VERSION-B

SCORING INDICATORS

Course Name: MACHINE TOOLS
Course Code: 3023

QID: 2110220184

Q.No	Scoring Indicators	Split score	Sub Total	Total Score
	Part A			9
I.1	Discontinuous chips	1	1	
I.2	Machinability	1	1	
I.3	Knurling	1	1	
I.4	Size	1	1	
I.5	Tapping	1	1	
I.6	Arbor	1	1	
I.7	Honing	1	1	
I.8	Part program	1	1	
I.9	High	1	1	
	Part B			24
II.1	**Cutting speed:** The speed at which the cutting edge passes over the workpiece material. Expressed in m/min **Feed:** The distance the tool advances into or along the workpiece each time the tool point passes a certain position in its travel over the surface. For single-point tools, feed is expressed in mm/rev, mm/stroke, etc. For multi-point tools like milling cutters and broaches, feed is expressed as mm/tooth. **Depth of cut:** Penetration of the tool below the original work surface and is expressed in mm. ***Each point carries 1 mark***	1X3	3	
II.2	1. Hot hardness: The material must be harder than the work material at elevated operating temperatures 2. Wear resistance: The material must withstand excessive wear even though the relative hardness of the tool-work material changes. 3. Toughness: The material must have sufficient toughness to withstand shocks and vibrations and to prevent breakage. 4. Cost and easiness in fabrication: The cost and easiness of fabrication should have within reasonable limits. ***Each point carries 3/4 marks***	3/4 X 4	3	
II.3	1. The size of the largest rectangular solid that can reciprocate under the tool 2. Type of drive 3. Power input 4. Floor space required 5. weight of the machine 6. Number and amount of feed and speed available ***Each point carries 1/2 mark***	1/2 X6	3	

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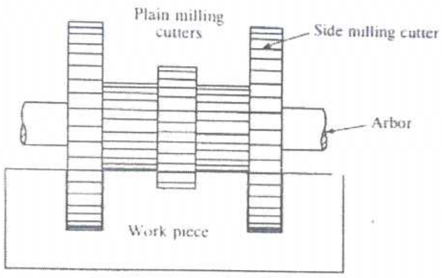
II.4	Shaper 1.These are light in construction 2.Requires less floor space 3.Tool reciprocates and workpiece stationary 4.only one tool use 5.Adopted for small work 6.used for batch or job production 7.cost of machine is less Planer 1. Large and heavy 2.More floor area 3.Tool stationary and workpiece on the table reciprocates 4.Massive 5.More than one tool can be used 6.adopted for large work 7.used for mass production 8.cost of the machine is high ***Any 3 points from both,each carries one mark***	1X3	3	
II.5	1. To form the cutting edges on the point 2. To allow the chips to escape 3. To cause the chips to curl 4. To permit the cutting fluids to reach cutting edges.	3/4 X4	3	
II.6	 Gang milling Gang milling is the operation of machining several surfaces of a workpiece simultaneously by feeding the table against a number of cutters having same or different diameters mounted on the arbor of the machine.The method saves much of machining time and is widely used in repetitive work. The cutting speed of a gang of cutters is calculated from the cutter of largest diameter. ***Figure: 1.5 marks*** ***Explanation:1.5 marks***	3	3	
II.7	1. Direct indexing 2. Simple indexing 3. Compound indexing 4. Differential indexing 5. Angular indexing ***Answer any three, each carries 1 mark***	1X3	3	

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II.8	1. High accuracy and repeatability 2. Reduced inspection 3. Ease of assembly and interchangeability 4. Less scrap and rework 5. Reduction in floorspace/number of men/handling, results in better management control over the production. 6. Development of new work is done faster 7. Saving in jigs and fixtures as well as in lead time 8. Less material handling 9. Cost accounting and production control become very precise 10. Optimum utilisation of the power of the machine. 11. Increased effective machine utilisation 12. Reduced usage of tools 13. Machine can switch over to different jobs 14. Less paperwork 15. In-process inventory gets reduced 16. Change in design can easily be incorporated. 17. Ability for higher levels of integration ***Answer any 6 points, each carries 1/2 mark***	1/2 X6	3	
II.9	1. Type of operation 2. The rate of metal removal 3. Material of the workpiece 4. Material of the tool 5. Surface finish requirement 6. Cost of cutting fluid ***Answer any three points, each carries 1 mark***	1X3	3	
II.10	1. High heat absorption 2. Good lubricating qualities 3. High flash point 4. Stability 5. Neutral 6. Odorless 7. Harmless to the skin of operators 8. Harmless to the bearings 9. Non corrosive 10 Transparency 11.Low viscosity **Any 3 points - 1 mark each**	1X3	3	

