



MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, APRIL/MAY 2018

SUBJECT: MACHINE TOOL TECHNOLOGY [MTE 4016] [REVISED CREDIT SYSTEM]

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed with justification
- 1A. In the context of oblique cutting of a cylindrical block by single point cutting tool, (3) consider the statements and express their effects:

(i) Assuming a constant specific cutting energy, when the feed rate increases, what change will occur in cutting force and feed force?

(ii) If the positive back rake angle is decreased, what will be the effect on chip temperature and cutting force?

(iii) How does the cutting force and radial force changes when spindle speed is increased?

(iv) When the depth of cut is increased to increase material removal rate, what consequences will occur to cutting force and radial force?

(v) If the side cutting edge angle is increased, what happens to the tool life?

(vi) How does increase in nose radius affects the surface finish and heat generation in a cutting tool?

1B. Draw front, top and side view of single point cutting tool with positive rake angle (3) according to ASA system showing all its angles.

- 1C. Mild steel is being machined at a cutting speed of 200m/min with a tool rake angle of (4) 10. The width of cut and uncut chip thickness are 2 mm and 0.2 mm respectively. If the average value of coefficient of friction between the tool and chip is 0.5 and shear strength of work material is 400 m/mm², determine using Ernst and Merchant's theory
 - (i) Shear Angle and shear force (ii) Cutting and Tangential Force.
- 2A. In a certain machining operation with cutting speed 50m/min, tool life of 45 min is observed, when the cutting speed was increased to 100 m/min, tool life decreased to 10 min. Estimate optimum cutting speed and optimum tool life for maximum productivity if tool changing time is 2 minutes, tooling cost is 6.5 Rs, machining cost is 0.5 Rs.
- 2B. Discuss various types of chips formed during machining operation in context of their formation mechanics, cutting conditions favoring them and the type of metals which leads to their formation. (4)
- 3A. When a tool is used for machining work metal A and work metal B, the following data is obtained, calculate machinability index for the tool considering work material A as standard free cutting steel.

Work material	Tool life (minutes)	Speed (m/min)
A	25	100
	10	150
В	40	200
	20	250

- 3B. Discuss the general characteristics and limitations of the following tool materials: (5)
 (i) High speed steel (ii) Uncoated carbide.
- **4A.** In the application chart of carbides developed by ISO what does P, M and K (2) represents?
- 4B. Discuss the characteristics of the following motors in CNC(i) Permanent magnet stepper motor(ii) Variable reluctance stepper motor
- **4C.** How does recirculating ball screw functions and explain its two different types? (3)
- 5A. Enumerate few advantages of automatic tool changer? For what range of tools Drum (3) type and Chain type ATC is Used?
- **5B.** Draw a schematic diagram showing all the essential elements of Jig and Fixture and (4) suggest any two quick clamping methods.
- 5C. Express the effect of Jig and fixture on machining cost using a graph between (3) machining cost and volume of production.

(5)