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(2123)

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M. Tech 1st Semester Examination

Metal Cutting

PE-102

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt 5 questions out of 8 questions, all questions carry equal marks.

1. (a) Sketch a single point cutting tool with proper labelling, indicating all surfaces and angles. Also write its salient features. **(10)**

   (b) Determine the values of side clearance (α_x) and minimum clearance (α_m) angles of the single point turning tool whose geometry is specified in ORS as -10°, 10°, 8°, 6°, 15°, 75°, 0 (mm). **(10)**

2. (a) In MCD, explain the Merchant's modified angle relationship. **(10)**

   (b) During pure orthogonal turning of a metal rod by a tool of the following geometry-inclination angle λ=0, orthogonal rake γ_0=0 and principle cutting edge angle (ϕ)=90, it was noted that the magnitudes of the tangential component (P_z) and the axial component (P_x) of the cutting force are 600 N and 200 N respectively, and the value of the chip reduction coefficient (ζ) is 1.732. Using MCD (Merchant's circle diagram), determine the magnitude of the shear force (P_s) and frictional force (F) for the above condition. **(10)**

3. (a) Write a note on the working principle and working of the dynamometer to find the cutting forces during the machining. Also write a short note on the drilling dynamometer. **(10)**

(b) A mild steel rod was subjected to orthogonal turning at high speed, feed of 0.20 mm/rev and 2.0 mm depth of cut by a carbide tool of geometry: 0°, 10°, 8°, 7°, 15°, 60°, 0 (mm). Assuming coefficient of friction at the chip-tool interface equal to 0.50, determine the following for the above machining: (a) Width of cut (b_1); (b) thickness of chip before (a_1) and after cut (a_2); (c) shear angle (β_0). **(10)**

4. (a) Write the various mechanisms of cutting tool wear during machining, also write a detailed note on the measurement of tool wear. **(10)**

(b) An HSS drill during its life can drill 200 through hole in a 20 mm thick brass plate at a drill speed of 200 rpm. Another drill of the same type can make only 100 holes when the drill speed was increased to 300 rpm. How many holes will be produced by another drill of the same type if its speed is raised to 400 rpm? **(10)**

5. (a) What is machining time? Write about its significance and the purpose of its evaluation. Write the formulae of machining time for turning, drilling, boring and shaping. **(10)**

(b) Determine the actual machining time T_c that will be required for plain milling a rectangular surface of length 200 mm and width 50 mm by a helical fluted plane HSS milling cutter of diameter 70 mm and length 75mm and 6 teeth. Approach (A)=Overrun(O)=5mm, Vc=44m /min and S_0=0.2 mm/tooth. **(10)**

6. (a) How to estimate analytically the heat generation during machining. Also discuss types of thermocouple techniques used in machining. **(10)**

(b) A medium carbon steel bar of diameter 200 mm is being turned at a cutting velocity of 120 m/min and feed of 0.2mm/rev. The observed main cutting force and axial force are 800 N and 450 N respectively. Calculate the machining power and comment on contribution of axial feed force on the same. **(10)**

7. (a) Write the detailed note on cryogenic cooling during machining in terms of (1) environment friendliness (2) technological benefits. **(10)**

(b) How much time in total will be required per piece if

- Idle time per piece is 5 min
- Actual cutting time is 20 min
- Life of each tool tip is 10 min
- Time of changing a tool tip is 2.5 min **(10)**

8. (a) Write a detailed note on super finishing, burnishing, polishing and honing. **(10)**

(b) Estimate the average uncut chip thickness for surface grinding (reciprocating, i.e in pendulum model) in a mild steel plate by alumina wheel of diameter 150 mm under the following conditions:

- No. of active grits per unit length along the wheel periphery =20/cm
- Grinding velocity is 50 m/sec
- Worktable feed rate is 2 m /min
- Depth or infeed is 40μm. **(10)**