

**B. MECHANICAL 3<sup>RD</sup> YEAR 1<sup>ST</sup> SEMESTER SUPPLE. EXAMINATION, 2017.**

**MACHINING TECHNOLOGY AND METROLOGY**

Time: Three hours

Full Marks: 100

Answer any *five* questions.

Assume suitable data if necessary.

1. a) Define cutting speed in metal cutting operation. State the factors on which it depends.  
 b) Show that the value of  $\phi$  lies between 1 and 2 where  $\phi$  is the ratio between two consecutive speeds in series of spindle speed.  
 c) Indicating the main motions required, sketch the following lathe operations:
  - i) Facing operation
  - ii) Drilling operation
- d) Give a classification of machine tools and write examples of each. 5 + 5 + 5 + 5
  
2. a) In lathe 0.2 mm/rev feed is to be obtained. Calculate the change gears. The apron constant of the lathe is 60, the rack pinion has 20 teeth and module of rack pinion is 2 mm. Give a neat sketch of the apron mechanism indicating the position of the change gears.  
 b) A taper is expressed as M 80 X 60. What is the small end diameter? Discuss the process for turning of the same taper. 10 + 10
  
3. a) A 20 teeth gear is to be cut in milling machine. The face width of the gear is 25 mm. The module of the gear is 2.5 mm. The cutter has 12 teeth and it rotates at 96 rpm. The feed is 0.25 mm/tooth. Calculate the machining time. Also discuss about the indexing method. Explain the type of milling cutter used for this operation.  
 b) Explain the through feed centreless grinding operation. 14 + 6
  
4. a) Neatly sketch a twist drill to show the relevant features of it.  
 b) Write the specification of drill.  
 c) A 500 X 500 mm steel plate is to be machined in shaping machine by using hss shaping tool. Amount of stock to be removed is 10 mm. The pawl carries 3 teeth of 20 teeth

ratchet wheel mounted on a 4 mm pitch table feed screw. Assuming suitable cutting speed, estimate the machining time.

d) State about the goose neck tool for shaping operation. 6 + 3 + 7 + 4

5. a) Describe the procedure of calibrating an external micrometer using slip gauges.  
b) A grinding wheel is specified as A-36-L-7-V. Explain all the terms of it.  
c) Neatly sketch an internal pull type broach and explain all the relevant features of it.

7 + 5 + 8

6. a) Briefly discuss about the failure of tool material.  
b) Explain the ceramic tool material.  
c) What are meant by economically feasible accuracy and maximum attainable accuracy?  
d) For a single point tool explain the effect of the rake angle, the clearance angle and nose radius.

5 + 4 + 5 + 6

7. a) With the help of a neat sketch, explain the working principle of any comparator.  
b) Determine the sizes of the hole and shaft for the assembly 40 H8/ f9. The diameter steps are 3-6-10-18-30-50-80-..... mm. The standard tolerance unit,  $i$  (in  $\mu\text{m}$ )  $= 0.45\sqrt[3]{D} + 0.001 D$  where  $D$  is in mm. The fundamental deviation for 'f' shaft  $= -5.5D^{0.41}$ . IT 8 = 25*i*, IT 9 = 40*i*. What is the type of fit? Show the sizes, tolerances and allowance on the diagram.

8 + 12

8. a) Give the concept of  $R_a$  and  $R_z$  values of surface roughness.  
b) Calculate the CLA value of surface for the following data:

The sampling length = 1 mm

Vertical magnification = 14000

Horizontal magnification = 100

Areas above the datum line: 150, 90, 190, 50  $\text{mm}^2$

Areas below the datum line: 95, 75, 160, 150  $\text{mm}^2$ .

Why is vertical magnification so high in comparison to horizontal magnification?

- c) Explain the process of AJM and ECM. Give neat sketches of the basic schemes.

4 + 6 + 10