Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2018

SUBJECT: AIRCRAFT DESIGN-II [AAE 3201]

REVISED CREDIT SYSTEM

(16/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. The thin walled single cell beam shown in figure 1A has been idealized into combination of direct stress carrying booms and shear stress only carrying walls. If the section supports a vertical shear load of 10kN and 20 KN acting in a vertical & horizontal plane, calculate the distribution of shear flow around the section. $B_1=B_8=150mm^2$, $B_2=B_7=160mm^2$, $B_3=B_6=210mm^2$, $B_4=B_5=130mm^2$ **(06)**

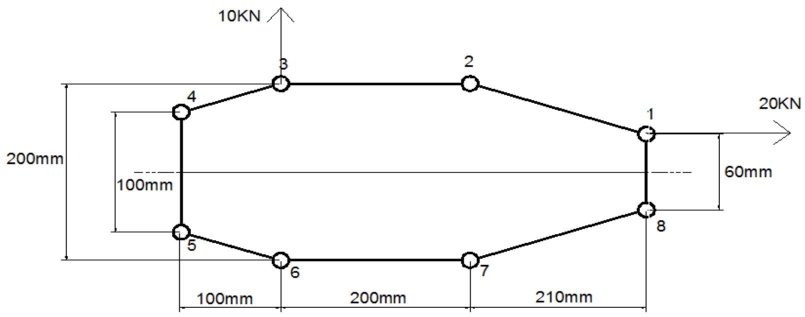

Figure 1A

1B. What are the main structural members of fuselage and also explain the classification of fuselage based of these structures. **(04)**

2A. A beam having the cross-section shown in following figure 2A is subjected to a bending moment of 1100Nm in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it acts. **(06)**

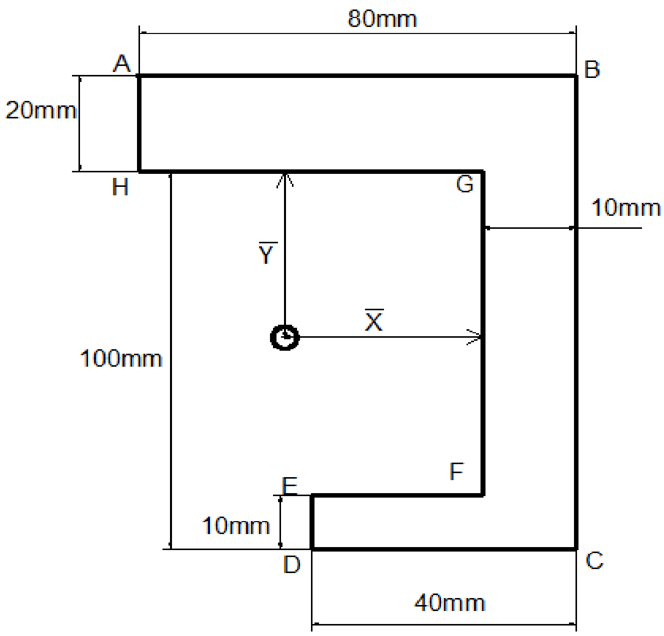

Figure – 2A

2B. The fuselage section shown in figure 2B is subjected to 175kNm applied in a vertical plane of symmetry. If the section has been completely idealized into a combination of direct stress carrying booms and shear stress carrying panels, **(04)**

