Scheme – I

Sample Question Paper

Program Name : **Diploma in Mechanical Engineering / Production Engineering / Production Technology**

Program Code : **ME / PG/ PT**

22564

Semester : **Fifth**

Course Title : **Elements of Machine Design**

Marks : **70** **Time: 4 Hrs.**

Instructions:

(1) All questions are compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Preferably, write the answers in sequential order.

Q.1) Attempt any FIVE of the following. **10 Marks**

a) Define term ‘ Stress Concentration’

b) State the significance of ‘ Wahl’s factor’

c) List the applications of Turn Buckle

d) Classify ‘Key’

e) Explain Term “Self-locking of Screws”

f) List the desirable properties of spring Material

g) Define Term “Dynamic Load Rating” of Bearing

Q.2) Attempt any THREE of the following. **12 Marks**

a) Enlist the steps involved in general design procedure

b) Differentiate between Knuckle joint and Cotter joint. (any four points of difference)

c) State the effect of keyway on the strength of the shaft

d) State the strength equations of double parallel fillet weld and single transverse fillet weld with neat sketches

Q.3) Attempt any THREE of the following. **12 Marks**

a) Define term ‘factor of safety’. State its importance in design of machine elements

b) Compare welded joints with screwed joints.

c) Define following terms with respect to springs :

1) Free length 2) Solid height 3) Spring rate 4) spring index

d) List the factors to be considered while selecting the material for design of Machine element

e) Write strength equations for Design of Screw spindle of toggle Jack

Q.4) Attempt any TWO of the following. 12 Marks

a) Explain with suitable example the importance of Aesthetics and Ergonomics while designing Machine element.

b) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression

c) A hollow shaft is to be designed to transmit 600 kW at 110 rpm. The maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and angle of twist in a length of 3 met. not to exceed 1.4 degree. Find external diameter of the shaft if the internal diameter to external diameter is 3/8. Take modulus of rigidity 84 GPa.

Q.5) Attempt any TWO of the following. 12 Marks

a) Design a bushed pin type flexible coupling for connecting a motor shaft to a pump shaft for the following service conditions.

Power to be transmitted = 40 kW.

Speed of the motor shaft = 1000 RPM.

Diameter of the motor shaft = 50 mm

Diameter of the pump shaft = 45 mm

The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 N/mm2 and 25 MPa respectively.

b) A power screw on a machine has single start square thread with a non rotating bronze nut. Axial force on the screw is 15 kN. Allowable stresses for screw material in compression and shear are 85 MPa and 37 MPa respectively. Allowable bearing pressure for the screw nut pair is 5 MPa. Find

(i) Core diameter of screw

(ii) Length of the nut

(iii) Efficiency of power screw in coefficient of friction between screw and nut is 0.12.

c) Write down the procedure for selection of bearing from manufacturer's catalogue with suitable example

Q.6) Attempt any TWO of the following. 12 Marks

a) i) A plate 100 mm wide and 10 mm thick is to be welded by another weld by means of double parallel fillet welds. The plates are subjected to a static load of 80 kN.

(Take permissible Shear stress = 55 N/mm^2).

ii) Draw Symbolic Representation of

1. Double V butt joint 2. Double 'U' butt joint 3. Single level butt

b) A closed coil helical spring is used for front suspension of an automobile. The spring has stiffness 90 N/mm with square and ground ends. The load on the spring causes a total deflection of 8.5 mm. By taking permissible shear stress of material as 450 MPa. Find

i) Spring wire diameter

ii) Length of spring

Assume spring index = 6 and G = 80 × 103 N/mm^2

c) A belt pulley is fastened to a 90 mm diameter shaft running at 300 r.p.m. by means of a key 20 mm wide and 140 mm long. Allowable stress for the shaft and key material are 40 N/mm^2 in shear and 100 N/mm^2 in crushing. Find the power transmitted and the depth of the key required

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Program Name : **Diploma in Mechanical Engineering / Production Engineering / Production Technology**

Program Code : **ME / PG/ PT**

22564

Semester : **Fifth**

Course Title : **Elements of Machine Design**

Marks : **20** **Time: 1 Hour**

Instructions:

(1) All questions are compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR. **08 Marks**

a. Define " Machine Design"

b. Name different Types of Lever

c. List the requirements of good Coupling

d. Define- Endurance Limit

e. State the purpose of Cotter in Cotter Joint

f. List different Shaft Materials

Q.2 Attempt any TWO **12 Marks**

a. Design single cotter joint to transmit 200 kN. Allowable stresses for the material are 75 MPa in tension and 50 MPa in shear

b. State Six examples of ergonomic considerations in the design of a lathe machine

c. Hollow shaft is required to transmit 50 kW power at 600 rpm. Calculate its inside and outside diameters if its ratio is 0.8. Consider yield strength of material as 380N/mm^2 and factor of safety as 4.

Scheme – I

Sample Test Paper - II

Program Name : **Diploma in Mechanical Engineering / Production Engineering / Production Technology**

Program Code : **ME / PG/ PT**

22564

Semester : **Fifth**

Course Title : **Elements of Machine Design**

Marks : **20** **Time: 1 Hour**

Instructions:

(1) All questions are compulsory.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data if necessary.

(5) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR. **08 Marks**

a. Draw neat labelled sketches of Acme and square thread profile

b. Write the equation with Wahl's factor, used for design of helical coil spring.

c. Differentiate between sliding contact and rolling contact type bearings

d. List the applications of Welded joints

e. Name any four manufacturers of Bearing

f. Explain the Design procedure for eccentrically loaded Bolted joint when load is perpendicular to the axis of the bolt

Q.2 Attempt any TWO. **12 Marks**

a. A taper roller bearing has a dynamic load capacity of 26 kN. The desired life for 90% of the bearing is 8000 hr. and speed is 300 rpm. Calculate equivalent radial load that the bearing can carry.

b) A helical spring is made from a wire of 8 mm diameter and has outside diameter 90 mm; if the permissible shear stress is 350 N/mm^2 and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and the deflection per active turn.

i) Neglecting the effect of curvature.

ii) Considering the effect of curvature

c) A power screw on a machine has single start square thread with a non rotating bronze nut. Axial force on the screw is 15 kN. Allowable stresses for screw material in compression and shear are 85 MPa and 37 MPa respectively. Allowable bearing pressure for the screw nut pair is 5 MPa. Find

(i) Core diameter of screw

(ii) Length of the nut

(iii) Efficiency of power screw in coefficient of friction between screw and nut is 0.12.

(iv) Shear stresses in the threads of screw and nut.