

Duration: 3 Hours

[Max Marks: 80]

- N.B.** (1) All questions carry equal marks.
(2) Question No. 1 is Compulsory.
(3) Attempt any three questions from remaining five questions.
(4) Figures to the right indicate full marks.
(5) Draw neat sketches wherever necessary.

- Q. 1 Attempt any **four** of the following: (20)
- A. Explain Tool wear mechanism.
 - B. Explain orthogonal rake system (ORS) in detail.
 - C. Explain various heat generation zones in metal cutting.
 - D. Draw neat sketch of twist drill and name all elements also explain importance of drill land and body clearance.
 - E. Explain Types of chips.
 - F. Explain BUE effect on surface finish..
- Q. 2 A. For a turning operation, derive relationship for optimum cutting speed and optimum tool life for minimum cost of production. (10)
- B During machining of C- 25 steel with **0 - 10 - 6 - 6 - 75 - 90 - 1mm** (ORS) shaped tripple carbide cutting tool. The following observation have been made. (10)
- Spindle Speed 400 rpm, Work diameter 60 mm, Depth of cut 2.5 mm, Tool feed rate 80 mm /min., Cut chip thickness 0.4 mm.
- Determine: Chip thickness ratio, Shear plane angle , Dynamic shear strain and theoretical continuous chip length per minute.
- Q. 3 A. Explain the concept of minimum quantity lubrication (MQL) and cryogenic cooling (07)
- B. Derive the following relation for the shear angle (ϕ) (07)
- $$\phi = \tan^{-1} \left(\frac{r \cos \alpha}{1 - r \sin \alpha} \right)$$
- Where, r = chip thickness ratio and α = Tool rake angle.
- C. How is the tool shank of a single point cutting tool designed ? (06)

- Q. 4 A. A Carbide tool with mild steel work piece was found to give life of 2 hours while cutting at 48 m / min. If Taylor's exponent $n = 0.27$ Determine: (i) The tool life, if the same tool is used at a speed of 20 % higher than the previous one. (10)
(ii) The value of cutting speed, if the tool is required to have tool life of 3 hours.
- B. Discuss different cutting tool materials with their relative advantages and limitations. (10)
- Q. 5 A. Explain the various steps involved in the design of circular broach and draw the neat diagram. (10)
- B. Give an example of alphanumeric specification (ISO coding system) for tipped tools and tool holders and explain it in brief? (10)
- Q. 6 A. Explain design considerations for design of reamer. (10)
- B. i) Explain Strain gauge type dynamometer. (10)
ii) Explain classification of Cutting fluids and its functions.
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