



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



III SEMESTER B.TECH (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: AUTOMOTIVE STRUCTURES AND DESIGN [AAE 2152]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.
- 1A. The load on a bolt consists of an axial pull of 10 kN together with a (08) transverse shear force of 5 kN. Find the diameter of bolt required according to
 - a. Maximum principal stress theory; b. Maximum shear stress theory;
 - c. Maximum principal strain theory; d. Maximum strain energy theory; and f. Maximum distortion energy theory.
- **1B.** When material is loaded with in the elastic limit, then stress is ______ to (01) strain

a) equal b) directly proportional c) inversely proportional

- **1C.** A solid shaft transmit a torque T, the allowable stress τ , the diameter of the **(01)** shaft is _____
- 2A. A section of 50 mm diameter shaft shown in figure 1 has transverse hole of (06) 2.5mm diameter. Bending moment at section is 1.5 kN-m. Investigate
 - a. nominal stress in the shaft at this section
 - b. stress concentration factor and maximum stress
 - c. Factor of safety if material is hot rolled carbon steel with 0.5% of carbon
- 2B. A Flat plate shown in figure 2 subjected to a tensile force of 5 kN, the plate (04) material is Gray cast iron FG200 and Factor of safety is 2.5. Determine the thickness of plate.
- 3A. A power screw having double started square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear

condition at the collar and allowable thread bearing pressure of 5.8 N/mm2, find:

- 1. the torque required to rotate the screw;
- 2. the stress in the screw; and
- 3. the number of threads of nut in engagement with screw.
- **3B.** Briefly explain the overhauling and self-locking and need of self-locking in the **(03)** power screw.
- 4A. A shaft is supported on bearings A and B, 800 mm between centers. A 20° (07) straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3: 1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa.
- **4B.** Draw the torque diagram, vertical and horizontal load diagram and resultant **(03)** bending moment diagram for question 4A.
- 5A. A 200 × 150 × 10 mm angle is to be welded to a steel plate by fillet welds as shown in Fig. 3. If the angle is subjected to a static load of 200 kN, find the length of weld at the top and bottom. The allowable shear stress for static loading may be taken as 75 MPa.
- 5B. An eccentrically loaded lap riveted joint is to be designed for a steel bracket (06) as shown in Fig. 4. The bracket plate is 25 mm thick. All rivets are to be of the same size. Load on the bracket, P = 50 kN ; rivet spacing, C = 100 mm; load arm, e = 400 mm. Permissible shear stress is 65 MPa and crushing stress is 120 MPa. Determine the size of the rivets to be used for the joint





Figure 2







Figure 4