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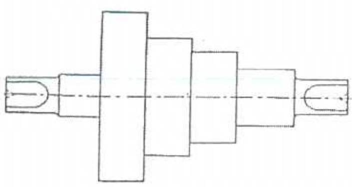
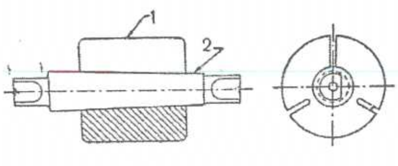
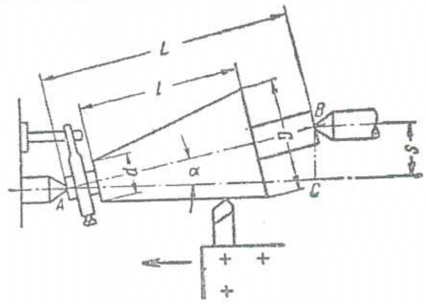
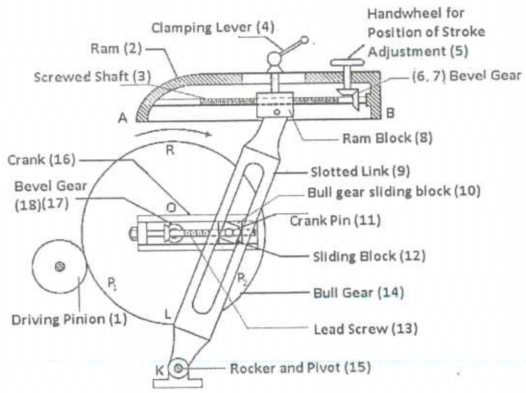
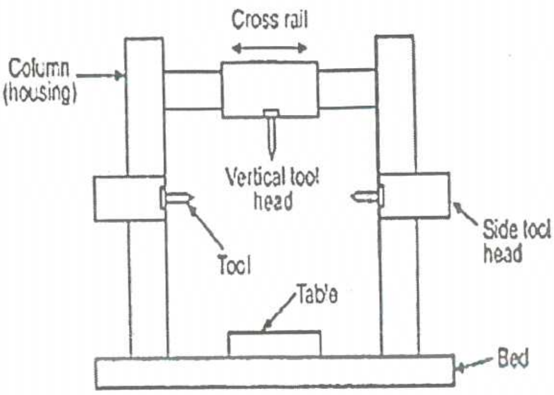
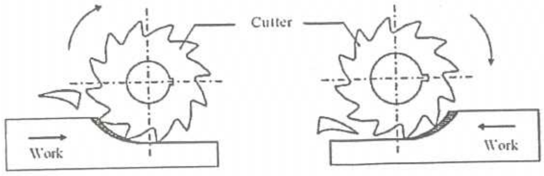
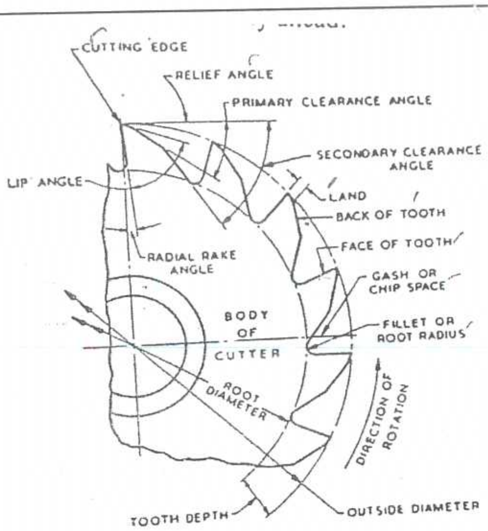
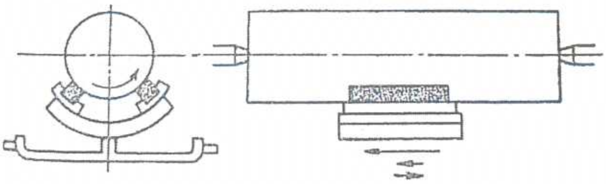
	Part C			42
III.1	The tool signature is a sequence of numbers listing the various angles in degrees and the size of the nose radius. This numerical method of identification has been standardized by the American Standard Association The seven elements that comprise the signature of a single-point cutting tool are always stated in the following order: Back rake angle, Side rake angle, End relief angle, Side relief angle, End cutting edge angle, Side cutting edge angle and Nose radius. Thus a tool with a shape specified as 8-14-6-6-6-15-4 has 8^0 back rake, 14^0 side rake, 6^0 end relief, 6^0 side relief, 6^0 end cutting edge, 15^0 side cutting edge and 4 mm nose radius. **Definition: 3marks** **Illustration: 4 marks**	3+4	7	
III.2	$VT^n = C$ Given $n = 0.2$, $C = 90$, $T = 1$ hr $= 60$ minutes. } 2 marks. $VT^n = C$ —— 1 mark $V \cdot (60)^{0.2} = 90$ $\therefore V = \frac{90}{(60)^{0.2}} = 39.70$ metre per minute } 4 mark	2+1+4	7	
III.3	 Figure 3.34 Step mandrel  Figure 3.39 Expansion mandrel 1. Sleeve, 2. Tapered pin. A step mandrel having steps of different diameters may be employed to drive different workpieces having different sizes of holes without replacing the mandrel each time. This type of mandrel is suitable for turning collars, washers and odd sized jobs used in repairing workshops. **(Figure:1.5 marks, Explanation : 2 marks)** Expansion mandrel consists of a tapered pin which is driven into a sleeve that is parallel outside and tapered inside.The sleeve has three longitudinal slots, two of which are cut nearly through, and the third splits it completely.This construction enables an expansion mandrel to grip various workpieces with different hole diameters within a limit that cannot otherwise be held in an ordinary mandrel. To use this mandrel the sleeve is first placed within the work with the pin removed.The tapered pin is then pressed from the end into the sleeve and the sleeve expands gripping the work securely and accurately.**(Figure:1.5 marks, Explanation : 2 marks)**	3.5 + 3.5	7	

