Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023

Fifth Semester

18ASE202T – APPLIED STRUCTURAL MECHANICS

(For the candidates admitted during the academic year 2020-2021 & 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

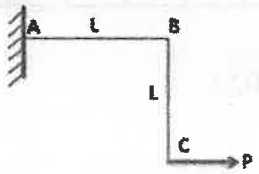
Time: 3 hours | Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO
1. Every airplane is limited to the _____ it can be flown and the _____ it can be subjected to in flight or landing. (A) Maximum velocity, maximum acceleration (B) Maximum acceleration, maximum velocity (C) Maximum height, maximum weight (D) Maximum thrust, minimum acceleration	1	1	1
2. From basic Physics, the relationship for a motion of pure translation if the acceleration is constant, is given by _____. (A) u – v = at (B) v + u = at (C) v – u = at (D) v + u = t	1	1	1
3. The shock struct in a landing gear is commonly referred to as _____. (A) Oleo frame (B) Oleo member (C) Oleo structure (D) Oleo strut	1	1	1
4. Convention aircraft usually consist of _____. (A) Fuselage, landing gear and tail plane (B) Landing gear, wings and tail plane (C) Fuselage, wings and landing gear (D) Fuselage, wings and tail plane	1	1	1
5. The number of unknowns for a beam whose both ends are fixed is _____. (A) 3 (B) 4 (C) 6 (D) 2	1	1	2
6. A fixed end beam of length 5 m and the support moment is 6.25 kNm, carries a point load W at the middle is given by _____. (A) 0 (B) 31.25 (C) 62.5 (D) 10	1	1	2
7. The distribution factor for an overhanding beam is _____. (A) 3I/4L (B) 0 (C) I/L (D) 0.5	1	12	

8. Find the horizontal deflection at C due to P for a frame shown below: Assume uniform EI. 1 1 2



(A) $\frac{2PL^3}{3EI}$ (B) $\frac{PL^3}{3EI}$

(C) $\frac{2PL^3}{EI}$ (D) $\frac{4PL^3}{3EI}$

9. Calculate the strain energy stored in a body of stress 0.04 N/mm^2. The cross sectional area is 100 m^2 and length of body is 0.05 m. Take E = 2×10^5 N/mm^2 1 1 3

(A) 80 Nmm (B) 4 Nmm

(C) 50 Nmm (D) 200 Nmm

10. A simply supported beam of 20 mm×20 mm having length 2 m, UDL of 1 kN/m over the entire span. Take E = 2×10^5 N/mm^2. Find the deflection at the middle. 1 1 3

(A) 75.125 mm (B) 78.125 mm

(C) 121.75 mm (D) 65.125 mm

11. Find the vertical force acting at the joint as shown 1 1 3

(A) 21.1 kN (B) 71.1 kN

(C) 61.1 kN (D) 0

12. A bar made up of same material and of length L, subjected to a tensile force of P. Portion 1 is having length L/3 and diameter D and the remaining portion 2 having diameter 2D. The ratio of strain energy of a bar is _____. 1 1 3

(A) 6 (B) 4

(C) 2 (D) 3

13. Which of the following formulae is/are used to find the buckling load in columns? 1 1 4

(A) Bernoulli's formula for beam columns (B) Lagrangian formula for columns

(C) Euler formula (D) Buckling theorem

14. The ratio of the effective length of the column to the least radius of gyration is known as _____. 1 1 4

(A) Poisson's ratio (B) Slenderness ratio

(C) Stress ratio (D) Length ratio

15. Long columns have a slenderness ratio _____. 1 1 4

(A) Between 70 and 99 (B) Between 32 and 50

(C) Between 51 and 69 (D) More than 120

16. The effective length of the column whose one end is fixed and the other end free is _____. 1 1 4

(A) 0.75 L (B) 0.5 L

(C) 2 L (D) 0.707 L

17. Which failure theory is used for brittle materials? 1 1 5

(A) Maximum principal strain theory (B) Maximum principal stress theory
(C) Maximum shear stress theory (D) Maximum strain energy theory

18. The principal stresses are 120 MPa (tensile) and 80 MPa (tensile). According to maximum principal stress theory, find the maximum permissible stress (MPa). 1 1 5

