**Name:**

**Enrolment No:**

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**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, December 2019**

**Course: Aircraft Structures** **Semester: V**
**Program: B. Tech ASE/ASE-AVE** **Time 03 hrs.**
**Course Code: ASEG 3002** **Max. Marks: 100**
**No.of pages:04**
**Instructions: a) All questions are compulsory.**
**b) Assume any suitable value for missing data**

## SECTION A

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Define elastic materials and state reason for the following questions. (2 Marks)<br>a) A non-linear material response can be elastic. (1)<br>b) Hooke's law is not valid constitutive law (stress-strain response) of rubber. (1) | **4** | **CO1** |
| Q2. | Difference between shear center and centroid of the cross-section, State the physical significance of shear centre in aircraft design. ( 2+ 2) | **4** | **CO2** |
| Q3. | Define shape function. List out the properties of shape function. ( 2 + 2) | **4** | **CO1** |
| Q4. | State the main components of aircraft wing and fuselage and clearly specify what kind of loads are resisted by each component. | **4** | **CO2** |
| Q5. | Difference between stiffness and flexibility method. Why stiffness method is most preferred approach. (2 + 2) | **4** | **CO5** |

## SECTION B

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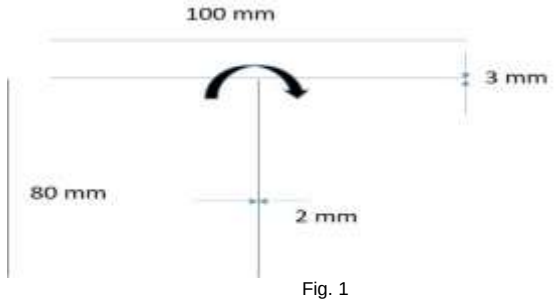
|---|---|---|---|
| Q 6 | Determine the maximum shear stress in the beam section shown in Fig.1 The beam is subjected to counterclockwise (CCW) torque of 100 KN. Determine also the rate of twist of the beam section if the shear modulus *G* is 25000N/mm$^2$<br>  <br><br>Fig. 1 | **10** | **CO4** |
| Q7. | An idelaised chaneel section shown in Fig. 2 is subjected to a shear load, Sy = 200 KN. Find out the shear flow distribution over the section and determine the location of shear centre (e) from web. Take h = 100 mm, b = 60 mm. Area of each boom = 300 mm$^{2.}$ | **10** | **CO4** |

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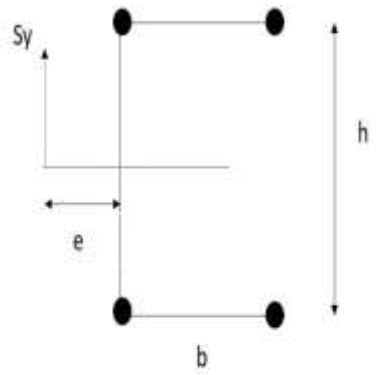
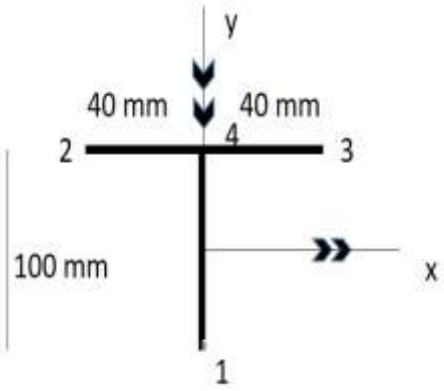
|---|---|---|---|
| |  <br>Fig. 2 | | |
| Q8 . | Derive the Bredt Batho torsion formula for a thin walled closed section. Draw the required skecthes clearly.<br><br>**OR**<br>Diffrenece between symmetric and unsymmetric beam. Derive the formula to obtain bending stress in unsymmteric beam. | **10** | **CO3** |
| Q9. | For a T- section shown ig fig. 3. Detrime the maximum bending stress value and its position, if the beam is subjeted to moment, $M_x$ and My of magnitude 100 and 120 KN mm respectively. Also find out the inclination of neutral axis w.r.t to x- axis.<br>  <br>Fig. 3 | **10** | **CO3** |
| **SECTION-C** | | | |
| Q10 | Determine the shear flow distribution of the idealized fuselage section shown in Fig. 4. The fuselage is subjected to a shear and torsion load of 120 KN and 100 KN mm respectively at point 1, The radius of the fuselage is 600 mm. Booms are equally place over surface of fuselage and area of each boom == 300 $mm^2$ | **20** | **CO4** |

