Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: AIRCRAFT STRUCTURES [AAE 2101]

REVISED CREDIT SYSTEM
(22/11/2018)

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. A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is 15 cm, determine: the stress in the rod and tube and load carried by each bar. E= 2.1 x 10^5 N/mm^2 for steel and 1.1 x 10^5 N/mm^2 for copper. **(3)**

1B. A metallic bar 300 mm x 100 mm x 40 mm is subjected to a force of 5 kN (tensile), 6 kN (tensile) and 4 kN (tensile) along x, y and z directions respectively. Determine the change in volume of the block. Take E= 2 x 10^5 N/mm^2 and Poisson's ratio as 0.25 **(2)**

1C. The resultant stress on a plane at a point in a material under stress is 80 MPa inclined at 30° normal to the plane as shown in **Fig. 1**. The normal component of stress on another plane at right angle to the first plane is 60 MPa. Determine: resultant stress on the second plane, principal stresses and their planes, maximum shear stresses and their planes. **(5)**

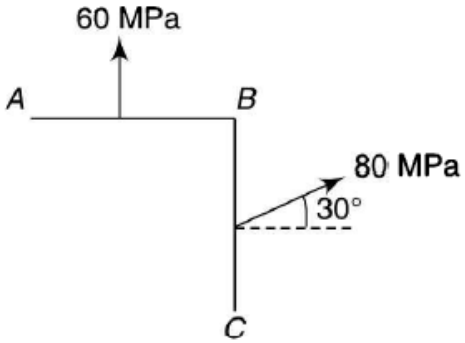

Fig. 1

2A. Using Macaulay's method derive an equation for slope and deflection in a simply supported beam with eccentrically acting load at a distance 'a' from the left end. **(5)**

2B. A cast iron bracket subjected to bending has an I-cross section with unequal flanges as shown in **Fig. 2**. Find the position of neutral axis and moment of inertia of the section about the neutral axis. If the maximum bending moment on the section is 40 MN-mm, determine the maximum bending stress and mention the nature of the stress. **(5)**

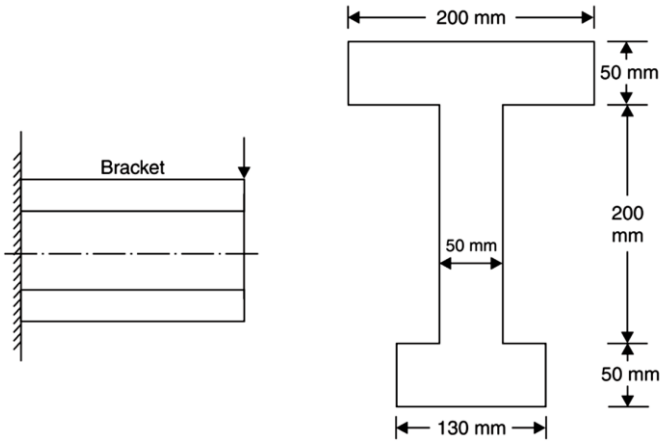

Fig. 2

3A. A simply supported beam of 8 m length carries two point loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left-hand end. Find the deflection under each load and the maximum deflection. Take E= 210 GPa and I= 180 x 10^6 mm^4. **(5)**

3B. What do you mean by effective length of a column? Mention the relationship between actual and effective length of a column when a) both ends are fixed b) when both ends are hinged. **(3)**

3C. A 4 m long circular bar deflects 20 mm at the center when used as a simply supported beam under a 200 N load at the center. Determine critical load for the same bar when used as a strut which is firmly fixed at one end and pin-jointed at the other. **(2)**

4A. Derive the shear flow equation for a thin walled open section beams subjected to pure shear loads **(5)**

4B. Idealize the box section shown in Fig. 3 into an arrangement of direct stress carrying booms positioned at the four corners and panels which are assumed to carry only shear stresses **(5)**