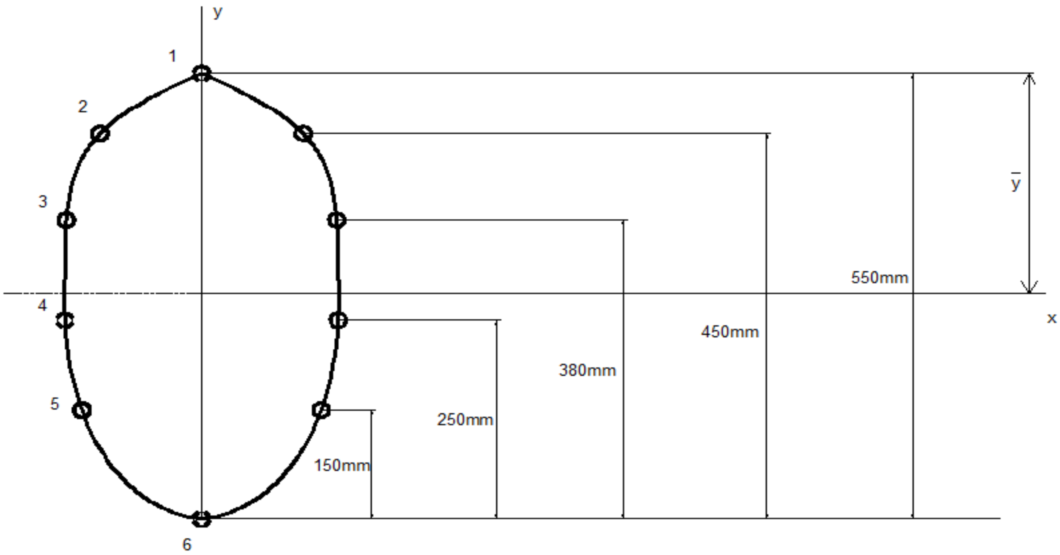

Figure – 2B

Determine the direct stress at each boom. $B_1=B_3=B_5= 240mm^2$, $B_2=B_4=B_6= 320mm^2$

3A. The cantilever beam shown in Figure 3A is uniformly tapered along its length in both x and y directions and carries a load of 140kN at its free end. Calculate the forces in the booms and the shear flow distribution in the walls at a section 1m from the root if the booms resist all the direct stresses while the walls are effective only in shear. Each corner boom has a cross-sectional area of 500mm^2 while both central booms have cross sectional areas of 1100mm^2 **(06)**

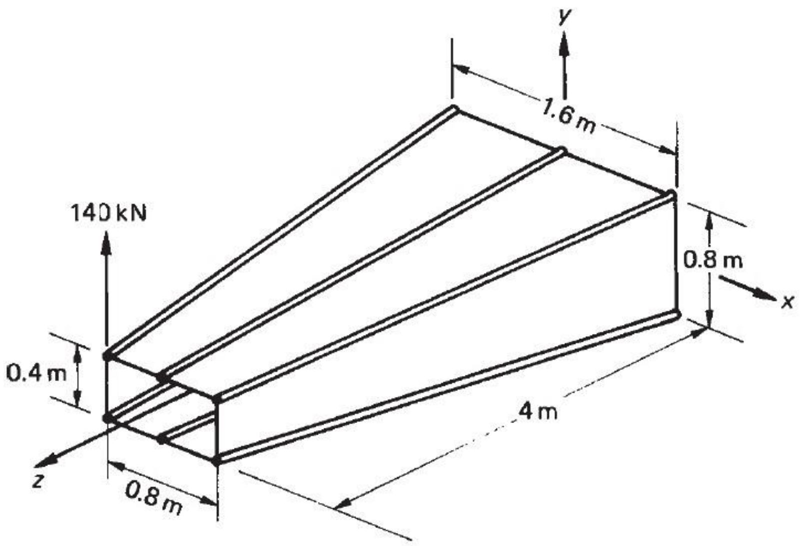

Figure-3A

3B. Considering an airplane at touch down with weight 9800 lb and deceleration of 2.6g (80.43 ft/s^2). Also consider the inertial force of the airplane is acting opposite to the deceleration of the airplane. If then find the followings, **(04)**

a) If it arrested to a cable for stoppage find the Tension (T) on the cable, Reaction force 'R' and distance from center of gravity to tension of the cable (e).

b) Find the tension in the fuselage at vertical section of A-A, B-B and C-C, if the weights of each sections are 900 lb, 1200 lb and 4000 lb respectively. B-B section length we can consider from B-B to section C-C.

