volume of a gas such as H_2,N_2,O_2 is passed through a small chamber in which highfrquency spark is maintained between cathode and anode.The plasma jet melts the work piece material. The depth of hat zone depends on the work material,its thickness and cutting speed.

02+02+02 +02



Plasma Arc Machining (PAM).

Advantages of PAM

1.High speed of cutting.With smooth cutting.
2.There is no contact between tool and work piece.
3.Small investment and operating costs

4.Very good for automation with economical cost.
5.Equally effective on any metal with its hardness.
6.Profile cutting of stainless steel and aluminiumcan be easily cut.

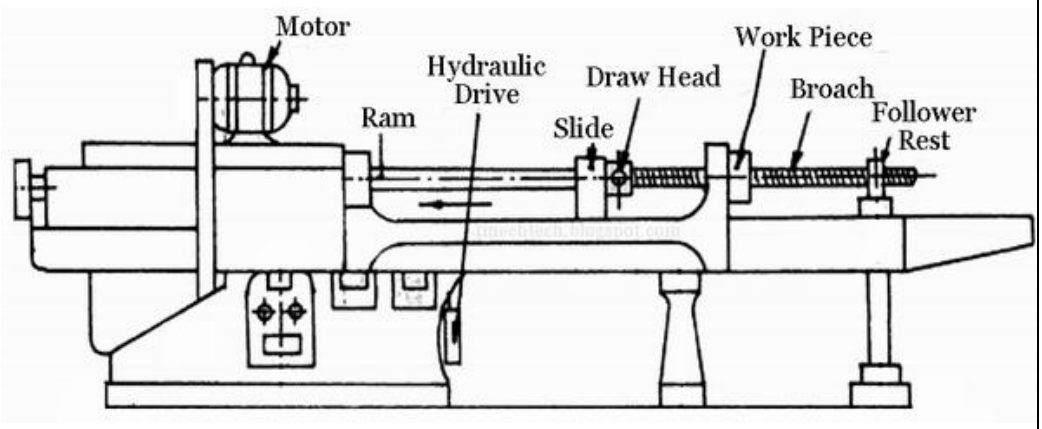
Disadvantages of PAM

1. Due to high heat metallurgical change on the work piece surface.
2. Due to High heat input, water colling is needed.
3. Safety arrangements and equipments are necessary. It increases cost of process.

04

4A a

a) Horizontal Broaching Machine & label the parts.



02+02

b

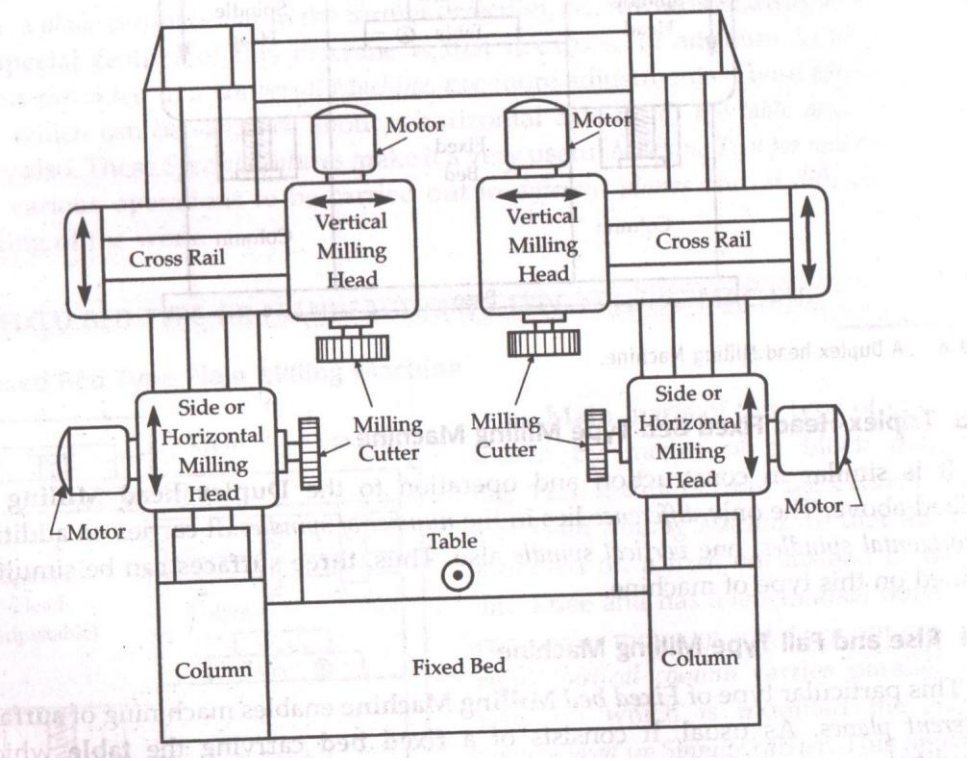
Differentiate between Broaching and Burnishing any four