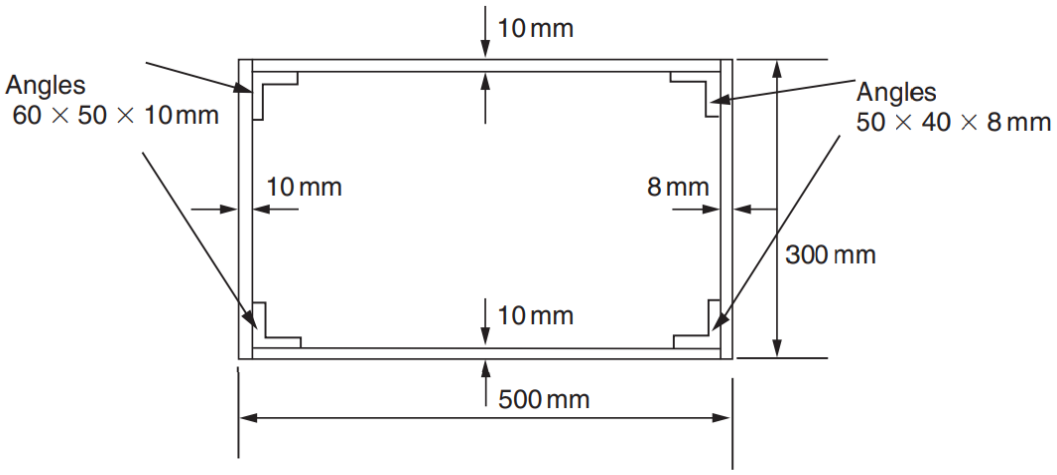

Fig. 3

5. The fuselage section shown in Fig. 4 is subjected to a bending moment of 100 kN m applied in the vertical plane of symmetry. If the section has been completely idealized into a combination of direct stress carrying booms and shear stress only carrying panels, determine the direct stress in each boom. **(10)**

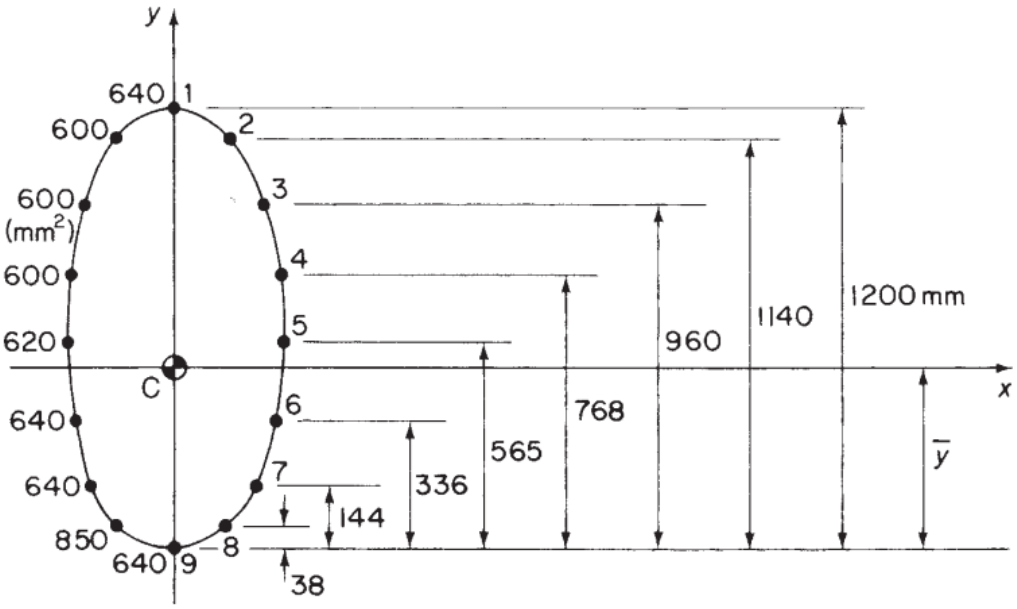

Fig. 4