

B.Tech III Year I Semester (R09) Supplementary Examinations June 2017

**DESIGN OF MACHINE ELEMENTS – I**

(Mechanical Engineering)

Time: 3 hours

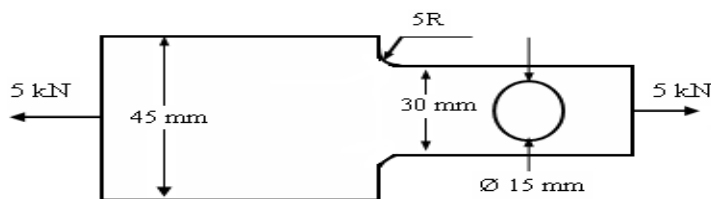
Max. Marks: 70

Answer any FIVE questions  
All questions carry equal marks

Use of Design data books is permitted in the examination hall

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- 1 (a) Calculate the limit dimensions for an interference fit on the shaft basis system for a basic size of 25 mm with a maximum interference 0.15 mm. Tolerance on the hole is 0.4 mm and the tolerance on the shaft is 0.25 mm. Check the calculated dimensions.  
(b) Write short notes on: (i) Interchangeability. (ii) Fits.
- 2 (a) A cantilever member 100 mm long having cross section of 50 mm x 250 mm supports a load of 27.5 kN. What is the maximum shear stress and where does it occur?  
(b) Find the diameter of a steel rod 1.5 m long if it resists the impact of 2500 N dropped through a distance of 50 mm along the axis. The maximum stress is limited to  $150 \text{ N/mm}^2$ . Take  $E = 2.1 \times 10^5 \text{ N/mm}^2$ .
- 3 (a) What is the criteria of failure for ductile material subjected to (i) Static load. (ii) Varying load.  
(b) A flat plate subjected to a tensile force of 5 kN is shown in figure below. The plate material is grey cast iron FG 200 and the factor of safety is 2.5. Determine the thickness of the plate. Take the stress concentration factor as 1.8 at the hole and as 2.16 for the fillet radius.



- 4 (a) Explain the different methods of riveting.  
(b) What are the various assumptions made in the design of riveted joint?  
(c) What is the difference between chain riveting and zig-zag riveting?
- 5 (a) A M16, 25 mm long bolt is subjected to an impact load. The kinetic energy to be absorbed is 5000 Nm. Determine the stress in the shank of the bolt if there is no threaded portion between the nut and the bolt head.  
(b) A steam engine cylinder of effective diameter of 250 mm is subjected to a steam pressure of 2 MPa. The cylinder head is connected by means of bolts. Bolts are tightened with an initial pre-load at 1.5 times the steam load. A soft copper gasket is used to make the joint leak proof. Assuming  $k = 0.25$ , determine the bolt diameter.
- 6 Sketch and explain the design procedure for a Cotter joint with Gib.
- 7 A line shaft is driven from a motor directly under it by means of a belt running over 1600 mm pulley attached to the line shaft. The pull on the tight side of the belt is 5500 N and on the slack side 2250 N. The weight of the pulley is 3000 N. The pulley is over hung, the distance from the central plane of the pulley to the centre line of the supporting bearing is 300 mm. The ultimate tensile and shear strength of the shaft material may be taken as  $440 \text{ N/mm}^2$  and  $330 \text{ N/mm}^2$  respectively. Determine the diameter of the shaft using a factor of safety of 6.
- 8 Design split muff coupling to transmit 30 kW power at 150 rpm. The allowable stresses are as follows:  
For shaft, keys and bolts:  $50 \text{ N/mm}^2$  in shear and  $100 \text{ N/mm}^2$  both in tensile and compressive. For muff:  $15 \text{ N/mm}^2$  in shear. Coefficient of friction between the muff and shafts = 0.15.