Sr. No.	Broaching	Burnishing
01	Broaching is material removing finishing process by using multi point broach tool.	It is a Process of super finishing, in which mirror like/glazed smooth surface is produced, by using ball or roller type of tool.
02	It is machining process	It is rubbing process no metal removal
03	Tools have small and multiple teeths.	Smooth rollers/balls act as tool
04	Pulling or pushing force is required to remove the	Pressure is required to press the balls or rollers.

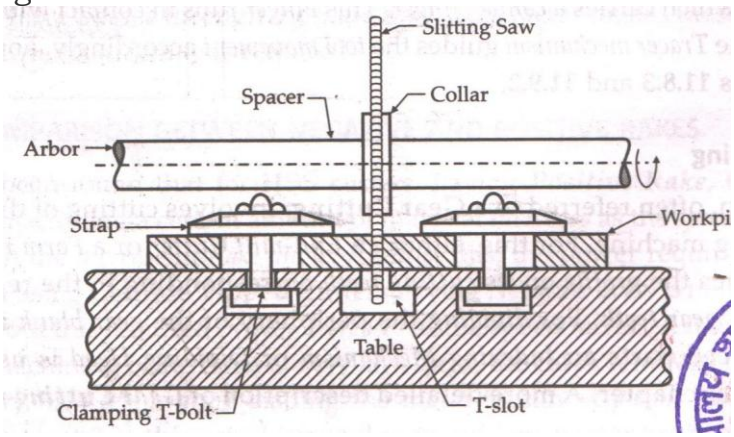
01 for each

	material.	
05	Broaching components are- Bearing caps, cylinder blocks, connecting rods etc.	Burnishing components are- Cam & followers, matting parts of engine, aesthetical components etc.

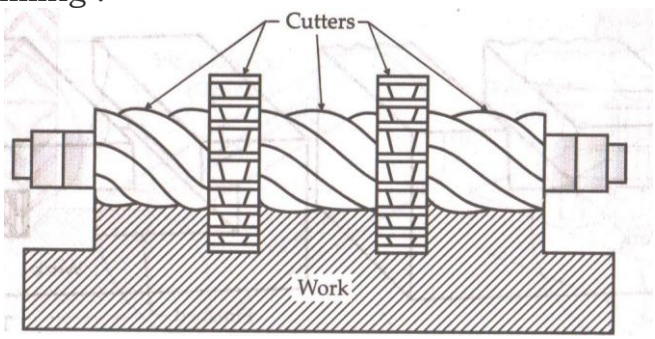
c Planomiller : 04



d Sketch of slitting 02+02



Sketch of gang milling :



4B a Differentiate between Turret & Automats Lathes any four

Sr. No.	Turret	Automats
01	Turrets are of Semi Automatic Type	Jobs are done Automatically
02	Skilled operator is needed. One operator can handle single machine.	Semi-skilled operator can work. One operator can handle number of machines.
03	Tools are need to be fixed manually	Automatic selection the tool with automatic feeding of work piece facility.
04	Used for medium production	Used for mass production
05	Cost is less	Cost is high
06	These machines are generally single spindle	These machines can be single or multispindles.

