

**BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)
THIRD YEAR FIRST SEMESTER EXAMINATION - 2019**

MACHINING TECHNOLOGY AND METROLOGY

Time: 3 hour

Full Marks: 100

Answer any *five* questions

Assume suitable data if necessary.

1. a) Define a machine tool. Give a classification of machine tool.
b) In a lathe 6.5 tpi thread is to be machined on ms bar over a length of 100 mm using hss thread cutting tool. The lead screw has 4 tpi. Calculate the change gears. Design the thread chasing dial for this purpose. Also calculate the machining time. Assume suitable cutting speed. Draw a neat sketch of the arrangement showing the positions of the change gears.
c) Sketch and explain the use of steady rest in lathe work. 5 + 10 + 5

2. a) The speed gear box of a lathe is to be designed for 9 speeds. The lathe will be used to machine ms and ci work piece having diameter from 25 mm to 75 mm with hss and carbide as cutting tool material. Assuming suitable cutting speed, determine the speeds considering both AP and GP variation of speed. Why is GP series preferred over AP series for selecting spindle speeds?
b) Discuss about metric taper and Morse taper.
c) Give the sketches of the following operations in lathe:
 - i) Drilling a hole.
 - ii) Straight turning 10 + 6 + 4

3. a) Write the differences between
 - i) Shaping and planing machines
 - ii) Plunge cut grinding and traverse cut grinding.
b) Neatly sketch a twist drill and label it
c) A 600 X 400 mm ci plate is to be shaped using hss shaping tool. The quick return ratio of the machine is 5:4. The pawl carries 4 teeth of a 20 teeth ratchet wheel mounted on 5 mm pitch table feed screw. Assume suitable cutting speed, approach and over travel. Calculate the machining time for removal of 10 mm stock. 6 + 7 + 7

4. a) What is through feed centreless grinding operation? Explain the process.
b) Write the specification of a grinding wheel and explain it..
c) Compare among drilling, boring and reaming operation.
d) Write the specific features of grinding operation in comparison to other machining operations. 7 + 4 + 4 + 5

[Turn over

5. a) Write the differences between up cut milling and down cut milling operations.
 b) Neatly sketch an ordinary cut pull type broach and label it.
 c) For cylindrical milling of a steel plate the cutting depth is 4 mm, the milling width is 80 mm and motor power of the machine is 3 kW. The permissible amount of chips is $12 \text{ cm}^3/\text{kW-min}$. The available feed rates are 12, 20, 33, 57, 99, 167, 276 and 480 mm/min. Calculate the biggest possible rate of feed. 6 + 7 + 7
6. a) Calculate the mrr and electrode feed rate in ECM of an iron surface (25 X 25 mm in cross section) using NaCl in water as electrolyte. The gap is 0.25 mm. Supply voltage= 12 V DC. The specific resistance of the electrolyte is $3\Omega\text{-cm}$. (take valency of iron= 2, gram-atomic weight of iron= 55.85, density of iron= 7860 kg/m^3).
 b) Explain the principle CHM process.
 c) With the help of neat sketch explain how the pitch diameter of an external threaded element by three wire method. What is best wire size? 8 + 5 + 7
7. a) Explain the causes of tool material failure.
 b) Discuss about carbide as cutting tool material.
 c) Explain the causes of machining errors.
 d) Sketch how bow shape and barrel shape of a cylindrical job are indicated in the working drawing. 5 + 5 + 6 + 4
8. a) Discuss about the different types of fit and explain in reference to hole basis system. Give necessary sketches.
 b) Determine the sizes of the hole and shaft for the assembly 50 H7/f8. The diameter steps are 3-6-10-18-30-50-80-..... mm. The standard tolerance unit, i (in μm) = $0.45D^{1/3} + 0.001D$ where D is in mm. The fundamental deviation for 'f' shaft = $-5.5D^{0.41}$, IT7=16*i*, IT8=25*i*. Determine the type of fit. Show the dimensions on the diagram. Indicate the tolerance and allowance for this assembly.
 c) Sketch a limit plug gauge and explain it. 5+ 12 + 3
9. a) Discuss about form error, surface waviness and surface roughness.
 b) Give an idea about the R_a value of surface roughness. How is the centre line found in case of R_a value? Why is vertical magnification higher than horizontal magnification?
 c) With the help of neat sketch explain the Eden Rolt Millionth Comparator. 6 + 6 + 8