Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

III SEMESTER B.TECH (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2015/JAN 2016

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 shaft of an overhang crank subjected to a force P of 1 kN is shown in Figure 1. The shaft is made of plain carbon steel 45C8 and the tensile yield strength is 380 N/mm^2. The factor of safety is 2. Determine the diameter of the shaft using the maximum shear stress theory. **(05)**

1B. A hollow circular column of external diameter 250 mm and internal diameter 200 mm carries a projecting bracket on which a load of 20 kN rests, as shown in Figure 2. The center of the load from the center of the column is 500 mm. Find the stresses at the sides of the column. **(05)**

2A. A steel rod is subjected to a reversed axial load of 180 kN. Find the diameter of the rod for a factor of safety of 2. Neglect column action. The material has an ultimate tensile strength of 1070 MPa and yield strength of 910 MPa. The endurance limit in reversed bending may be assumed to be one-half of the ultimate tensile strength. Other correction factors may be taken as follows: For axial loading = 0.7; For machined surface = 0.8 ; For size = 0.85 : For stress concentration = 1.0. **(07)**

2B. A rectangular plate 50 mm × 10 mm with a whole 10 mm diameter is subjected to an axial load of 10 kN. Taking stress concentration into account, find the maximum stress induced. **(03)**

3A. The screw, as shown in Figure 3 is operated by a torque applied to the lower end. The nut is loaded and prevented from turning by guides. Assume friction in the ball bearing to be negligible. The screw is a triple start trapezoidal thread. The outside diameter of the screw is 48 mm and pitch is 8 mm. The coefficient of friction of the threads is 0.15. Find: **(07)**

1. Load which can be raised by a torque of 40 N-m ;
2. Whether the screw is overhauling ; and
3. Average bearing pressure between the screw and nut thread surface.

3B. a) Differentiate between buttress threads and Trapezoidal threads **(03)**
b) Excess lubrication of lubrication _____ self-locking
c) Chucking is done to prevent _____

4A. Figure 4 shows a shaft carrying a pulley A and a gear B and supported in two bearings C and D. The shaft transmits 20 kW at 150 r.p.m. The tangential force F on the gear B acts vertically upwards as shown. The pulley delivers the power through a belt to another pulley of equal diameter vertically below the pulley A. The ratio of tensions T1/T2 is equal to 2.5. The gear and the pulley weigh 900 N and 2700 N respectively. The permissible shear stress for the material of the shaft may be taken as 63 MPa. Assuming the weight of the shaft to be negligible in comparison with the other loads, determine its diameter. Take shock and fatigue factors for bending and torsion as 2 and 1.5 respectively. **(07)**

4B. A shaft made of mild steel is required to transmit 100 kW at 300 r.p.m. The supported length of the shaft is 3 meters. It carries two pulleys each weighing 1500 N supported at a distance of 1 meter from the ends respectively. Assuming the safe value of stress, determine the diameter of the shaft. **(03)**

5A. A 50 mm diameter solid shaft is welded to a flat plate as shown in figure 5. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld. **(05)**

5B. Find the efficiency of the following riveted joints: **(05)**
1. Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm.
2. Double riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm.
Assume
Permissible tensile stress in plate = 120 MPa
Permissible shearing stress in rivets = 90 MPa
Permissible crushing stress in rivets = 180 MPa