III.4	 **Figure 3.47 Taper angle by setover method** D. Large diameter of taper, d. Small diameter of taper. L. Length of the work, l. Length of the taper, α. Half taper angle, S. Setover. The principle of turning taper by this method is to shift the axis of rotation of the workpiece at an angle to the lathe axis and feeding the tool parallel to the lathe axis. The angle at which the axis of rotation of the workpiece is shifted is equal to half angle of taper.This is done when the body of tailstock is made to slide on its base towards or away from the operator by a set over screw. The amount of set over is limited.This method is suitable for turning small taper on long jobs. **Figure: 3 marks** **Explanation: 4 marks**	3+4	7	
III.5	 ***Figure: 3 marks*** Crank and slotted link mechanism converts the rotary motion of electric motor and gear box into reciprocatory motion of ram. The return stroke allow the ram to move at a faster rate to reduce the idle time which is known as quick return mechanism reducing the time waste during return stroke. Bull gear is driven by a pinion which connects to the motor shaft through gear box.The bull wheel has a slot. The crank pin secured into this slot at the same time can slide in the slotted crank. As the Bull gear rotates cause the crankpin also to turn and slide side by side through the slot in the slotted crank. This makes the slotted crank to oscillate about its one end.This oscillating motion of the slotted crank makes the ram to reciprocate. ***Explanation: 4 marks***	3+4	7	

III.6	 **1. Bed:** The bed of a planer is a box-like casting having cross ribs. It is a very large in size and heavy in weight and it supports columns and all other moving parts of the machine. **2.Table:** The table supports the work and reciprocates along the ways of the bed. The planer table is a heavy rectangular casting and is made of good quality cast iron.The top face of the planar table is accurately finished in order to locate the work correctly. **3. Columns:** These are rigid box like vertical structures placed on each side of the bed and are fastened to the sides of the bed. The front face of each housing is accurately machined to provide precision ways on which the cross rail may be made to slide up and down for accommodating different heights of work. **4. Cross rail :** Cross rail is a rigid box like casting connecting the two housings. This construction ensures the rigidity of the machine.The cross rail may be raised or lowered on the face of the column and can be clamped at desired position by manual, hydraulic or electric clamping devices **5.Tool head :** The tool head of a planer is similar to that of shaper both in construction and operation. The important parts of a tool head are saddle, swivel base, vertical slide, Apron, clapper box, clapper block, tool post etc. **Figure: 3 marks** **Explanation: 4 marks**	3+4	7	

