

MEL233 – MACHINING, MACHINE TOOLS & METROLOGY**(I Semester 2006-07)****Major****Max. Marks :35****Time: 2 Hrs.****Instructions:**

1. Write your name, entry no and group no. on the front page of the answer sheet.
2. The question paper contains two parts. Answer them separately and do not mix the questions from the two parts.

Part – A

- 1 (a) Show that, when cutting metal orthogonally with a tool of zero rake angle, the rate of heat generation, P_s , in the shear zone is given by

$$P_s = F_c V (1 - \mu r_c)$$

Where F_c	=	Cutting force	
V	=	Cutting speed	
μ	=	Mean coefficient of friction on the tool face	
r_c	=	Cutting ratio (t/t_c)	(2.5)

- (b) A tool used in a turning operation is of the brazed-carbide tip type. Its cost is Rs.450/- and on an average it can be reground ten times. The cost of regrinding is Rs.45/-. The lathe cost is Rs.2,00,000/- and is used 8hrs. per day, 5 days per week, 50 weeks per year. Its cost is to be amortized over 10 years, and the machine overheads are 100%. The operator's wage is Rs.20/hr, and the operator's overheads are 100%. The relation between cutting speed and tool life for the conditions employed is

$$VT^{0.25} = 7$$

Where V is the cutting speed, in metres per second and T is the tool life in seconds. The tool changing time is 4 min, and the handling time per component is 5 min. The cutting distance for machining components of 50 mm diameter is 400 mm at the rate of 0.25 mm/rev. Calculate

- (a) the minimum production cost
- (b) the minimum production time. (5)

- 2 (a) Evaluate the metal removal rate of Nimonic alloy containing 18% Cobalt, 62% Nickel and 20% Chromium while machining with a current of 500 A. The density of alloy has been 8.28gm/cc. Given the valency of Chromium as 6 and that of Nickel and Cobalt as 2. (2)
- (b) List out the parameters which influence material removal rate in Ultrasonic Machining and show the trends. (2)
 - (c) Explain various steps of photochemical machining. (1)
 - (d) What are the benefits of the nature of EDM surface? (1)
 - (e) Why is the efficiency of laser beam machining very low? (1)

3. (a) What is the significance of Airy points in the context of measurement? Obtain the position of Airy points for the length bar of 500 mm to be placed horizontally. (2)
- (b) Design a progressive type of GO & NOGO plug gauges required for inspecting a 60 H7 hole and show the sketch with all necessary tolerances.

Use the following data:

The diameter 60mm lies in the diameter step 50-80 mm

Fundamental tolerance unit, $i = 0.45 D^{1/3} + 0.001 D \mu\text{m}$, D is in mm

Tolerance value for IT7 = $16i$

(4)

(State the assumptions made, if any, clearly)

- (c) Indicate material considerations for limit gauges, including some reference to the heat treatment. (1)

PART B

1. List the different methods of making threads. Explain the following.
- (a) Advantages of forming threads over the thread cutting. (1.5 + 1.5 + 1.5)
- (b) Grinding of threads
2. List the different methods of manufacturing spur & helical gears. Explain the following (1.5 x 3)
- (a) Gear hobbing
- (b) Gear shaper
3. In a surface grinding operation the following data is observed.
- Grinding wheel diameter = 300 mm ; wheel speed = 2000 rpm
- Depth of cut = 0.1 mm ; Transverse feed = 10 mm
- Table speed = 20 m/min ; Number of grains per mm = 2
- Unit energy for grinding = 18 J/mm^3
- Determine (i) the average chip thickness, (ii) grinding spindle power required for operation and (iii) tangential grinding force. Assume a suitable value of any other data needed. 3x1.5