01 for each

B

Differentiate between End Milling & Gang Milling any four — 01 for each

Sr. No.	End Milling	Facing operation
01	In this process End Milling cutters are used to produce sloting,recessing and small facing operations.	In this milling operation number of flat surfaces are machined which are right angles to the axis of rotating cutter.
02	Cutter used here is End mill cutters. Like shell end mill cutter and solid end mill cutter.Single cutter is used at a time.	Cutter used here is side and face mil cutter. Number of cutters of diffent diameter can be used at a time.
03	This process is used when machining area is large	Used for small machining area
04	Single face is machined at a time.	Number of parallel or perpendicular face can be machined simultaniosly.
05	Used for simple geometry jobs	Used for complicated geometry jobs

02+02

5 a **Construction of Boring Machine:**

Horizontal boring machines are constructed in such a way that the workpiece remains stationary and the tool revolves.

The basic components of these machines are shown in Fig. The essential features of the

machine are:

(i) A horizontal spindle that rotates the cutting tool.
(ii) A table that can be moved and fed in two directions in a horizontal plane.
(iii) A head stock that can be moved vertically.
(iv) An outboard bearing support for a long boring bar.

They perform different operations at various locations on the workpiece without the need for changing the basic setup and they maintain accurate relationship between the machined surfaces. The tool is mounted either in a stub type bar held in the spindle or in a long line type bar whose outer end is supported in the bearings on the outboard support.

Horizontal boring machines are available in a wide range of capacities. The size of the machine is generally specified by the diameter of its spindle, which varies from 75 to 250 mm. Horizontal boring machines are used primarily for boring holes less than 30 cm in diameter or for long holes or for a series of in-line holes. These machines are extensively used for large, complex castings, forgings, weldments and similar workpieces.

02+02

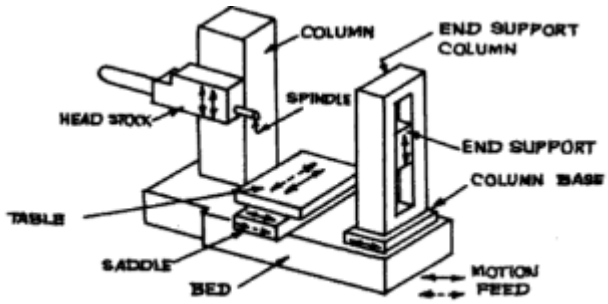


Fig. Horizontal boring machine

5 b

UNIVERSAL DIVIDING HEAD

This is a very important attachment used in a milling machine for gear cutting mechanism. Dividing head, also known as indexing, is a mechanism employed for accurately spacing the teeth on the perimeter of the gear wheel blank to be machined.

The indexing may be classified as :

(*i*) Rapid
(*ii*) Plain
(*iii*) Differential
(*iv*) Compound and
(*v*) Angular

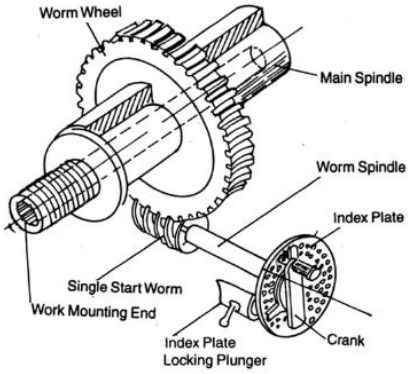
The universal dividing head is used for holding and indexing work through any desired arc of rotation. The work may be mounted between centers or held in a chuck that is mounted in the spindle hole of the dividing head. The spindle can be tilted from about 5 degrees below horizontal to beyond the vertical position.

A special device known as raising block is used for locating the dividing head at 90° from its regular position on the milling machine's work table.