III.7	 Upmilling Downmilling Upmilling and Down Milling **Upmilling :** It is the process of removing metal by a cutter which is rotated against the direction of the travel of workpiece.The thickness of the chip in up milling is minimum at the begnning of the cut and it reaches to maximum when the cut terminates.The cutting force is directed upwards and this tend to lift the work from the fixtures.As the cutter progresses, the chip accumulate at the cutting zone, and may be carried over with the cutter spoiling the work surface. **Downmilling :** It is the process of removing metal by a cutter which is rotated in same direction of travel of workpiece.The thickness of chip is maximum when the tooth begins its cut and it reduces to minimum when the cut terminates.In downmilling the fixture design becomes easier as the direction of cutting force is such that it tends to seat the work firmly in the work holding devices.The chips are also disposed off easily and do not interfere with the cutting. ***Figure: 4 marks*** ***Explanation: 3 marks***	4+3	7	
III.8	 **Figure 11.38 Elements of plain milling cutter** ***Figure: 3 marks*** ***Marking: 4 marks***	3+4	7	

III.9	**Advantages** 1. As a true floating condition exists during the grinding process, less metal needs to be removed. 2. The workpiece being supported throughout its entire length as grinding takes place, there is no tendency for chatter or deflection of the work and small, fragile or slender workpieces can be ground easily. 3. The process is adapted for production work 4. No centre holes, no chucking or mounting of the work on mandrels or other holding devices are required. 5. The size of work is easily controlled. 6. A low order of skill is needed in the operation of the machine. ***Any 5 points, one mark each*** **Disadvantages** 1. In hollow work there is no certainty that the outside diameter will be concentric with the inside diameter. 2. Work having multiple diameters is not easily handled. ***Two points, each carries 1 mark***	5+2	7	
III.10	 **Figure 16.2 Schematic diagram of shaft superfinishing** Superfinishing is an operation using bonded abrasive stones in a particular way to produce an extremely high quality of surface finish in conjunction with an almost complete absence of defects in the surface layer.A very thin layer of metal (0.005 to 0.02 mm) is removed in superfinishing. This operation may be applied for external and internal surfaces of parts made of steel, cast iron and non ferrous alloys which have been previously ground or precision turned. It is most frequently used to obtain very fine surface finish. In superfinishing a very fine grit abrasive stick is retained in a suitable holder and applied to the surface of the workpiece with a light spring pressure. The stick is given a feeding and oscillation motion, and the work piece is rotated or reciprocated according to the requirements of the shape being superfinished. A special lubricant usually a mixture of kerosene and oil is used to obtain a high quality of surface finish. ***Figure: 3 marks*** ***Explanation: 4 marks***	3+4	7	

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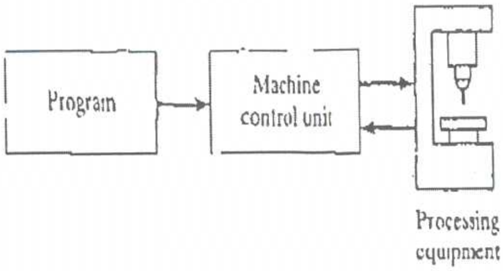
III.11	 Basic components of an NC system. **1. Part program:** Part program is the most important element of the NC system. It consists of step by step instructions to the Machine Control Unit to carry out the operations as per the plan.The program is written using standard codes and symbols.The various media used to prepare the part program are – Punched Card, Paper Tape,Magnetic Tape etc. **2. Machine control unit:** MCU consists of the electronics and hardware system which is either fitted to machine tool or may be housed in a separate cabinet.The coded part program is used by MCU to control the position of the cutting tool and the work piece.MCU is the brain of the NC machine. It reads,interprets and converts the input NC code into signals, which control the various movements in the machine tool.Controls various non machining activities like tool change, coolant on/off, loading unloading of parts etc. **3. Processing Equipment:** Processing equipment may be a machine tool consists of worktable, spindle and motors, controls necessary to drive them and cutting tools, fixtures and other accessories needed for machining ***Figure: 2 marks*** ***Explanation: 5marks***	2+5	7	
III.12	1. To cool the tool 2. To cool the workpiece 3. To lubricate and reduce friction 4. To improve surface finish 5. To protect the finished surface from corrosion 6. To cause chips break up into small parts 7. To wash the chip away from tool. ***Seven points, each carries 1 mark***	1X7	7	