

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2101

Roll No.

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B. Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION
2010-11

MACHINE DESIGN—I

Time : 2 Hours

Total Marks : 50

Note : Attempt **all** questions. Design Data Books are allowed in Exam. Hall. Any missing data may be assumed suitably.

1. Attempt any **three** parts of the following : $(4 \times 3 = 12)$
 - (a) Define and classify Machine Design.
 - (b) Explain stress-strain diagram for mild steel and cast iron.
 - (c) Describe briefly Creep and Fatigue.
 - (d) Explain Saint Venant's theory.
 - (e) Classify materials for engineering use.
2. Attempt any **two** parts of the following : $(6 \times 2 = 12)$
 - (a) What are the various factors that reduce Fatigue strength of materials ? What factors should be considered while designing against Fatigue ?
 - (b) Determine the thickness of a 115 mm wide uniform plate for safe continuous operation, if the plate is to be subjected to a tensile load that has a maximum value of 225 kN and a minimum value of 75 kN. The properties of the plate material are as follows :
Endurance limit stress = 225 MPa and
Yield point stress = 300 MPa.
The factor of safety based on yield point may be taken as 1.5.

(c) What is function of rivet ? Describe type of rivetted joint ? With neat diagrams explain various failure modes of rivets.

3. Attempt any two parts of the following : (6×2=12)

(a) A 40 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of 12 mm wide and 8 mm thick made of steel with a yield strength of 340 MPa is to be used. Find the required length of key. The shaft is loaded to transmit maximum permissible torque. Use maximum shear stress theory and assume a factor of safety 2.

(b) Write short note on the splined shaft, covering the points of application and different types of splined shaft.

(c) Design a clamp coupling to transmit 25 kW at 100 rpm. The allowable shear stress for shaft and key is 40 MPa and number of bolts connecting the two halves is six. The coefficient of friction between the muff and the shaft surface may be taken as 0.25. The permissible tensile stress for the bolts is 70 MPa.

4. Attempt any two parts of the following : (7×2=14)

(a) What is the function of spring ? Define following terms used in compression spring :

- (i) Solid length
- (ii) Free length
- (iii) Spring index
- (iv) Spring rate.

(b) An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 250 mm/min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw thread is 0.1. Estimate power of the motor.

(c) A simple screw jack is used to lift a load of 95 kN having a maximum lift of 250 mm. Allowable bearing pressure between screw and nut is 15 N/mm². The stress for screw and nut are given as follows :

Parts	Ultimate tensile/ Compression strength N/mm ²	Shear stress N/mm ²	Factor of safety
Screw	800	340	4
Nut	552	260	5

Design the screw and nut and check for its design safety.