

R09

Code: 9A03504

B.Tech III Year I Semester (R09) Supplementary Examinations December 2015

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

- 1 (a) Explain why brittleness is an undesirable property, especially for materials to be used as machine parts.
(b) Explain the terms: (i) Creep. (ii) Machinability.
- 2 (a) Explain: (i) Maximum normal stress. (ii) Maximum principal strain theories of elastic failure.
(b) An I-section beam of depth 250 mm is supported at two points 4 m apart. It is loaded by a weight of 4 kN falling through a height 'h' and striking the beam at mid span. Moment of inertia of the section is $8 \times 10^7 \text{ mm}^4$. Modulus of elasticity is 210 kN/mm^2 . Determine the permissible value of 'h' if the stress is limited to 120 N/mm^2 .
- 3 (a) Explain the Miner's cumulative damage equation in fatigue.
(b) A component is subjected to completely reversed stress cycle which varies over a 30 second time period, as follows: 10 cycles at 500 MPa; 5 cycles at 600 MPa; and 3 cycles at 700 MPa. The corresponding fatigue lives for the above stresses are: 10^5 , 4×10^4 , and 1.5×10^4 cycles respectively. Determine the fatigue life of the component.
- 4 (a) What are the advantages and disadvantages of riveted joints?
(b) A triple riveted lap joint is to be made between 6.5 mm plates. The allowable stresses are 35 N/mm^2 in tensile, 29 N/mm^2 in shear, and 52.5 N/mm^2 in compression. Calculate the rivet diameter, rivet pitch and back pitch, zig-zag riveting is to be used. Indicate how the joint will fail.
- 5 (a) What hole must be drilled in the head of the bolt M36, to make uniform strength?
(b) A bolt is used to fasten two members together. The members and the bolt are of the same material and have the same cross section area. Determine what external load W_2 will cause separation of the members to occur if the initial tightening load W_1 is 20 kN.
- 6 Sketch and explain the design procedure for a Cotter joint with sleeve.
- 7 A shaft, 2 m long between bearings, carries a 900 N pulley at its midpoint. Through a belt drive, the shaft receives 25 kW at 180 rpm. The belt drive is horizontal, and the sum of the belt tensions is 7 kN. Assume the permissible shear stress in the shaft material as 50 MPa. Take shock and fatigue factors for torsion and bending as 2 and 1.5 respectively. Determine the diameter of the shaft, based on (i) Strength. (ii) Torsional stiffness. (iii) Lateral stiffness.
- 8 (a) State the various types of keys used with shafts for torque transmission and describe their special features.
(b) Give construction details of Oldham coupling and describe its features. Why it is not preferred for high speed shafts?
