Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: AUTOMOTIVE STRUCTURES AND DESIGN [AAE 2152]

REVISED CREDIT SYSTEM
(28/11/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, IF ANY, may be suitable assumed and clearly mentioned.

1A. With a neat sketch explain the working of electric arc welding. Briefly explain thermit and gas welding. **(05)**

1B. With neat sketches and dimensional relationship classify 5 types of riveted joints. **(05)**

2A. A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and torsional moment 30 kN-m. Determine the diameter of the shaft using two suitable theories of failure, and assuming a factor of safety of 2. Take E = 210 GPa and Poisson's ratio = 0.25. **(05)**

2B. A pulley is keyed to a shaft midway between two bearings. The shaft is made of cold drawn steel for which the ultimate strength is 550 MPa and the yield strength is 400 MPa. The bending moment at the pulley varies from – 150 N-m to + 400 N-m as the torque on the shaft varies from – 50 N-m to + 150 N-m. Obtain the diameter of the shaft for an indefinite life. The stress concentration factors for the keyway at the pulley in bending and in torsion are 1.6 and 1.3 respectively. Take the following values: Factor of safety = 1.5 Load correction factors = 1.0 in bending, and 0.6 in torsion Size effect factor = 0.85 Surface effect factor = 0.88 **(05)**

3A. A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact **(07)**

for both the pulleys is 180° and μ = 0.24. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley

3B. For the above shaft design, draw a line diagram consisting of all forces, reactions, bending moments and torques. **(03)**

4A. A hollow shaft of 0.5 m outside diameter and 0.3 m inside diameter is used to drive a propeller of a marine vessel. The shaft is mounted on bearings 6 meters apart and it transmits 5600 kW at 150 r.p.m. The maximum axial propeller thrust is 500 kN and the shaft weighs 70 kN. Determine: The maximum shear stress developed in the shaft, and the angular twist between the bearings. **(05)**

4B. With a neat sketch, deduce the relation for torque required to raise a load using square threaded screws. **(05)**

5A. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa; compressive stress 140 MPa; and shear stress in the rivet 56 MPa. **(05)**

5B. A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in Fig. 1. Determine the weld size if shear stress in the same is not to exceed 140 MPa. **(05)**

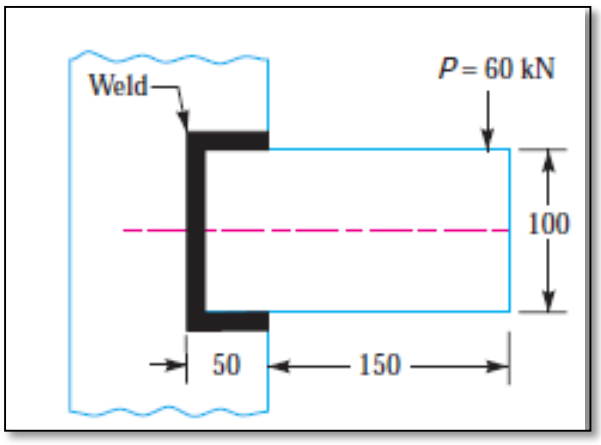

Fig. 1