

Printed Pages—4

TME—502

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

PAPER ID : 4075

Roll No.

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B.Tech.

FIFTH SEMESTER EXAMINATION, 2006-07

MACHINE DESIGN - I

Time : 3 Hours

Total Marks : 100

- Note :**
- (i) Attempt **ALL** questions.
 - (ii) All questions carry equal marks.
 - (iii) In case of numerical problems assume data wherever not provided.
 - (iv) Only data book is allowed related to design.
 - (v) Be precise in your answer.

1. Attempt **any two** parts of the following : (10×2=20)

- (a) (i) What do you understand by "Mechanical Engineering Design" ?
- (ii) Discuss the basic requirements for machine elements and machines.
- (b) (i) Define and discuss optimum design.
- (ii) Explain briefly various theories of failure.
- (c) (i) Which alloy steel is suitable for springs and why ?
- (ii) Give the materials which are commonly used for the following parts and give the reason also.
Shaft, screw, piston, connecting rod.

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2. Attempt *any two* parts of the following : (10x2=20)
- (a) Discuss Soderberg method for combination of stresses.
 - (b) Use Soderberg formula to determine the thickness of a 110 mm wide plate for safe continuous operation, if the plate is to be subjected to a tensile load that has a maximum value of 250000 N and minimum value of 10,000 kgf. The properties of the plate material are as follows
Endurance limit = 22500 N/cm^2
Yield stress = 30000 N/cm^2
The factor of safety = 1.5
 - (c) A mild steel shaft of 4 cm diameter is subjected to a bending moment of 1,50,000 N cms and a Torque T. If the yield point of the steel in tension is 20000 N/cm^2 find the maximum value of this torque T without causing yielding of the shaft according to
 - (i) maximum principle stress theory
 - (ii) the maximum shear stress theory.
3. Attempt *any two* parts of the following : (10x2=20)
- (a) A plate 100 mm wide and 13 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. find the length of the weld so that the maximum stress does not exceed 56 N/mm^2 consider the joint first under static loading and then under fatigue loading.
 - (b) The cylinder head of a steam engine is subjected to a steam pressure of 0.8 N/mm^2 . It is held in position by 12 bolts. A soft copper gasket is used to a make the joint leak proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 N/mm^2 .

- (c) A line shaft rotating at 200 rpm is to transmit 25 kW. The allowable shear stress for the material of the shaft is 4200 N/cm^2 . If the shaft carries a central load of 900 N and is simply supported between bearings 3 metre apart, determine the diameter of the shaft. The maximum tensile or compressive stress is not to exceed 5600 N/cm^2 .

4. Attempt *two* parts of the following : (10x2=20)

- (a) (i) Explain surging in springs. [5]
(ii) Design a helical spring for spring loaded safety valve for the following condition operating pressure = 1 N/mm^2

Maximum pressure when the valve blows off freely = 1.075 N/mm^2

Maximum lift of the valve when the pressure is $1.075 \text{ N/mm}^2 = 6 \text{ mm}$

Diameter of the valve seat = 100 mm

Maximum shear stress = 400 N/mm^2

Modulus of rigidity = $80 \times 10^3 \text{ N/mm}^2$

Spring index = 5.5 [15]

- (b) A screw jack suitable to lift a maximum load of 50 kN through a height of 200 mm with ground clearance of 300 mm is to be designed. The allowable bearing pressure between nut and screw is 16 N/mm^2 . Coefficient of friction of threads and collars may be taken as 0.14. Select suitable material and stresses. Use design data hand book.

5. Attempt *any five* parts of the following : (4x5=20)
- (a) Discuss Need based analysis.
 - (b) Discuss Design by Evaluation.
 - (c) What do you mean by technology based developments ?
 - (d) What do you mean by case studies ?
 - (e) What do you mean by Brain storming ?
 - (f) Write short note on product development and design.
 - (g) Standardisation and Interchangeability.

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