Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(PE)/SEM-2/PEM-203/2012

2012

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

5 × 14 = 70

GROUP – A

1. a) Why is G.P. series preferred over other series such as A.P. , H.P. & L.P. in Gear Box design. 3

   b) Draw the structural diagrams of a machine tool speed box for n_{min} = 16 rpm, n_{max} = 770 rpm and ϕ = 1·26. Which layout is best and why ? 8 + 2

   c) What are the constraint in gear box design ? 1

2. a) What is self-excited vibration ? 2

   b) Show that limiting value of coupling coefficient in regenerative feed vibration is $r_{lim} = -\frac{1}{2G}$ where G is the real part of cross-receptance. 7

c) Draw the schematic diagram of Harmonic Locus for a forced vibration with labels. 2

d) Write the equations of motion for 2-degree of freedom vibration system. 3

3. a) Why is C.I. preferred as machine tool structural material over M.S. ? 2

b) What is stick-slip motion in machine tool structure ? 2

c) What are the conditions for which there will be motion with constant velocity and stick-slip motion ? 2

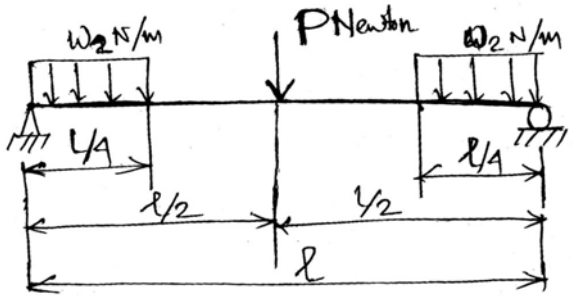
d) How can stick-slip motion be prevented in machine tool ? 2

e) What are the design criteria for a slideway in Machine Tool ? 1

f) For a bar of cross-sectional area A, length L and elastic modulus E, form the stiffness matrix if the bar is subjected to tensile load with force F_1 and F_2 at two ends. 3

g) Define the term 'unit strength' under bending and write the expression for it. 2

4. a) Derive the expression for optimum l/h ratio for a solid rectangular structure of height h and width b which is loaded as shown in the figure. 10



b) Prove that $1 \le \phi \le 2$. 3

c) What are the effects of vibration in Machine Tool ? 1

GROUP – B

5. a) Which the help of neat sketches, explain tracing method and enveloping method.
   b) Explain the *E*-33 and *C*-12 structures of machine tool drive. Give illustrative sketches.
   c) How is the pitch error correction made during thread cutting in a lathe, by using differential mechanism ? Explain with neat sketch. 4 + 6 + 4
6. a) What is meant by stepless regulation of speed ?
   b) Write the advantages of hydraulic stepless drive.
   c) Discuss throttling circuits with throttles in the forward line. Give necessary sketches.
   d) Explain the poppet type and ball type pressure control valves. 2 + 3 + 5 + 4
7. a) What are the functions of the operator in 'Man-machine system' ?
   b) Discuss the role of ergonomics in application to the design of control members.
   c) With the help of an explanatory sketch, explain the data processing in a CNC machine tool in a closed loop control.
   d) Give a sketch of the test setup for true running of the spindle of a centre lathe. Explain the test also. 2 + 4 + 5 + 3
8. Write short notes on any *four* of the following :
   a) Axes selection in CNC machine tools
   b) Measuring instruments used for machine tool testing
   c) Design of knob of machine tool
   d) Hydraulic servo control
   e) Variable delivery hydraulic circuit
   f) Cone disc transmission system.

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