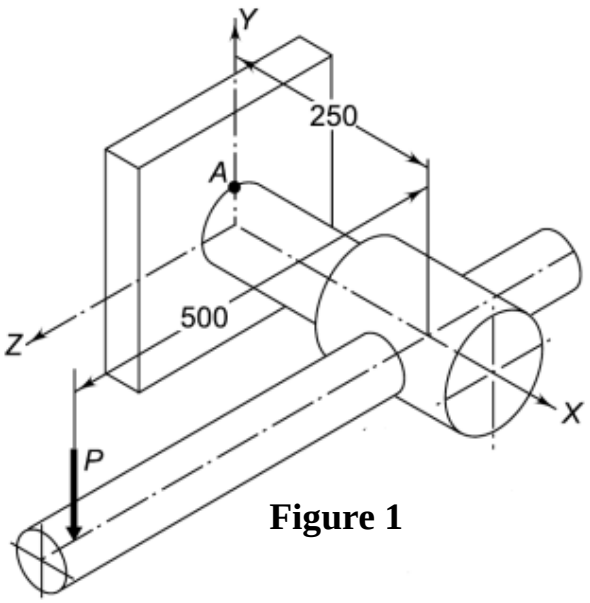

Figure 1

e 3

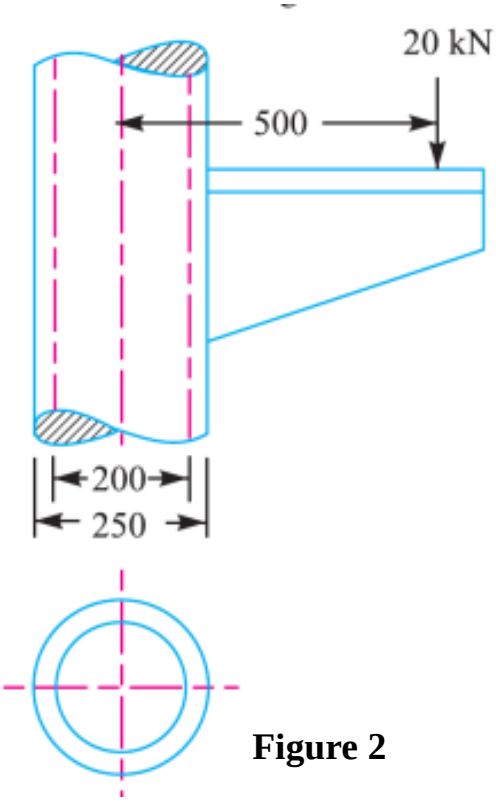

Figure 2

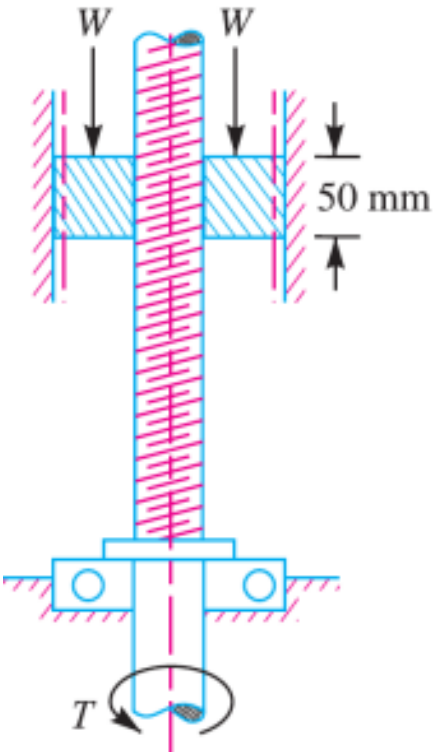

Figure 3

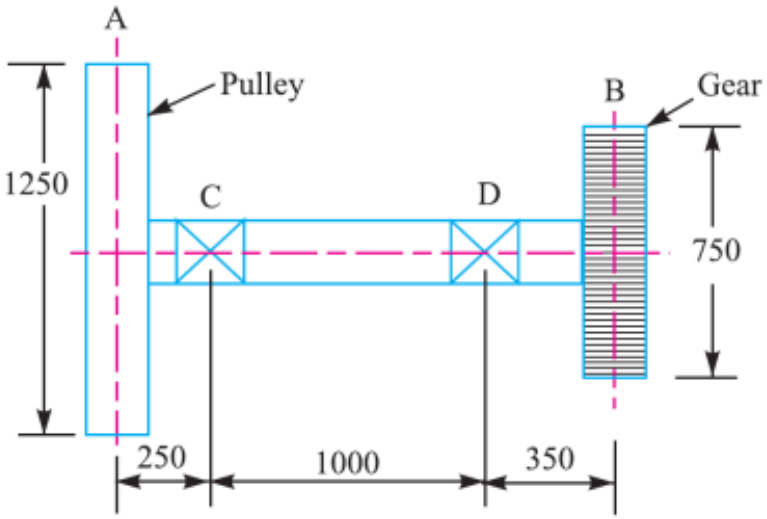

Figure 4

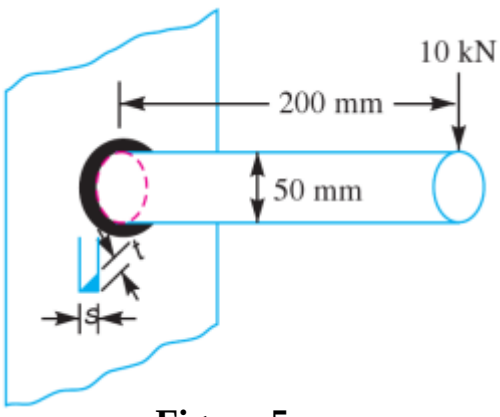

Figure 5