Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

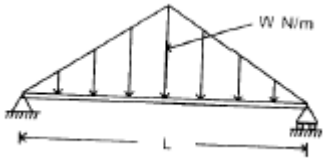
B.Tech. Summer 2018 - 19 Examination

Semester: 4 **Date: 01/05/2019**
Subject Code: 03101252 **Time: 02:00pm To 04:30pm**
Subject Name: Aircraft Structures-I **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Short Type Questions (All compulsory) **(15)**

1) A simply supported beam is subjected to a distributed loading as shown in the figure. What is the maximum shear force in the beam

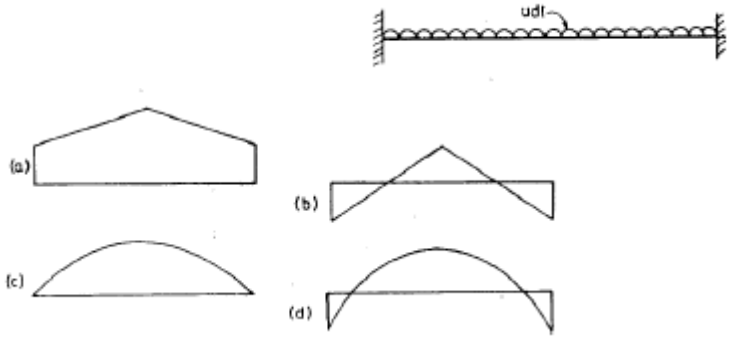


(a) WL/3 (b) WL/2 (c) WL/4 (d) WL/6

2) A body is subjected to a pure tensile stress of 100 units. What is the maximum shear stress produced in the body at some oblique plane due to the above?
(a) 100 units (b) 75 units (c) 50 units (d) 0 units

3) A mild steel specimen is tested in tension upto fracture in a Universal Testing Machine. Which of the following mechanical properties of the material can be evaluated from such test
1. Modulus of elasticity 2. Yield stress 3. Ductility 4. Tensile strength 5. Modulus of rigidity 6. Poisson ratio
Select the correct answer using the code given below
(a) 1,3,5 and 6 (b) 2,3,4 and 6 (c) 1,2,5 and 6 (d) 1,2,3 and 4

4) A beam is built in at both ends, carries udl over its entire span as shown in figure. Which one of the diagrams given below, represents bending moment distribution along the length of the beam?



5) A simply supported laterally loaded beam was found to deflect more than a specified value. Which of the following measures will reduce the deflection
(a) Increase the moment of inertia
(b) increase the span of the beam
(c) select the different material having lesser modulus of elasticity
(d) magnitude of the load to be increased

6) For an isotropic homogeneous and linearly elastic material, which obeys Hooke's law, the number of independent elastic constant is _____.

7) The coordinates of the Mohr's circle for an element subject to only complementary shear stress is _____.

8) The shapes of the bending moment diagram for a uniform cantilever beam carrying a uniform distributed load over its length is _____.

9) The point of contraflexure is a point where _____.

10) Maximum shear stress developed on the surface of a solid circular shaft under pure torsion is 240MPa. If the shaft diameter is doubled then the maximum shear stress developed corresponding to the same torque will be _____.

11) Name the various methods for calculating the deflection of beams.

12) Explain the reason, why do we need the failure theories.

13) Write the boundary conditions for the fixed end and free end of the cantilever beam

14) A solid circular shaft of diameter 100mm is subjected to axial stress of 50MPa. It is further subjected to a torque of 10 kNm. What is the maximum principal stress experienced on the shaft?

15) A steel rod 10mm in diameter and 1m long is heated from 20^0C to 120^0C, E=200GPa and $\alpha = 12 \text{ X } 10^{-6}$ /K. If the rod is free to expand, then what is the thermal stress developed?

Q.2 Answer the following questions. (Attempt any three) **(15)**

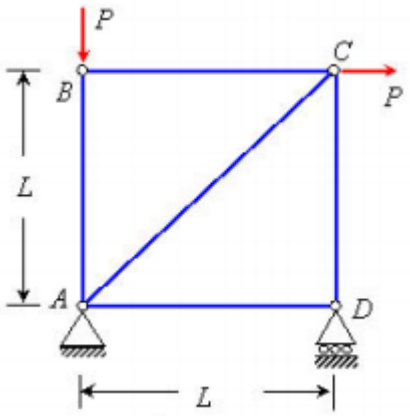
1. Derive the strain energy equation for a member subjected to bending.
2. Explain the Mohr's circle for an element subjected to direct stresses and shear stress.
3. Explain and derive Haigh's theory for 2D and 3D stress system.
4. Explain the different internal parts of the wing with the function of each.

Q.3A) A simply supported beam of 4m span is carrying a point load of 4 KN at a distance of 3m from the left end. Calculate the slope at the two supports and deflection under the load. Also find the maximum deflection. Take $EI = 2.6\ X\ 10^7\ Nm^2$ **(07)**

Q.3B) Derive an equation of maximum deflection of fixed-fixed beam having uniformly distributed load (w/unit length) over an entire length of the beam. Also draw the Shear force and Bending moment diagram. **(08)**

OR

Q.3B) Find the horizontal and vertical deflection at joint C of the pin-jointed frame shown in Figure. AE is constant for all members. **(08)**



Q.4A) (i) Define Moment area theorems. **(07)**
(ii) Define conjugate beam theorems.
(iii) Give the relation between bending moment, shear force, rate of loading, slope and deflection

OR

Q.4A) (i) State the difference between determinate and indeterminate structure. **(07)**
(ii) Which points should be taken care while using Macaulay's Method?
(iii) Define Castigliano's theorem

Q.4B) A shaft is subjected to a maximum torque of 10 kNm and a maximum bending moment of 7.5 kNm at a particular section. If the allowable equivalent stress in simple tension is 160 MN/m^2. Find the diameter of the shaft according to the maximum shear stress theory. **(08)**