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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
- b. Explain different forms of tool wear and various tool wear mechanisms. (10 Marks)

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