M. MECHANICAL ENGINEERING EXAMINATION, 2017

(1st Semester)

MACHINE TOOL DESIGN

Time: **Three Hours**   Full Marks: **100**

Answer any *four* questions.

Assume relevant data, if necessary.

1.   Design a twelve speed gear box of a machine tool having maximum rpm= 360 and minimum rpm= 30. The hp of the motor is 10.   **25**

2. a)   What are the advantages of hydraulic drive?
   b)   With the help of a neat sketch explain the throttling circuit with throttles in the forward line. Also sketch the characteristic of the same.
   c)   Draw a sketch of the compound relief valve and explain its working principle.
   d)   Discuss about the hydraulic servo control.   **4+10+4+7**

3. a)   Discuss about the PIV drive and Wulfel Kopp Tourator.
   b)   What is compliance of a machine tool? Explain the effects of P_x and P_z on overall compliance of machine tool.
   c)   Figure-1 shows the results of compliance test carried out for a centre lathe. Three different curves indicate the tool point deflections at three different points of application of the load. Calculate the individual component compliances of the tailstock, headstock and saddle elements.   **8+7+10**

4. a)   Discuss about the model technique in design of machine tool structure.
   b)   Compare among the volume requirement for cast iron bed and mild steel bed of a machine tool. The following information is given:

	Cast Iron	Mild Steel
Young's modulus (kgf/mm^2)	1.2×10^4	2×10^4
Permissible normal stress (kgf/mm^2)	300	1400
Permissible deflection (mm)	0.002	0.002

Show the necessary plot.   **15 +10**

5. a) State the factors on which the shapes of the slideways depend. Sketch the common shapes of the slideways.

   b) Design the guideway dimension for a total load of 500 kg. The slide is moving with a traverse rate of 3 m/min. The viscocity of the lubricant is 0.01 kg-s/m². The permissible pressure is 2 kg/cm². The minimum film thickness can be taken as 0.01 mm. Derive the formula for solving this problem.   5+5 +15

6. a) What is stick-slip motion in a machine tool? Derive the expression of the stickslip amplitude.

   b) Discuss about the application of finite element method in machine tool design.

   c) Explain open loop system and close loop system in CNC machine tools.

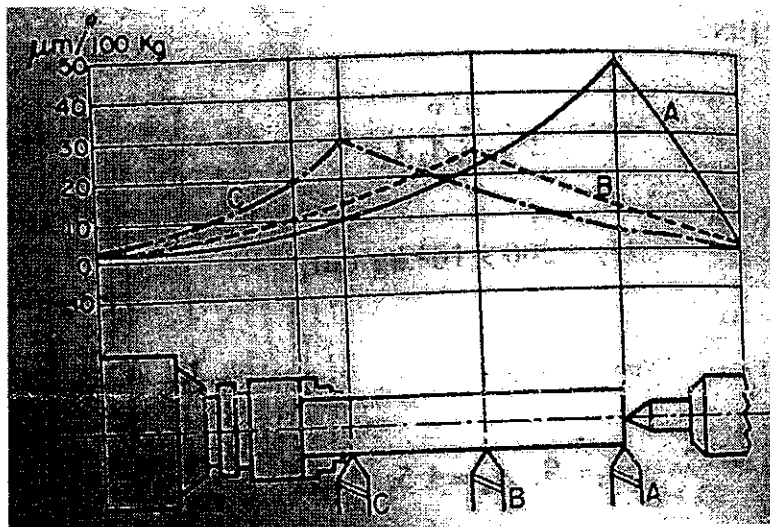   10+10+5

Figure-1