Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(PE)/SEM-2/PEM-203/2013

2013

MACHINE TOOL ENGINEERING

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 *five* questions taking at least *two* from each group.

GROUP – A

1. a) Write short notes on the following : 2 × 2 = 4

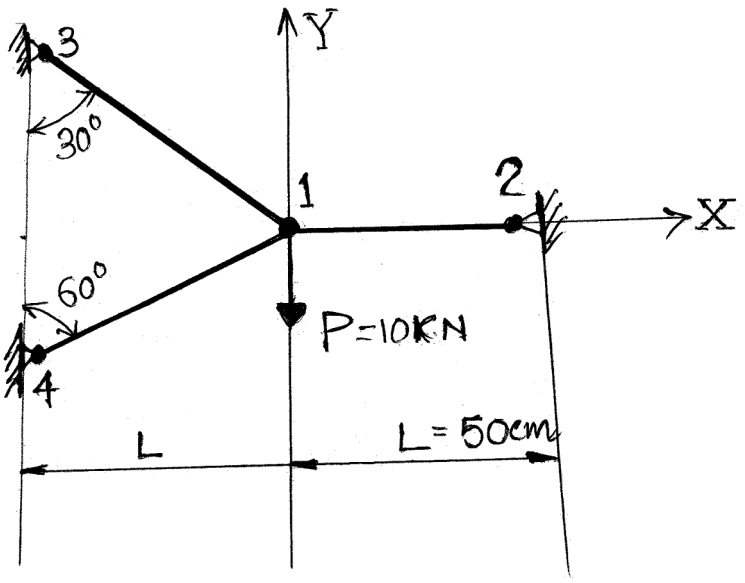
   (i) Stick-Slip Motion

   (ii)) Finite Element Analysis.

   b) How do you choose materials on the basis of strength, rigidity under tension, torsion and bending ? 4

   c) Find the expression for overall machine tool compliance for a lathe. State briefly the assumptions you made. 6

2. a) A pin-jointed bar system is shown in the figures below. Find the reactions at the support and deflection of point 1 if the force is 10 kN, E = 200 GPa and cross-sectional area of the bar 250 mm^2. 10



b) Show that,

$$\left[\overline{K}\right] = \left[T\right]^T \left[K\right] \left[T\right]$$

where $\left[\overline{K}\right]$ = Global stiffness Matrix

$\left[T\right]$ = Transformation Matrix

$\left[K\right]$ = Local stiffness Matrix.

Start from basic principle i.e. by drawing a bar element. 4

3. a) Find the optimum design criteria of a contilever beam of cross-sectional area ($b \times h$) and length l subjected to a load p. 8

b) What are the parameters for designing a slide ways. 1

c) What is self-exited vibration ? How it is related to cutting tool angle ? 2 + 1

d) Draw the Harmonic response Locus (HRL) for self exited vibration with proper sketch. 2

4. a) Draw the structural diagram for a machine tool speed box of n_{min}=16 rpm n_{max} = 770 rpm and ϕ = 1·26. Which layout is best and why ? 10

b) What is R-20 series. 1

c) Why G.P. is preferred over other progression in speed box design. 2

d) Write the limiting value of ϕ . 1

GROUP – B

5. a) What is meant by acceptance test of a machine tool ? Write the systematic procedure to be followed for performing acceptance test of machine tool. 4

b) Discuss about the test mandrel and spirit level used for acceptance test of a machine tool. 5

c) Explain how the parallelism of two surfaces and squareness of two planes are checked. Give necessary sketches. 5

6. a) What is stepless regulation of speeds in machine tool ? Write the advantages of hydraulic drives when it is used for straight line and reciprocating motions. 4

b) Discuss the working principle of vane pump used in machine tool drive. 4

c) Sketch and explain the hydraulic circuit with throttling valve in the forward line. Also show the characteristic of the circuit and explain it. 6

7. a) Give a schematic diagram depicting the closed loop nature of man-machine interaction and explain it. 3

b) Why are the ergonomic considerations applied to the design of control members of a machine tool ? 4

c) What are meant by open loop and closed loop systems in relation to NC machine tool ? With the help of a block diagram of a closed-loop NC system, discuss the taper turning process. 5

d) Sketch the schematic diagram of an electromagnetic feed drive. 2

8. Write short notes on any *four* of the following : $4 \times 3\frac{1}{2}$

a) Pressure control valve

b) Compound relief valve

c) Flow control valve

d) Adaptive control

e) Stepping motor

f) Ply drive.