(A) 40 (B) 80
(C) 200 (D) 120

19. The principal stresses are 200 MPa (tensile) and 150 MPa (tensile). Find the maximum shear stress (MPa) 1 1 5

(A) 350 (B) 185
(C) 25 (D) 200

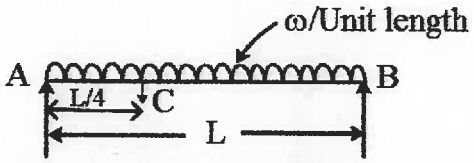
20. The factor safety is given by _____, if the principal stresses are 300 MPa and 150 MPa, and stress at elastic limit is 350 MPa according to maximum principal stress theory. 1 1 5

(A) 1.285 (B) 2.333
(C) 1.167 (D) 0.777

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

	Marks	BL	CO
21. What are the factors influencing the structural failure of a unit?	4	1	1
22. Determine the carry over factor for a beam fixed at one end and simply supported at the other end.	4	2	2
23. Use strain energy method and find the deflection at C.	4	2	3



24. How failure occurs in a short and long columns?	4	2	4
25. List down the Euler's formula for all end conditions of a column.	4	2	4
26. Explain the assumptions made in Euler's column theory.	4	2	4
27. Explain the importance of failure theories.	4	1	5

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

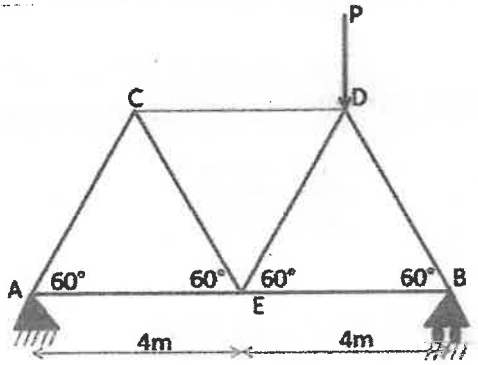
	Marks	BL	CO
28. a. Explain a landing gear structure with a neat sketch.	12	2	1
(OR)			
b. Explain in detail about loads on an aircraft structural components.	12	2	1

29. a. A continuous beam ABC, where A, B and C are simply supported. The length for AB and BC are 5 m and 4 m respectively. Span AB carries a UDL of 2 kN/m over its length and span BC carries a point load of 4 kN at its middle. Find the support moments. Also plot shear force and bending moment diagrams. 12 3 2

(OR)

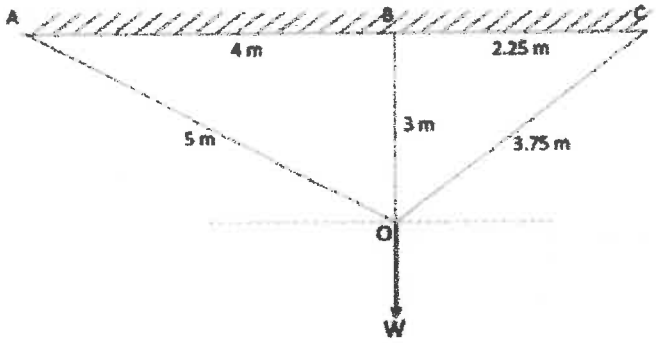
b. A continuous beam ABC, where A is fixed, B and C are simply supported. The length for AB and BC are 6 m and 4 m respectively. Span AB carries a UDL of 3 kN/m over its length and span BC carries a UDL of 4 kN/m over its length. Draw shear force and bending moment diagrams. 12 3 2

30. a. Find the vertical deflection at D for a truss shown below. Take E = 200 GPa. Assume AE as constant and the cross sectional area of each member as 1000 sqmm. 12 3 3



(OR)

b. For a given frame below, find the forces in all the members. Assume all the members have same AE. 12 3 3



31. a. The external and internal diameter of a hollow cast iron column are 100 mm and 70 mm respectively. If the length of this column is 1.5 m and both ends hinged, determine the crippling load using Euler's and Rankine's formula. Take crushing stress as 500 MPa and Rankine's constant as 1/1600. 12 3 4

(OR)

b. Determine the crippling load for a T-section of uniform thickness 20 mm, flange and web dimensions as 120 mm each, both ends are hinged. Take E =200 GPa. 12 3 4

32. a. Explain the five theories of failure in detail. 12 3 5

(OR)

b. Determine the diameter of a bolt which is subjected to an axial pull of 8 kN together with a transverse shear force of 4 kN using Maximum principal stress theory and Maximum principal strain theory. Given the elastic limit in tension as 220 MPa, factor of safety as 4 and Poisson's ratio as 0.28. 12 3 5

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