

(Set-Q<sub>1</sub>)

**B.Tech-7th (PE)**  
**Principles of Machine Tools**

*Full Marks : 70*

*Time : 3 hours*

**Answer Q.No.1** which is compulsory and  
any **five** of the remaining seven questions

*The figures in the right-hand margin indicate marks*

All parts of a question (a, b, etc) should be  
answered at one place.

Answer should be brief and to-the-point and be  
supplemented with neat sketches.

Any missing data or wrong data may be assumed  
suitably giving proper justification.

1. Answer in brief the following : 2 × 10

(a) What is the procedure of selecting speed  
steps in a stepped drive ?

(b) How backlash can be minimized in power  
screw ?

( Turn Over )



- (c) General requirements of machine tool design.
- (d) With sketch show the different forces applied on a lathe machine.
- (e) Difference between unilateral and bilateral speed diagrams.
- (f) What is antifriction bearing? Give its application.
- (g) Give three reasons why cast-iron is the material mainly used for the production of machine beds.
- (h) Principle of automatic control.
- (i) What is P.I.V. drive? Where it is used?
- (j) Make neat sketches of three different forms of slide and slide ways.
2. (a) A stainless steel bar of 53 mm diameter and 150 mm long is to be turned to be 50 mm diameter with the help of a carbide tool. Determine the cutting speed and time of machining if the approach length is set at 5 mm and feed is set at 0.25 mm/rev. 5

- (b) Enumerate the inputs, outputs, constraints and environment of a single machine tool manufacturing system. 5
3. (a) Discuss in brief the design principles of sliding friction power screws on the following factors: (i) Wear resistance, and (ii) Strength. 5
- (b) What do you mean by static compliance of a machine tool? Derive the expression for overall system compliance of a centre lathe. 5
4. (a) What is the function of the main spindle and how the machine tool spindle is mounted? 5
- (b) If chatter vibration is occurring in a turning process on a lathe, what remedial measures you will take to remove it. 5
5. (a) What are the characteristic features of hydrostatic bearings? How do you define the stiffness of a hydrostatic bearing? 5



( 4 )

- (b) A machine tool spindle is to have six speeds and is to run at a maximum speed of 768 rpm and a minimum speed of 24 rpm. Calculate the spindle speeds. 5
6. (a) Discuss in brief the design criteria used for machine spindles. 5
- (b) What do you mean by adaptive control systems? Discuss the limit constraint and process optimization adaptive control systems with diagrams. 5
7. A 4 speed ( $2 \times 2$ ) gear box is required to transmit 8 H.P. with speed ranging from 300 rpm with  $\Phi = 1.25$ . Select an optimum ray diagram and hence calculate gear box sizes module and width of gears. Calculate the shaft size and sketch the gear box. The gears made of mild steel. 10
8. Write short notes on any four :  $2\frac{1}{2} \times 4$
- (i) Cross stiffness in machine tool design

( 5 )

- (ii) Methods of improving the functioning of slide ways
- (iii) Degree of freedom
- (iv) Ruppert-drive
- (v) Elements of Hydraulic transmission system.