

22570

22232

3 Hours / 70 Marks

Seat No.

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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Preferably, write the answers in sequential order.

Marks

1. Attempt any FIVE of the following :

10

- (a) Define stress concentration factor.
- (b) State the functions of machine tool structures.
- (c) Define :
 - (i) Slideways
 - (ii) Antifriction ways
- (d) State materials of guideways.
- (e) State the functions of spindle unit.
- (f) List any four standard values of geometric progression ratio (ϕ) commonly used machine tool gearbox.
- (g) List any two ergonomic considerations in design of hand wheel.



- 2. Attempt any THREE of the following : 12**
- (a) State the general requirements of machine tool design.
 - (b) State the sources of vibration in machine tools.
 - (c) Describe the factors affecting the stiffness of machine tool structure.
 - (d) Explain the methods of improving stiffness of machine tool structure.
- 3. Attempt any THREE of the following : 12**
- (a) Explain any four methods to reduce stress concentration.
 - (b) State the classification of machine tool structures on the basis of following :
 - (i) By purpose
 - (ii) By the method of manufacture
 - (iii) By the function they perform
 - (c) State any four major functions of guideways.
 - (d) Draw the profiles of following slideway :
 - (i) Open flat
 - (ii) Open symmetrical 'V'
 - (iii) Closed cylindrical
 - (iv) Closed flat
- 4. Attempt any THREE of the following : 12**
- (a) State any four requirements of a good spindle unit.
 - (b) Describe the effects of vibration on cutting conditions and workpiece.
 - (c) Describe ergonomic considerations applied to location of display.
 - (d) Describe the essential requirements for layout of stepped drive.
 - (e) Define Aesthetics and list aesthetic characteristics.

5. Attempt any TWO of the following : 12

- (a) Explain design process of machine tools.
- (b) Explain the requirements to design good machine tool structure.
- (c) Draw the structural diagrams for possible structural formulae for 2 stage 8 speed gear box. Decide on the best structural diagram. Take $\phi = 1.41$.

6. Attempt any TWO of the following : 12

- (a) Draw the following spindle supports.
 - (i) Spindle end for lathe machine spindle
 - (ii) Spindle end for drilling machine
- (b) Draw the structure diagram for following structural formulae :
 - (i) $Z = 2(1) 3(2) 2(6)$
 - (ii) $Z = 2(1) 3(4) 2 (2)$

For $\phi = 1.4$, choose the best structural diagram on the basis of transmission ratio restriction and minimum shaft size.

- (c) Draw the structure diagram for six speeds and three stages. If $N_1 = 50$, calculate next five speeds considering $\phi = 1.12$.

Apply minimum shaft size criterion to choose the structural formula for drawing the structural diagram.