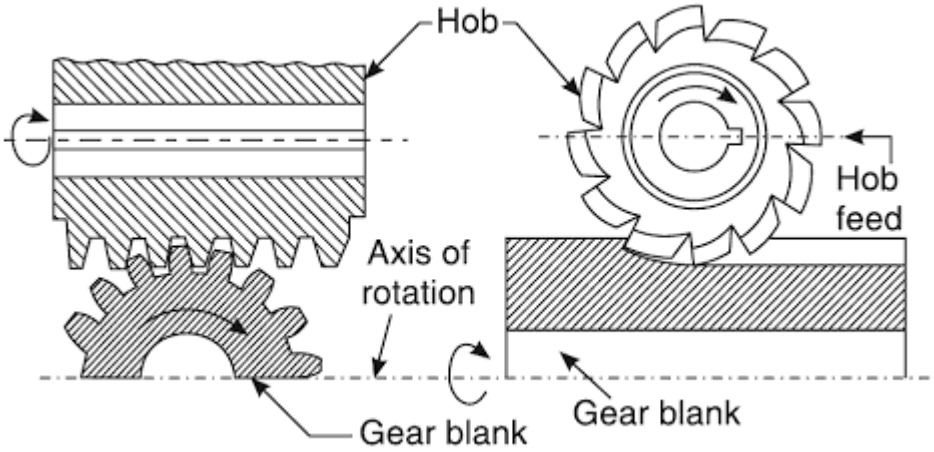
The dividing head is a rugged, accurate 40 : 1 worm gear reduction unit. The spindle of dividing head is rotated by one revolution by turning the input crank by 40 turns. An index plate, mounted breath the crank, contains a number of holes, arranged in concentric circles and equally spaced, with each circle having a different number of holes. A plunger pin on the crank handle can be adjusted to engage the holes of any circle. This permits the crank to be turned an accurate, fractional part of a complete circle. The number of turns of the index crank can be found for a given division on the work as under : 02+02

$$T = \frac{40}{N} \text{ [This is true if the reduction ratio is 40 : 1]}$$

where, T is the number of turns of the index crank and N is the number of division required on the work.



c **Sketch of gear hobbing process:** 04



d **List of gear finishing processes: Any four** 04

1. Gear shaving
2. Gear grinding
3. Gear lapping

		4. Gear honing 5. Gear burnishing.	
	e	**Advantages of CNC machine: (Any four)** 1. Reduced lead time 2. Elimination of operator error 3. Lower labour cost 4. High accuracy 5. Elimination of jigs and fixture 6. Flexibility 7. Reduced inspection 8. Less scrap	02
		Applications of CNC machine: Any four 1) Electronics Parts Manufacturing. 2) Engraving Machine Applications. 3) Machining Composites. 4) 5 Axis Machining. 5) Dental Milling Applications. 6) Micro Hole Drilling. 7) Machining Aluminum. 8) Machining Plastics	02
	f	**Grinding wheel designation:** Grinding wheel is designated by six symbols representing following properties of grinding wheel. 1) Manufacturers symbol 2) Type of abrasive. 3) Grain size. 4) Grade. 5) Structure . 6) Type of bond.	

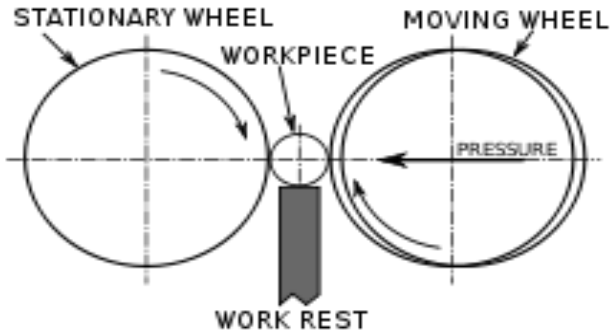
7) Manufacture symbol (optional) for reference