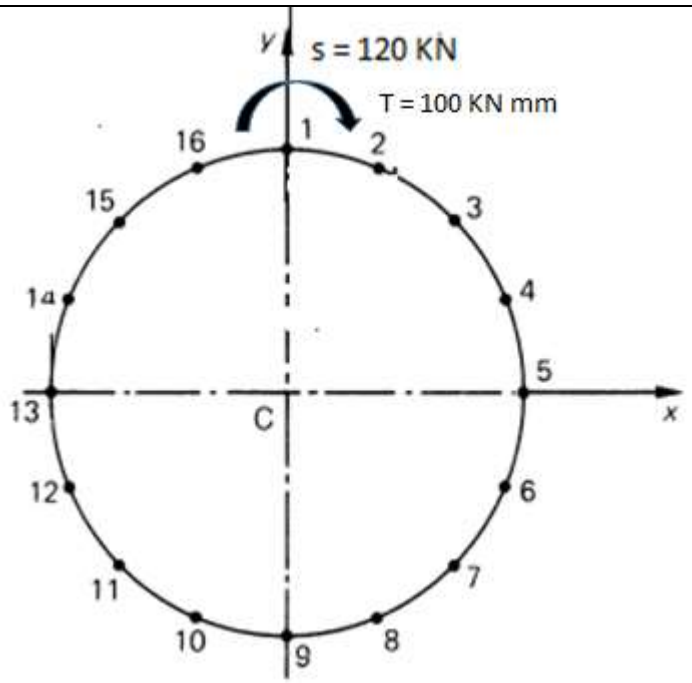



Fig. 4

**OR**

Determine the shear flow distribution of idealized wing section as shown in Fig. 5 the wing is subjected to CCW torsion = 200 KN mm. Required data is provided in Table 1

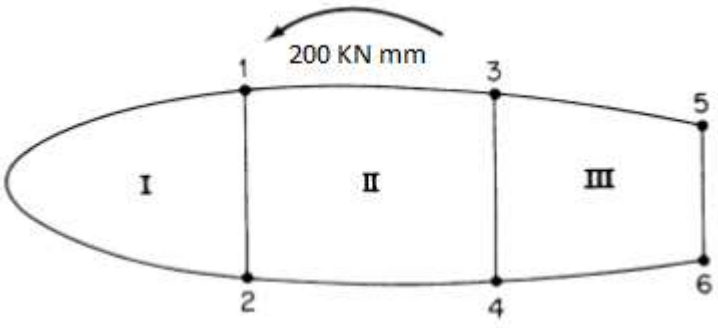
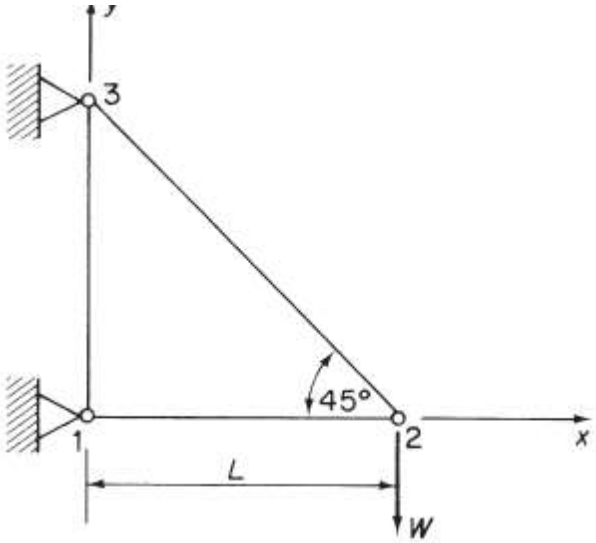



Fig. 5

Table 1.

| Wall | Length , mm | Thickness (mm) | G N/ $mm^2$ | Cell area ($mm^2$ |
|---|---|---|---|---|
| $12^{0}$ | 1200 | 1 | 25 000 | $A_I$ = 2000 |
| $12^{i}$ | 300 | 2 | 30 000 | $A_{II}$ = 3500 |
| 13, 24 | 600 | 1 | 25 000 | $A_{III}$ = 2200 |
| 34 | 250 | 2 | 30 000 | |
| 35, 46 | 400 | 1 | 25 000 | |
| 56 | 200 | 2 | 30 000 | |

| | | | |
|---|---|---|---|
| | Determine the displacement value at node 2 for a truss problem shown in Fig. 6, using stiffness method. Take area, A = 100 $mm^2$ and E = 210 GPa for each member of the truss. Solve for L = 10 mm, and W = 1000 N<br>  <br><br>Fig. 6 | | |