

[3 Hours]

[Maximum Marks: 80]

- Question No.1 is compulsory and Answer 3 Questions remaining 5 Questions.
- Assume suitable data wherever necessary
- Diagram and sketches explanations are right to reserve full marks



- Q1 (i) Attempt any four of the following 10**
- (ii) a) Difference Between orthogonal and oblique metal cutting 10
- b) Draw Merchant's Circle diagram with usual notations and show all forces
- c) Explain Cutting fluids functions and classification
- d) Draw single point cutting tool three views and ASA Tool signature
- e) Milling cutter types with diagram and selection criteria for milling cutters in metal cutting process
- Q2 (i) Derive an equation of merchant's modified theory with usual notations, merchant circle diagram and assumptions 10**
- (ii) Explain the various steps involved in the design of circular broach and draw the neat diagram 10
- Q3 (i) Design a circular form tool graphically and to cut a semicircular groove in the cylindrical work piece whose details are given below Minimum radius = 50mm; and Maximum radius = 75mm Assume Design a circular form tool graphically and to cut a semicircular rake and relief 12° and 7° respectively. The form tool is HSS 10**
- (ii) A pipe 30mm in diameter is being turned on a lathe with a tool having rake angle of 10° and a feed of 0.2mm/rev. The length of chip over one revolution of workpiece is 72mm. The cutting speed is 60m/min. the tangential force is 1KN and the feed force is 0.65KN. chip thickness 0.6mm Calculate (a) Resultant force; (b) Shear angle; (c) Shear force; (d) Normal compressive force (e) Frictional force; (f) Normal force; (g) Cutting Power 10

- Q4** (i) Calculate the length of broach for roughing and finishing operation for machining a slot of 10 mm in depth and 20 mm in width for 400 mm long steel piece having specific cutting energy of 2000 N/mm². Cutting speed is 5m/min and chip space number 8. Taking roughing feed as 0.08 mm/tooth and finishing feed as 0.02mm/tooth. **10**
- (ii) Derive an expression for optimum cutting speed at minimum cost criteria by using usual notations **10**
- Q5** (i) Derive an expression for shear angle in orthogonal cutting in terms of rake angle and chip thickness ratio **8**
- (ii) A 200 mm long and 30 mm in diameter metal bar is being turned on lathe with a feed of 0.25 mm / rev. The operating cost is Rs.5 / min while tool cost is Rs.10 per cutting edge. Tool changing time is 1 min for each cutting edge. Compare the machining cost per component while operating under most economical conditions for following materials: **12**

Material	Tool life equation
X	$VT^{0.1} = 67$
Y	$VT^{0.1} = 90$

Q6 Attempt any four of the following:

4 x 5 = 20

- (i) Explain tool life parameters with tool life equation
- (ii) Explain machinability with example and Macinability Index
- (iii) Classify cutting tool Materials and explain any one of the material
- (iv) Design Procedure of single point cutting tool
- (v) Different types of chips in metal cutting process
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