

Total No. of printed pages = 10

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 : $1 \times 5 = 5$

- (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 : $1 \times 5 = 5$

(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 : $1 \times 5 = 5$

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

(i) Kgf/m^2 (ii) N/m^2
(iii) 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 40kN. 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 \times 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, $E_s = 2.1 \times 10^5$ N/mm 2 and $E_c = 0.14 \times 10^5$ 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/m² and $I= 8.98\times 10^{-5}$ m⁴. 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 $E= 200\text{GN/m}^2$ 5

(b) A thin cylindrical shell of 2 mm wall thickness carrying a fluid under a pressure of 25 N/mm². 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/mm², 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 $800\text{kg}/\text{cm}^2$ and 1.1 cm respectively. Determine the number of coils and their Mean radius. Take $C = 0.84 \times 10^6\text{kg}/\text{cm}^2$. 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 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 N/mm², Crushing of rivets = 160 N/mm² and Tearing of rivets = 100 N/mm². 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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Questions no.	CO
12	CO5 (unit-V)
	CO5 (unit-V)
13	CO5 (unit-VII)
	CO5 (unit-VII)