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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. – Automobile Engineering

Semester End Examination, Dec. - 2014

Design of the Elements - I

Time: 3 hrs

Max. Marks: 100

Note: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.
ii) Use of DDH book is permitted. iii) Missing data if any may be suitably assumed.

PART – A

- 1 a. Mention any six important characteristics that must be considered in designing a machine part. 6
- b. Discuss factors influencing selection of appropriate value for the factor of safety. 6
- c. A beam of uniform rectangular cross section is fixed at one end and carries a load 1000 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 80 N/mm^2 . Find the width and depth of beam, if depth is twice that of width. 8
- 2 a. Explain stress concentration. 5
- b. The load on the bolt consists of an axial pull of 10 kN together with a transverse shear of 5 kN. Find the size of the bolt according to,
- i) Maximum principal stress theory ii) Maximum shear stress theory
- iii) Maximum principal strain theory iv) Maximum strain energy theory 15
- v) Maximum shear energy theory.
- Take tensile stress at elastic limit as 100 N/mm^2 and Poisson's ratio = 0.3
- 3a. Explain low cycle fatigue and high cycle fatigue. 6
- b. A cantilever beam Fig. 3(b) made of cold drawn carbon steel ($\sigma_u = 550 \text{ MPa}$, $\sigma_y = 470 \text{ MPa}$, $\sigma_{en} = 275 \text{ MPa}$) of circular cross section is subjected to load which varies from $-F$ to $3F$. Determine the maximum load that this member can with stand for an indefinite life using a factor of safety of 2.

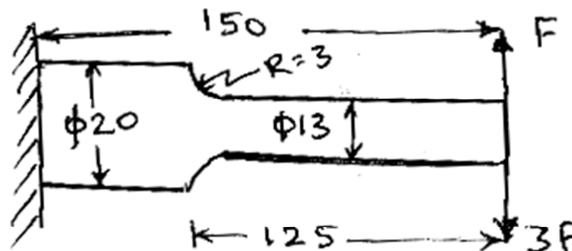


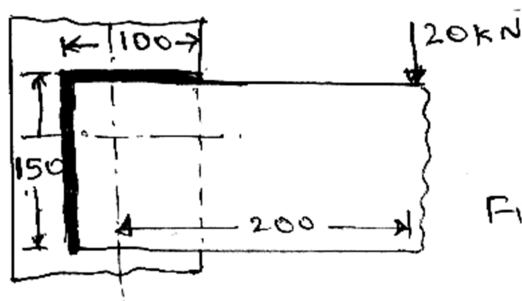
Fig 3.b

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- 4 a. Design a knuckle joint to connect two mild steel rods subjected to an axial pull of 100 kN. The allowable stresses for rods and pin are 100 MPa intension, 130 MPa in crushing, 60 MPa in shear. 10
- b. Determine the dimensions of a tapered key to transmit 10 kW at 1000 rpm. Also find the axial force necessary to drive the keyhome. The permissible shear and compressive stresses in the key material are 60 N/mm^2 and 130 N/mm^2 respectively. 10

PART – B

5. A shaft is supported by bearings placed 1100 mm apart. A pulley of diameter 620 mm is keyed at 400 mm to the right from the left hand bearing and this drives a pulley directly below it with a maximum tension of 2.75 kN. Another pulley of diameter 400 mm is placed 200 mm to the left of right hand bearing and driven with a motor placed horizontally to the right. The angle of contact of the pulleys is 180° and coefficients of friction is 0.3. Find the diameter of the shaft. Assume $C_m = 3$, $C_t = 2.5$. Allowable shear stress = 40.5 N/mm^2 . 20
- 6 a. Sketch and explain following forms of screw threads. 10
- i) British standard whit worth thread ii) ACME thread
- Give their applications with examples.
- b. The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2 . It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak proof. The effective diameters of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolt not to exceed 100 MPa. 10
- 7 a. Clearly explain classification of riveted joints with suitable sketches. 8
- b. Design a double riveted butt joint with two corner plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm^2 . Assume joint efficiency = 75%, $\sigma_t = 90 \text{ MPa}$, $\sigma_e = 140 \text{ MPa}$ and shear stress $\tau = 56 \text{ MPa}$. 12
- 8 a. Explain types of screw threads used for power screws. 5
- b. What are the advantages of welded joints? 5
- c. Fig. 8(C) shows a welded joint. Determine the size of weld permissible shear stress for weld material is 80 MPa.



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