

D-180275

B. Tech. EXAMINATION, 2018

Semester V (CBS)

MACHINE DESIGN-I (ME, AE)

ME-504

Time : 3 Hours

Maximum Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet, will be issued.

Note : Attempt Five questions in all, selecting *one* question from each Section B, C, D and E and all the subparts of question in Section A.

Section A

Attempt all questions :

- (a)✓ What is Ergonomics ? 2
- (b) What is Maximum Principal Strain Theory ? 2
- (c)✓ What are Fits and Tolerances ? 2

- (d) What is meant by 'hole basis system' and 'shaft basis system' ? 2
- (e) What is Proof Resilience ? 2
- (f)✓ What is meant by eccentric loading and eccentricity ? 2
- (g) What is Endurance Limit ? 2
- (h)✓ What do you understand by the term 'efficiency of a riveted joint' ? 2
- (i) Explain seam welding. 2
- (j) What type of stresses developed in the key ? 2

Section B

- ✓ (a) Derive an expression for the impact stress induced due to a falling load. 5
- (b) A wrought iron bar 60 mm in diameter and 3 m long transmits a shock energy of 100 N-m. Find the maximum instantaneous stress and elongation. Take $E = 200 \text{ GN/m}^2$. 5
- (a) What is meant by 'stress concentration' ? How do you take it into consideration in case of a component subjected to dynamic loading ? 5

- (b) Find the extreme diameters of shaft and hole for a transition fit H7/n6, if the nominal or basic diameter is 12 mm. What is the value of clearance and interference ? 5

Section C

- ✓ Compare the weight, strength and stiffness of a hollow shaft of the same external diameter as that of solid shaft. The inside diameter of the hollow shaft being half the external diameter and both the shafts have the same material and length. 10
5. A steel shaft has a diameter of 25 mm. The shaft rotates at a speed of 600 rpm and transmits 30 kW through a gear. The tensile and yield strength of the material of shaft are 650 MPa and 353 MPa respectively. Taking a factor of safety 3, select a suitable key for the gear. Assume that the key and shaft are made of the same material. 10

Section D

6. A double riveted lap joint with chain riveting is to be made for joining two plates 10 mm thick. The allowable stresses are : Tensile stress = 50 MPa; Shear stress = 40 MPa and Compressive stress = 90 MPa. Find the rivet diameter, pitch of rivets and distance between rows rivets. Also find the efficiency of the joint. 10

7. A low carbon steel plate of 0.7 m width welded to a structure of similar material by means of two parallel fillet welds of 0.11 m length (each) is subjected to an eccentric load of 4000 N, the line of action of which has a distance of 1.5 m from the centre of gravity of the weld group. Design the required thickness of the plate when the allowable stress of the weld metal is 60 MPa and that of the plate is 40 MPa. 10

Section E

8. 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. 10
9. A seamless pipe carries 2400 m³ of steam per hour at a pressure of 1.4 N/mm². The velocity of flow is 30 m/s. Assuming the tensile stress as 40 MPa, find the inside diameter of the pipe and its wall thickness. 10

P.T.O.