



Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech(MTI)/SEM-1/MTI-102/2009-10

2009

METAL CUTTING & MACHINE TOOLS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions taking at least two from each Group.

GROUP – A

1. a) For a single point cutting tool, find out γ_x and γ_y angles in terms of γ_o , λ and ϕ angles. 6

- b) In a face milling test, the following data were obtained for speed search : 8

Speed, m/min	10.65	12.6	15.3
Speed, rpm	36	43	52
Feed, mm/rev	0.33	0.33	0.33
Feed, mm/min	11.88	14.19	17.16
Tool life, cm^3	200	213	107
MRR, cm^3/min	2.92	3.75	4.57

Given, Tool usage cost = Rs. 21.50

Tool change cost = Rs. 2.00

Operating cost = Rs. 1.16 per min.

Calculate the efficient cutting speed.

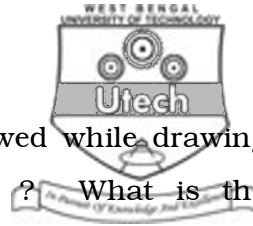


2. a) Compare between a SPC tool and a twist drill with respect to various tool geometry parameters. 3
- b) Show how side rake γ_x increases during drilling operation. Is it true for turning operation also ? 4
- c) Find out engagement parameter for milling a 50 mm wide job by a 60 mm dia milling cutter with 20° helix angle. The depth of cut is 5 mm and number of teeth is given by the equation $Z = 1.4 \sqrt{D}$. In above problem, at what job width the engagement parameter will be exactly 2 ? 7
3. a) What is the utility of a drop tool apparatus ? 2
- b) What equation you will use to determine the effect of chip reduction coefficient on dynamic shear strain for different orthogonal rake of a cutting tool. Deduce the equation. 8
- c) What are the causes for up-curling and side curling of chips in turning operation. 4
4. a) Using Kronenberg's relationship establish the effect of frictional coefficient on chip reduction coefficient. 5
- b) Explain the basic principle of a strain gauge type lathe tool dynamometer. Why are four strain gauges used for measuring any of the forces. 3
- c) Why HSS is still used as a cutting tool material ? 3
- d) What are the shortcomings of plain ceramic tools and how these have been overcome ? 3



GROUP – B

5. a) Explain how can controlled automation is implemented in single spindle automatic machine. 5
- b) Schematically represent a hydraulic copying system and describe its principle of operation. 5
- c) Describe through a diagram the “fast forward-power stroke-stop-fast return” operation of a milling machine table slide using stop control method. 4
6. a) Define elementary, complex and compound kinematic structures of machine tools with suitable diagrams. 6
- b) Draw the kinematic diagram and explain a “pitch error correction” differential mechanism for a lathe machine. 8
7. a) What is speed spectrum of a machine ? 2
- b) What is productivity loss of a machine ? Calculate maximum productivity loss between two spindle speeds of 360 rpm and 285 rpm. Deduce the equation used for the calculation. 4
- c) State and explain the rules for sliding cluster gear box. 5
- d) What is “unit strength” and what is its significance in designing a machine structure ? 3



8. a) What are the basic rules to be followed while drawing speed structure of a machine tool ? What is the difference between speed structure and ray diagram ? 4
- b) Consider a sliding cluster reduction gear box, where in one of its stages, from an input speed of 1000 rpm three outputs of 810 rpm, 655 rpm and 520 rpm is desired. Design a gearbox with feasible number of teeth of the 3 sets of matching gears and calculate the output speeds obtained therefrom. 10
