Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: AUTOMOTIVE STRUCTURES AND DESIGN [AAE 2152]

REVISED CREDIT SYSTEM
(26/12/2017)

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. Deduce the Goodman relation for combination of stresses. **(03)**

1B. With neat sketch, explain the working of forge welding process. **(03)**

1C. With a neat sketch, derive a relation for torque required to raise a load by square threaded screws. **(04)**

2A. A rotating shaft of 16 mm diameter is made of plain carbon steel. It is subjected to axial load of 5000 N, a steady torque of 50 N-m and maximum bending moment of 75 N-m. Calculate the factor of safety available based on 1. Maximum normal stress theory; and 2. Maximum shear stress theory. Assume yield strength as 400 MPa for plain carbon steel. If all other data remaining same, what maximum yield strength of shaft material would be necessary using factor of safety of 1.686 and maximum distortion energy theory of failure. Comment on the result you get. **(06)**

2B. With a neat sketch explain the working of an electric arc welding process. **(04)**

3A. A steel cantilever is 200 mm long. It is subjected to an axial load which varies from 150 N (compression) to 450 N (tension) and also a transverse load at its free end which varies from 80 N up to 120 N down. The cantilever is of circular cross-section. It is of diameter 2d for the first 50 mm and of diameter d for the remaining length. Determine its diameter taking a factor of safety of 2. (σ_y=330 MPa, σ_{eb}=300 MPa, K_{tf}= 1.44 (bending), 1.64 (axial), K_{size}= 0.85, $K_{surface}$=0.90, q=0.90 **(06)**

3B. Mention any 4 merits and demerits of welded joints over riveted joints **(04)**

4A. 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 for both the pulleys is 180° and $\mu = 0.24$. 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. **(07)**

4B. For the above arrangement, draw the line diagram, load diagram, reaction load diagram, shear force and bending moment diagrams. **(03)**

5A. A steam boiler is to be designed for a working pressure of 2.5 N/mm^2 with its inside diameter 1.6 m. Give the design calculations for the longitudinal and circumferential joints for the following working stresses for steel plates and rivets: In tension = 75 MPa ; In shear = 60 MPa; In crushing = 125 MPa. **(05)**

5B. Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 r.p.m. The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa. **(05)**