Total No. of Questions :12]

SEAT No. :

P3942

[Total No. of Pages :4

[4959] - 131

B. E. (Production)

MACHINE TOOL DESIGN

(2008 Course) (Semester - I) (411081)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Attempt one question from each unit of Section I and Section II.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of non-programmable electronic pocket calculator and statistical tables is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

UNIT - I

Q1) a) List the general recommendations for developing the gearing diagram. **[4]**

b) An six speed gear box is to be designed for the minimum speed of 90 rpm and maximum speed of 1200 rpm. It is to be driven by a three-phase asynchronous motor rotating at 1500 rpm. Draw the best structural diagram, optimum ray diagram and gear box layout. **[14]**

OR

Q2) a) Prove that the maximum loss of economic speed is constant in geometric progression and show that the value of geometric progression ratio 'ϕ' lies between 1 & 2. **[8]**

b) What are the important features of stepless regulations? List the different stepless regulation methods used in machine tools and explain any one of the method with a neat sketch. **[10]**

P.T.O.

UNIT - II

Q3) a) State the various systematic steps involved in designing bases and tables of a general purpose machine tool. **[8]**

b) Explain the concept of static and dynamic stiffness of machine tool and state the procedure for estimating them. **[8]**

OR

Q4) a) In designing the bed of a machine tool, it is often found that the hollow rectangular cross - section is the most suitable one. Make a comprehensive evaluation of the various types of cross sections commonly used in machine tool on the basis of stress and deflection in both bending and torsion. **[10]**

b) Discuss the functions of machine tool structures and their requirements with a suitable example. **[6]**

UNIT - III

Q5) a) Classify the various types of configuration of the guides used in machine tools, based on material lubrication system drives control etc. **[8]**

b) What is meant by a rigidity of a lubricated slide ways? Show that the rigidity of a hydrostatic slideways is 50% more than that of a hydrodynamic slideways. **[8]**

OR

Q6) a) Explain the specific merits and demerits of plastic guides commonly used in machine tools. Name some of the filled and unfilled plastic guides. **[8]**

b) Describe with neat sketches the various methods used for the compensation of wear of guides. **[8]**

SECTION - II

Unit - IV

Q7) a) Make a sketch of at least two different types of spindle ends of a machine tool and make a comparative evaluation of their characteristics and the forces acting on the spindle. **[10]**

b) Analyze the load taken by the balls in a ball bearing used as a spindle support and show that due to contact deformation not more than 80% of the balls take the entire thrust. **[8]**

OR

Q8) a) Show, with neat sketches, at least two methods of preloading a ball lead screw. Also deduce an expression that the magnitude of preload in normally equal to 1/3 of the total load. **[8]**

b) Show that in a sliding friction lead screw the distribution of load per tooth is non uniform. Write down an expression for efficiency of a sliding friction lead screw, assuming included angle of the thread as 2β. How will this expression be changed, in the case of a Recirculating Ball Screw? State clearly the reasons thereof. **[10]**

UNIT - V

Q9) a) Why is damping of machine tools important? How is it accomplished? **[6]**

b) Discuss the dynamic characteristic of the cutting process. **[6]**

c) Why is thermal expansion of machine tool components important? **[4]**

OR

Q10)a) Classify the essential control systems, with particular reference to shifting of gear in a gear box. Explain the difference between: **[8]**

i) Centralized control

ii) Selective control and

iii) Pre-selective control system.

b) With neat sketches of circuit diagrams show the functioning of a thermal relay and an electrical braking system. **[8]**

UNIT - VI

Q11)a) Discuss the method of obtaining stepless speed variation of a machine tool having regulation upto 20, using epicyclic mechanism. **[8]**

b) Write note on: **[8]**

i) PIV drive

ii) Friction and ball variator

OR

Q12)a) Discuss the recent trends in design of special purpose machine tools.**[8]**

b) What are the essential requirements in retrofitting an existing machine tool into a CNC system? **[8]**