

T.E./Insem.-606
T.E.(Mechanical (Semester - I)
DESIGN OF MACHINE ELEMENT - I
(2015 Pattern)

Time : 1.30 Hours]

[Max. Marks :30

Instructions to the candidates:

- 1) Answer (Q1) or (Q2), (Q3) or (Q4), (Q5) or (Q6).
- 2) Draw neat labelled diagrams wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary and clearly mention the assumed data.

Unit - I

Q1) a) State any eight factors deciding the magnitude of factor of safety. [4]

- b) Figure 1 shows a C clamp which carries a load P of 25 kN. The cross section of the clamp is a rectangular section and the ratio of width to thickness (b/t) is 2:1. The clamp is made of cast steel of grade 20-40 ($S_{ut} = 400 \text{ N/mm}^2$) and the factor of safety is 4. Determine the cross section of the clamp. [6]

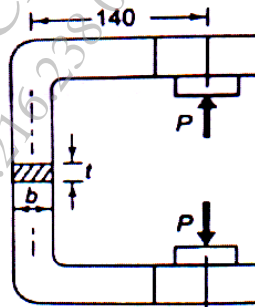


Fig. No. 1.

OR

- Q2)** A bell crank lever is subjected to a force of 7.5kN at the short arm end. The lengths of the short and long arms are 100 and 500 mm respectively. The arms are at right angles to each other. The lever and pins are made of steel FeE 300 ($S_{yt} = 300 \text{ N/mm}^2$) and the factor of [10]

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safety is 5. The permissible bearing pressure on the pin is 10N/mm^2 . The lever has rectangular cross-section and the ratio of width to thickness is 4:1. The length to diameter ratio of the fulcrum is 1.5:1 calculate,

- i) Diameter and length of the fulcrum pin
- ii) Shear stress in the pin
- iii) Dimensions of cross section of the lever.

Unit - II

- Q3)** a) Explain shaft design on the basis of torsional rigidity derive the necessary equation [4]
- b) A standard splined connection $8\times 36\times 40$ is used for a gear and shaft assembly rotating at 700 rpm. The dimensions of the spline are as mentioned under.

Major diameter = 40 mm and Minor diameter = 36 mm

Number of splines = 08.

The length of the gear hub is 50mm and the normal pressure on the splines is limited to 6.5 N/mm^2 . Calculate the power that can be transmitted from the gear to the shaft. [6]

OR

- Q4)** a) Differentiate between rigid and flexible couplings. [4]
- b) Following are the specifications given for a rigid coupling: [6]

- i) Outer diameter of flanges = 100 mm
- ii) Diameter of recess = 095 mm
- iii) Number of bolts = 06
- iv) Pre-load on each bolt = 10kN
- v) Coefficient of Friction = 0.15
- vi) Speed of rotation = 100 r.p.m

The bolts are fitted in large clearance with the holes. Calculate the power transmitting capacity of the coupling.

Unit - III

- Q5)** a) State endurance limit modifying factors. Explain any two in detail. [4]
- b) A forged steel bar, 50mm in diameter is subjected to a reversed Bending stress of 250N/mm^2 . The bar is made of steel 40C8 ($S_{ut} = 600\text{N/mm}^2$). Calculate the life of bar for a reliability of 90%. [6]

OR

- Q6)** a) Explain with neat sketch S-N curve for steel material. [4]
- b) A rotating bar made of steel 40C8 ($S_{ut} = 580\text{N/mm}^2$) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 275N/mm^2 . Calculate the fatigue strength of the bar for a life of 90000 cycles. [6]