Eg.**5I A 36 L 5 V 40** 02+02

- 5I-manufacturers symbol indicating type of abrasive.
- A-abrasive (aluminium oxide)
- 36-grain size (medium)
- L-grade (medium)
- 5-structure (dense)
- V-bond (vitrified)
- 40-manufacture symbol (optional)

6 a **Centre-less grinding**

This grinding machine is a production machine in which outside diameter of the workpiece is ground. The workpiece is not held between centres but by a work support blade. It is rotated by means of a regulating wheel and ground by the grinding wheel. In through-feed centre-less grinding, the regulating wheel revolving at a much lower surface speed than grinding wheel controls the rotation and longitudinal motion of the workpiece. The regulating wheel is kept slightly inclined to the axis of the grinding wheel and the workpiece is fed longitudinally as shown in Fig.



Methods of Feed in the centre-less grinding are:

1) Through Feed

2) In Feed

3) End Feed

1**) Through Feed**- It is the simplest method and is applied only to the plain parallel parts such as roller pins and straight long bars. 02+02

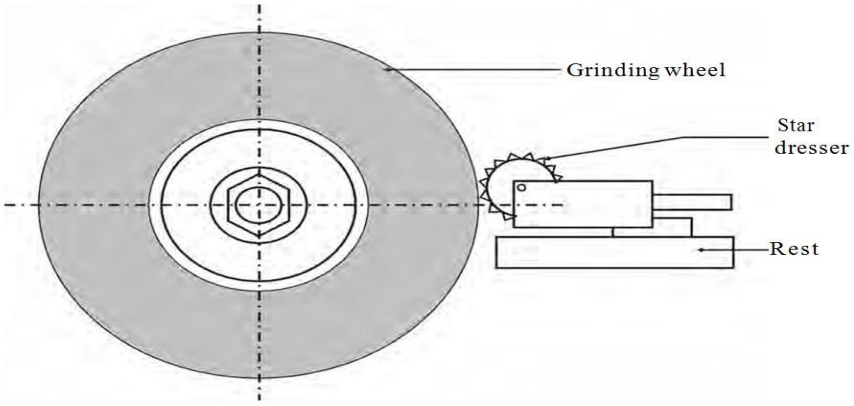
2) **In Feed** -In the method there is no axial movement of the work-piece, the only movement

is the rotating movement.

3) **End Feed** -The work-piece is fed as in case of in feed method and after certain portion of length of work-piece has been ground ,the axial movement takes place until whole length has been ground.

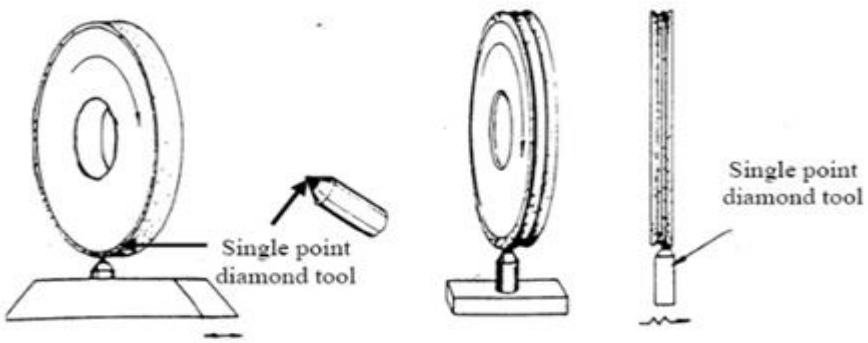
Grinding wheel dressing & truing:

b Dressing is an operation performed on the grinding wheel with an aim to restore the cutting ability. The basic principle for dressing is the generation and exposure of the new cutting egdes on the surface of the wheel. The principle of dressing is demonstrated in Fig. 1. It is achieved by fracturing the existing abrasive grains and allowing desired protrusion of abrasive particles on the surface. The operation also unloads the grinding wheel i.e. removes work piece material that is embedded on wheel surface after the grinding operation. On performing this operation, the wheel can machine again with higher feed and in-feed (depth of cut) rate, which permits to conclude the machining in less time but with higher accuracy. Dressing is required at regular intervals to maintain the desired grain edge sharpness and the grain protrusion. 01+01



