[Total No. of Questions - 8] [Total No. of Pri d Pages - 3]
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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 drilling tool with proper labelling, indicating all surfaces and angles. Also write its salient features. (10)

   (b) Determine the values of orthogonal rake (γ_0), inclination angle (λ) of the main cutting edge and the maximum rake (λ_m) of the turning tool specified in the ASA system as 10°, - 10°, 8°, 6°, 15°, 30°, 0(mm). (10)

2. (a) Write a step by step procedure for the construction of a merchant's circle diagram. List its advantages and disadvantages. (10)

   (b) During the turning of a steel rod of 150 mm diameter at a cutting speed of 560 rpm, feed of 0.32 mm/rev and 4 mm depth of cut by a tool of geometry 0°, -12°, 8°, 7°, 30°, 60°, 0(mm), it was observed that P_z =1000 N, P_Y =200 N and chip thickness a_2 =0.80 mm. Determine without using MCD, for the above mentioned condition, the values F, N, μ_A, P_S, P_N, τ_s and cutting power consumption. (10)

3. (a) Explain the basic functioning and principle for finding the cutting forces using a dynamometer, Also write a note on the construction and working of a piezoelectric type dynamometer for turning. (10)

   (b) During the turning of a steel rod at a feed of 0.24 mm/rev by a carbide tool having the orthogonal rake angle of 10 and a principle cutting edge angle of 30°, the chip thickness was found out to be 0.48 mm. Determine (a) the expected values of chip reduction coefficient and (b) the shear angle of this machining condition. (10)

4. (a) What is tool life and how is it evaluated? Write and explain the Taylor's tool life equation and also explain the modified Taylor's tool life equation. (10)

   (b) Determine the value of the constant "C" and the exponent "n" of the Taylor's tool life equation for cutting condition if the tool life increases from 30 min to 60 min due to reduction of cutting velocity from 200 m /min to 160 m/min. (10)

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

   (b) Determine the actual machining time required to reduce the diameter of a rod from 200 mm to 195 mm over a length of 200 mm at a cutting velocity of 220 m /min and a feed of 0.2mm/rev. Assume approach (A)=5 mm and overrun(0)=5 mm. (10)

6. (a) What are the various sources of heat generation in a work tool interface and what are its causes? Also explain the effects of the cutting temperature on the job, tool, and the product quality. (10)

   (b) In a given turning operation, by how much percentage will the average cutting zone temperature increase if:

   - only cutting velocity is doubled
   - only tool feed rate is doubled

- only the depth of cut is doubled
- All the four variables are doubled simultaneously.

(10)

7. (a) Write a detailed note on the economics and optimization of machining. Draw graphically the role of increase in V_C on the machining cost per piece. (10)

   (b) Evaluate the machining cost per piece in a batch production turning if

   - idle time per piece is 5 mins
   - Actual machining time per piece is 10 mins
   - Life of each tool tip is 10 mins
   - Time of changing the tool tip is 5 mins
   - Man machine hour rate K_i =Rs 60 per hour

   Cost of each new tip K_2 = Rs 5 (10)

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

   (b) During creep feed grinding of a HSS plate by a super abrasive wheel of diameter 400 mm depth of 20 mm and a worktable feed of 0.10 m/min. The average uncut chip thickness was found out to be close to 10 µm only. Determine the approximate number of active grits per unit length along the periphery of the wheel. (10)