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**END SEMESTER EXAMINATION (NEP)**

**November/December 2025**

**Semester : 3rd (NEP)**

**Branch : Mechanical Engineering**

**Course Code : MEPC-304**

**Course Name : STRENGTH OF MATERIALS**

**Full Marks – 60**

**Pass Marks – 24**

**Time –Three hours**

**The figures in the margin indicate full marks for the questions.**

**Instructions :**

(i) Question Nos. 1, 2 and 3 are compulsory.

(ii) Any *five* questions from the rest.

1 Fill in the blanks : 1×5=5

(a) Within elastic limits stress is directly proportional to \_\_\_\_.

(b) Ratio of ultimate stress to the working stress is called \_\_\_\_.

[Turn over

- (c) A cantilever is a beam, one end of which is \_\_\_\_\_ and the other is free.
- (d) The ratio of effective length of a column to the radius of gyration is called \_\_\_\_\_.
- (e) Bending stress is zero at \_\_\_\_\_ of the beam.

2 Write True or False : 1×5=5

- (a) All struts are columns, but all columns are not struts.
- (b) Point of contra flexure occurs only in case of overhang beam.
- (c) The hollow shafts are stronger than the solid shafts of same material.
- (d) Hoop stress is twice that of longitudinal stress.
- (e) The ratio of the linear strain to the lateral strain is called Poisson's ratio.

3. Choose the correct answers : 1×5=5

(a) The unit of shear stress in S.I.S unit is

- |                      |                                   |
|----------------------|-----------------------------------|
| (i) $\text{Kgf/m}^2$ | (ii) $\text{N/m}^2$               |
| (iii) $\text{kg/m}$  | (iv) $\text{kgf} \times \text{m}$ |

(b) The bending moment at the free end of a cantilever beam is

- (i) zero                      (ii) one
- (iii) Maximum              (iv) None of these

(c) Equivalent length of a column is maximum when

- (i) Both ends hinged
- (ii) Both ends fixed
- (iii) one end fixed and other free
- (iv) one end fixed and other hinged

(d) The S.I. unit of Torsion is

- (i) N                          (ii) Kgs,
- (iii) N-m                      (iv) N/m.

(e) The property of a material by virtue of which a body returns to its original shape and size after removal of the load is known as

- (i) Ductility                  (ii) Plasticity
- (iii) Elasticity                (iv) None of these.

4. (a) Define the terms :

3

Stress, Strain and Poisson's ratio.

(b) An elastic rod of 25 mm in diameter, 200 mm long extended by 0.25 mm under a tensile load of 40 kN. Find the intensity of stress, strain modulus of elasticity of the material.

6

5. (a) State and explain the Hooke's Law 3

(b) A reinforced concrete column of 300 mm × 300 mm in section. The column is provided with 8 bars of 18 mm diameter. The column carries a load of 350 kN. Find the stresses in concrete and in steel bars. Take,  $E_s = 2.1 \times 10^5 \text{ N/mm}^2$  and  $E_c = 0.14 \times 10^5 \text{ N/mm}^2$ .

6

6. (a) Define shear force and bending moment.

3

(b) A beam AB of 10 m long has to support at its ends A and B. It carries a point load of 12 kN at 3 m from support A and a point load of 10 kN at 4 m from support B. Draw SF and BM diagrams.

6

7. (a) Draw the Stress–Strain diagram of mild steel and show the significant points on it.

3



- (b) A simply supported beam of 4 m long carries an u.d.l of 10 kN/m over the entire length. Find the maximum deflection of the beam and the slope at the supports. Take  $E=2.1 \times 10^8$  kN/m<sup>2</sup> and  $I= 8.98 \times 10^{-5}$  m<sup>4</sup>. 6
- 8 (a) A steel rod of 15 m long is at a temperature of 15°C. Find the free expansion of the length when temperature is raised to 65°C, find the temperature stress produced, when
- (i) The expansion of the rod is prevented.
- (ii) The rod is permitted to expand by 6 mm. Take,  $\alpha=12 \times 10^{-6}$  per °C and  $E= 200$  GN/m<sup>2</sup>. 5
- (b) A thin cylindrical shell of 2 mm wall thickness carrying a fluid under a pressure of 25 N/mm<sup>2</sup>. The internal diameter of the shell is 60 mm. calculate the hoop stress and longitudinal stress. 4
- 9 (a) What are the assumptions made in the theory of pure bending ? 3
- (b) A timber beam is 120 mm wide and 200 mm deep is used on a span of 4 metres. If the stress due to bending is not to exceed 7 N/mm<sup>2</sup>, find the safe uniformly distributed load (udl) on the beam. 6

10. (a) Define helical springs. What is stiffness of spring ? 3

(b) A closely coiled helical spring is made of 6 mm wire. The maximum shear stress and deflection under a load of 20 kg is not to exceed  $800 \text{ kg/cm}^2$  and 1.1 cm respectively. Determine the number of coils and their Mean radius. Take  $C = 0.84 \times 10^6 \text{ kg/cm}^2$ . 6

11. (a) What are the assumptions made in pure torsion ? 3

(b) Find the torque which a shaft of diameter 100 mm can transmit safely, if the shear stress is not exceed  $100 \text{ N/mm}^2$ . 6

12. (a) What is equivalent length of a column ? Write the equivalent length in terms of actual length of column with various end conditions.

1+2=3

(b) A steel column is of length 8 m and diameter 600 mm with both ends hinged. Determine the crippling load by Euler's formula. Take  $E = 2.1 \times 10^5 \text{ N/mm}^2$ . 6

13. (a) Draw the net sketches how a riveted joint may fail. 3

- (b) A double riveted double cover butt joint is made in 20 mm thick plates with 25 mm diameter rivets and 100 mm pitch and permissible stresses are :

Shearing of rivets =  $80 \text{ N/mm}^2$ , Crushing of rivets =  $160 \text{ N/mm}^2$  and Tearing of rivets =  $100 \text{ N/mm}^2$ . Calculate the strength of the joint and efficiency of the joint. 6



# **NOT FOR STUDENT USE**

**Course Outcome ( CO)**

**Course Code:-MEPC-304**

**Course Name : STRENGTH OF MATERIALS**

Questions no.	CO
1	—
a	CO1
b	CO1
c	CO2
d	CO5(unit-V)
e	CO3
2	—
a	CO5(unit-V)
b	CO2
c	CO4
d	CO5(unit-VI)
e	CO1
3	—
a	CO1
b	CO2
c	CO5(unit-V)
d	CO4
e	CO1



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**Course Outcome (CO)**

**Course Code:-MEPC-304**

**Course Name : STRENGTH OF MATERIALS**

Questions no.	CO
4	CO1
	CO1
5	CO1
	CO1
6	CO2
	CO2
7	CO1
	CO3
8	CO1
	CO5 (unit-VI)
9	CO3
	CO3
10	CO4
	CO4
11	CO4
	CO4

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### **Course Outcome (CO)**

**Course Code:-MEPC-304**

**Course Name : STRENGTH OF MATERIALS**

Questions no.	CO
12	CO5 (unit-V)
	CO5 (unit-V)
13	CO5 (unit-VII)
	CO5 (unit-VII)