

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: MEC-212

Subject: Machine Design-I

Time: 3 Hours

Maximum Marks: 75

Note: Attempt five questions in all including Q. no.1 which is compulsory. Select one question from each unit.

- Q1 Answer the following: (10×1.5=15)
- (a) Enlist the most important basic principle of a good mechanical design
 - (b) Define the factor of safety.
 - (c) What do you mean by stress concentration?
 - (d) Write different types of keys.
 - (e) What is the dynamic loading and fluctuating stress?
 - (f) Why butt joints are preferred over lap joints.
 - (g) Write the advantages offered by the threaded joint.
 - (h) What is the function of a power screw?
 - (i) What is spur gear?
 - (j) What is the lever? Explain the principle on which it works.

UNIT- I

- Q2 (a) What is the fatigue or endurance limit of a material? Explain the mechanism of such failure. (8)
- (b) Explain the causes of stress concentration. (7)
- Q3 (a) Explain the design procedure of the Spigot and Socket Cotter Joint. (10)
- (b) Design a knuckle joint to transmit 150 kN. The design stress may taken as 75 MPa in tension, 60 MPa in shear, and 150 MPa in compression. (5)

UNIT- II

- Q4 Compare the weight, strength, and stiffness of a hollow shaft of some external diameter to that of a solid shaft. The inside diameter of the hollow shaft is half the external diameter Both the shafts have the same material and length. (15)
- Q5 Design a close-coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for load range is 6mm. Assume the spring index of 5. The permissible shear stress 420 MPa. And the modulus of rigidity $G=84\text{kN/mm}^2$ Neglects the effect of stress concentration. Draw fully dimensioned sketch of the spring, showing details of the finish of the end coils. (15)

UNIT- III

- Q6 An eccentrically loaded lap riveted joint is to be designed for a steel bracket as shown in Figure 1. The bracket plate is 25 mm thick. All rivets are to be of the same size. Load on the bracket $P=50\text{ kN}$; rivet spacing $C=100\text{ mm}$ load arm $e=400\text{ mm}$. Permissible stress is 65 MPa and crushing stress is 120 MPa. Determine the size of the rivet to be used for the joint. (15)

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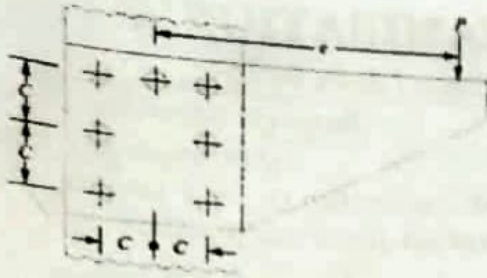


Figure 1

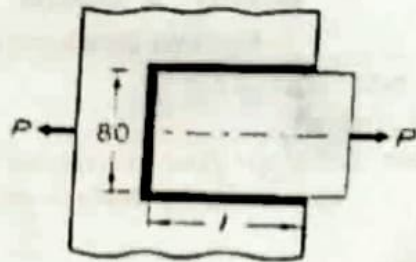


Figure 2

- Q7 A steel plate, 80 mm wide and 10 mm thick, is joined to another steel plate by means of a single transverse and double parallel fillet weld, as shown in Figure 2. The strength of the welded joint should be equal to the strength of the plate to be joined. The permissible tensile and shear stresses for the weld material and plates are 100 MPa and 70 MPa respectively. Find the length of each parallel fillet weld. Assume that the tensile force passes through the center of gravity of three welds. (15)

UNIT- IV

- Q8 Explain the complete analysis of the design of Screw Jack. (15)
- Q9 The following particulars of a single reduction spur gear are given:
 Gear Ratio = 10; Distance between centers = 660 mm approximately;
 Pinion transmits 500 kW at 1800 rpm; Involute teeth of standard proportions (addendum = m) with the pressure angle of 22.6° ;
 Permissible normal pressure between teeth = 175 N per width. Find
 (i) The nearest standard module if no interference is to occur;
 (ii) The number of teeth on each wheel;
 (iii) The necessary width of the pinion; and
 (iv) The load on the bearing of the wheel due to power transmitted. (15)

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