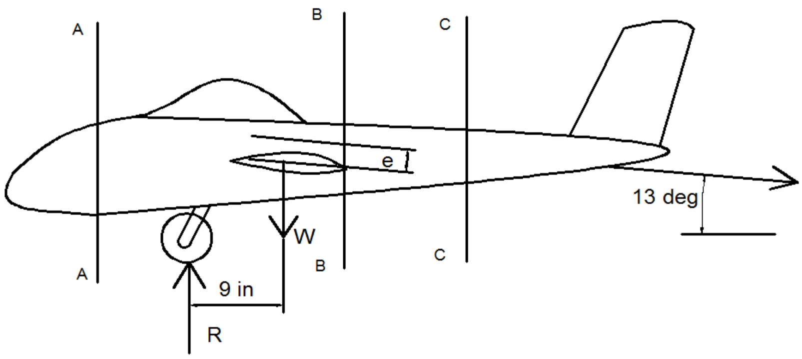

Figure – 3B

4A. Explain in-details about wing internal structures and wing classification according to these structures **(04)**

4B. The fuselage of a light passenger carrying aircraft has the circular cross-section shown in figure 4B is subjected to a vertical shear load of 130kN applied at a distance of 160mm from the vertical axis of symmetry as shown, for the idealized section. Calculate the distribution of shear flow in the section. (Assume $B_1=B_2=B_3,,,,,,B_{16}= 236mm^2$) **(06)**

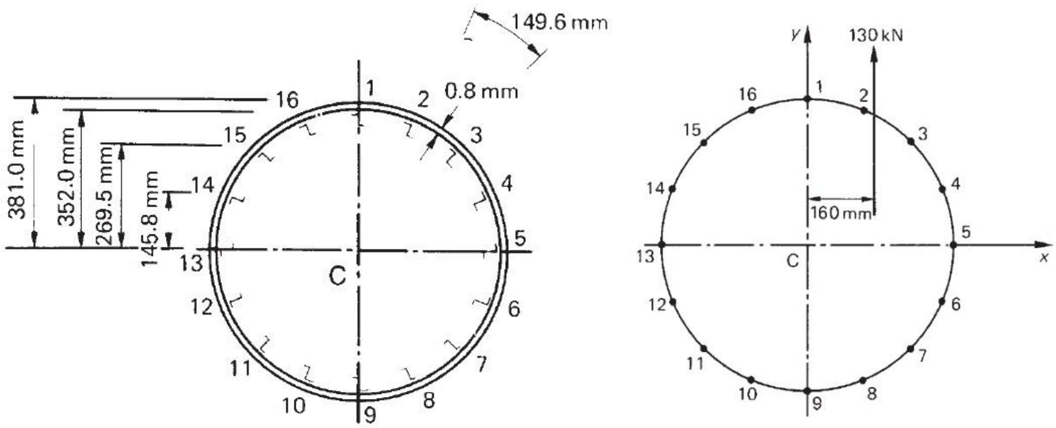

Figure-4B

5A. Part of a wing section is in the form of two-cell box shown in figure 5A which the vertical spars are connected to the wing skin through angle sections all having a cross sectional area of $400mm^2$. Idealize the section into an arrangement of direct stress carrying booms and shear stress only carrying panels suitable for resisting bending moments in a vertical plane. **(05)**

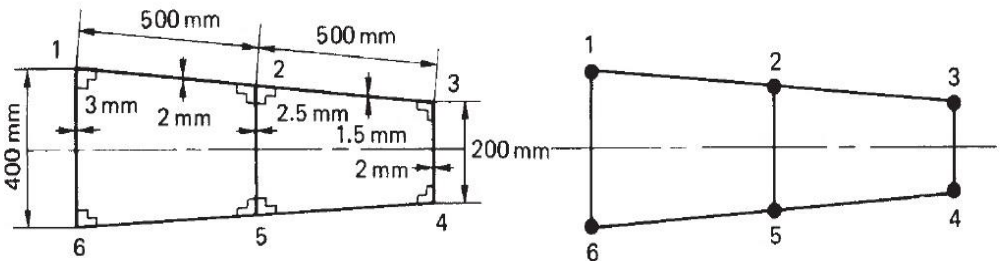

Figure-5A

5B. Derive the equation to determine the unknown shear flow stress for closed section beams **(05)**