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15ME45B

Fourth Semester B.E. Degree Examination, June/July 2019 Machine Tools and Operations

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With a neat sketch, explain principal parts of engine lathe. (12 Marks)
 b. Write any four important differences between Engine lathe, Capstan lathe and Turret lathe. (04 Marks)

OR

- 2 a. With a neat sketch explain a radial drilling machine. (08 Marks)
 b. Explain with neat sketch hydraulic drive Quick return mechanism. (08 Marks)

Module-2

- 3 a. With a neat sketch explain types of motion for turning, shaping, planning, slotting and drilling operations. (10 Marks)
 b. With respect to lathe machine tool, define following machining parameters:
 (i) Cutting speed (ii) Feed (iii) Depth of cut. (03 Marks)
 c. Index 69 divisions by compound indexing on periphery of a circular blank, the index plate with circles of holes – 21, 23, 27, 29, 31, 33 is available. (03 Marks)

OR

- 4 a. With a neat sketch explain the following operations:
 (i) Plain Milling
 (ii) Form Milling
 (iii) Centreless Grinding
 (iv) Reaming
 (v) Horizontal shaping. (10 Marks)
 b. Estimate the machining time required to machine 5mm thick layer from a workpiece of 200mm wide × 400mm (length) × 50mm (thick) MS material. The available stroke rate are 10, 20, 40, and 80 stroke per minute. The feed is 0.28 mm/stroke. The depth of cut was given as 1mm during each cut. Consider the cutting speed 30 m/min. Also determine the MRR, [Assume R or $m = 2/3 = \frac{RT}{CT}$]. (06 Marks)

Module-3

- 5 a. Explain the desirable properties of cutting tool material. (06 Marks)
 b. Explain the following cutting tool material with respect to usage, composition and structure
 (i) High speed steel (ii) Ceramics. (10 Marks)

OR

- 6 a. Sketch and explain the nomenclature of a single point cutting oil. (10 Marks)
 b. Explain the desirable properties and purpose of cutting fluids. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Write the difference between orthogonal cutting and oblique cutting (any 6 points). (06 Marks)
- b. Explain Merchants circle diagram and derive the equation for the co-efficient of friction between tool face and chip. (10 Marks)

OR

- 8 a. In an orthogonal cutting process, the following data were obtained :
Chip length obtained = 96mm, uncut chip length = 240mm, Rake angle used = 20° , Depth of cut = 0.6 mm, Horizontal component of cutting force = 2400 N and vertical component of cutting force = 240 N. Calculate (i) Shear plane angle (ii) Resultant cutting force for the given data. (08 Marks)
- b. Derive an expression for shear angle in orthogonal cutting in terms of rake angle and chip thickness ratio. (04 Marks)
- c. With a neat sketch explain different types of chips produced during machining process. (04 Marks)

Module-5

- 9 a. What is tool life? Explain the effect of cutting parameters on tool life. (06 Marks)
- b. The tool life for a HSS tool is expressed by the relation $VT^{1/7} = C_1$ and for the tungsten carbide $VT^{1/5} = C_2$. If the tool life for cutting speed of 24 m/min is 128 min, compare the life of the two tools at a speed of 30 m/min. (06 Marks)
- c. Define Machinability and Machinability Index. (04 Marks)

OR

- 10 a. The tool Taylor tool life equation for carbide tool steel work piece pair was obtained experimentally : $VT^{0.25} = 650$ where V is 271 m/min and T is in min. A batch of 1000 steel parts., each 100mm in diameter and 250mm in length is to be rough turned using a feed of 0.2 mm/rev. If the cost per cutting edge of throw away carbide insert is Rs. 50 , time required to reset the cutting edge is 1 min, and the total machined rate (including operator cost) is Rs. 300/hr. Calculate
(i) Optimum cutting speed for minimum cost
(ii) Corresponding tool life
(iii) Total production time for the given batch (06 Marks)
- b. Explain different forms of tool wear and various tool wear mechanisms. (10 Marks)
