

**327201**

May, 2019

**M.Tech. - II SEMESTER  
Machine Tool Design (MME-201-A)**

Time : 3 Hours]

[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) It is required to cut a screw thread of pitch 3 mm on a lathe with lead screw of pitch 10 mm. Determine the required change gears. (1.5)
- (b) What are the characteristics of Ball bearings? (1.5)
- (c) What are the advantages of automatic control of machine tools? (1.5)
- (d) How clearance is adjusted with flat strips in dovetail slideways? Explain with the help of a suitable sketch. (1.5)
- (e) Write three major design requirements for guideways in machine tools. (1.5)

- (f) Find the spindle steps arranged in arithmetic progression for  $n_{\min} = 100$  and  $n_{\max} = 630$  and  $z = 8$ . (1.5)
- (g) Explain the function of directional control valve. (1.5)
- (h) Calculate the machining time for drilling a through hole of diameter 30 mm in a 40 mm thick plate at a cutting speed of 30 m/min and feed 0.15 mm/tooth. (1.5)
- (i) Write the layout formula of a Knee-type vertical milling machine. (1.5)
- (j) Explain briefly the working principle of adaptive control system in machine tools. (1.5)

### PART-B

2. Design a nine speed gear box having  $n_{\min} = 100$  and  $n_{\max} = 630$ . Assume motor rpm = 1400. The design should include structural diagram, speed chart, gearing diagram and number of teeth of gears. (15)
3. (a) Discuss different methods of mechanical stepless regulation of speed and feed rates. (10)
- (b) What are the advantages of Geometrical Progression law of Stepped regulation of speed over other laws? Explain. (5)

4. Explain model technique in design of machine tool structures by deriving relationships for bending stiffness of structure and for natural frequency of torsional vibrations. (15)
5. What are important features of power screws for using them in machine tools? Explain the design procedure of sliding friction power screws. (15)
6. What are the design requirements of spindle units in machine tools? What types of materials are used for spindle units? Derive a relationship for determining the deflection of spindle axis due to compliance of spindle supports. (15)
7. What are the functions and requirements of control systems in machine tools? How these systems are classified? Explain speed and feed changing systems with preselective control system. (15)