Dressing of a Grinding Wheel (Star wheel method)

Truing is another operation performed with the purpose to restore the shape of the grinding wheel that is out of shape due to wear and deformation. The purpose of truing operation can be understood by referring to Fig. 2. Truing makes the periphery of the wheel concentric to the central bore and also imparts a perfect form to the surface of the wheel. It is carried out with the same tool but with lighter depth of cut. 01+01



Truing of Grinding Wheel

c **Types of maintenance of machine tools:** 04

Basically two types of maintenances

1) Unplanned maintenance

i) Breakdown maintenance

ii) Corrective maintenance

iii) Opportunistic maintenance

2) Planned maintenance

i) Preventive maintenance

ii) Predictive maintenance

iii) Corrective maintenance

iv) Routine maintenance

v) Design out maintenance

vi) Total productive maintenance.

d **"Maintenance Manual":** 04

When purchase a new vehicle then maintenance booklet or service booklet is provided by manufacturer, called as maintenance manual. This booklet in printed format given the user of the equipment about the preventive maintenance to be done with respect to time scale of that machine tool. It is prepared on the vast experience of manufacturer and feedback collected from the customers who had used that type of machine tool already. It is a systematically maintenance of m/c tool in a right manner. Standardized maintenance procedure is adopted.

Contents of maintenance manuals

Maintenance manuals contents following things

1) Safety precautions.

2) Service center details.

		3) Procedure for maintenance of different parts one by one. 4) Maintenance schedule for different parts. 5) Instructions for safe handling. 6) Important terms and abbreviations. (if formats of the manuals given with explanation should be given full marks.)	
	e	**Maintenance practice for coupling (2 marks for maintenance practice & 2 for procedure)** They are used to connect the shaft ends together for transmitting torque or rotary motion directly from one shaft to the other. The bearings are classified 1) Rigid coupling. 2) Flexible coupling. e.g. flanged coupling, muff coupling, bushed-pin coupling, and Oldham coupling. **Maintenance procedure of coupling** • Due to misalignment, loose bolts etc abnormal noise comes out. • Observe the vibrations due to run out. • Visual inspection for misalignment, wear out parts. • Checking the lubrication regularly and change oil after certain interval. • Prepare maintenance report for showing history of maintenance of each coupling	04
	f	**Need of maintenance record:** Records are indispensable for smooth, systematic and successful working of an industry or manufacturing plant. The need of maintenance records is as below- 1. Any industry has to maintain certain maintenance records of the machine tools to meet legal requirements. Sometimes court maters require accurate information about the plant, machine tools, workers, supervisors if any accident happens. 2. It is also important from administrative point of view. Planning & scheduling of various production & inspection related activities are to be based on records. It is also clear from the records available that how much time a machine tool requires to get repaired after breakdown. 3. It is also needed to meet certain financial needs such as preparation of budget for maintenance & repair work for various machine tools for upcoming year and records	02+02

provides the expenditure.

4. It provides a clear picture and up to date information regarding machine tools & their conditions which will be helpful for purchase department for procurement of some new equipments & tools well in advance to avoid delay if any.

For example maintenance chart for milling machine is given below:

Kind of maintenance work	Interval
1. Cleaning of guideways	daily
2. Inspection of oil level (sight glasses)	daily
3. Lubrication as per lubrication chart	as per instructions on lubrica chart
4. Oil renewal	semi-annually/annually
5. Inspection and, if necessary, refilling of coolant tank	weekly
6. Thorough cleaning of the machine	weekly
7. Inspection of slackness of bearings	annually
8. Inspection of electrics (contactors, limit switches, cable connections)	every 3 months
9. Inspection of lubrication pump	semi-annually
10. Coolant renewal	semi-annually

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