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**3rd Sem / Auto, Mech, Mecatronics, Prod, T&D, Plastic,
GE, CNC, CAD/CAM, Found. & Forg, Metallurgy,
Print making Tech., Mech (Ad. Manu tech.), Mech Engg
(Fabrication Tech), Rubber Tech, Polymer Tech, AME.
Mech. Engg. (Prod.)**

Subject:- Strength of Materials/ Basic Mech. Engg.

Time : 3Hrs. M.M. : 100

SECTION-A

Note: Multiple choice questions. All questions are compulsory (10x1=10)

- Q.1 Unit of Strain Energy-
a) N-m b) N/m
c) N-m² d) N/m²

Q.2 Beam whose one end is fixed and another end is free is called-
a) Simply Supported b) Cantilever
c) Fixed d) Overhanging

Q.3 U.V.L. stands for-
a) Uniformly varying load
b) Uniaxial varying load
c) Uniformly vertical load
d) Uniaxial vertical load

Q.4 The rate of change of bending moment is equal to-
a) Shear force b) Slope
c) Deflection d) None of the above

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- Q.5 Unit of section modulus is-

a) m b) m^3
c) m^2 d) m^4

Q.6 Rankine's formula holds good for-

a) Short columns b) long columns
c) medium columns d) both a and b

Q.7 For a column with both ends hinged, the relation between Effective length(L) and Actual length (l) is-

a) $L=l$ b) $L=l/2$
c) $L=l/\sqrt{2}$ d) $L=2l$

Q.8 Proof resilience per unit _____ is known as Modulus of Resilience.

a) Weight b) Area
c) Volume d) Density

Q.9 Unit of Radius of Gyration is-

a) m^3 b) m^4
c) m d) m^2

Q.10 The S.I. unit of Torque is N-m.

a) True b) False

SECTION-B

Note: Objective type questions. All questions are compulsory. (10x1=10)

- Q.11 Define Factor of Safety.
 - Q.12 Define Compressive strain.
 - Q.13 Explain Bulk Modulus.
 - Q.14 What is Solid length of spring.
 - Q.15 What is fixed beam.
 - Q.16 Explain Neutral axis of beam.
 - Q.17 Define column.
 - Q.18 Define Slenderness ratio.

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Q.19 Write torsion equation.

Q.20 Define Toughness.

SECTION-C

Note: Short answer type questions. Attempt any twelve questions out of fifteen questions. (12x5=60)

Q.21 A rod 20cm in diameter, 2m long is subjected to an axial pull of 30kN. If modulus of elasticity (E) of rod material is 210 Gpa. Calculate :

- I) Stress
- ii) Strain

Q.22 Define thermal stress and strain.

Q.23 Derive an expression for the strain energy induced in a body due to suddenly applied load.

Q.24 Explain Moment of Inertia and Second Moment of Area.

Q.25 Draw the SFD and BMD diagrams for a simply supported beam carrying a point load at the midspan.

Q.26 Name various types of ends supports for beams and explain any two with diagrams.

Q.27 A rectangular beam of 400 mm deep and 4m long carries a UDL of 4.2kN/m. Find the maximum bending stress. Take $I=9 \times 10^6 \text{ mm}^4$.

Q.28 Explain -

- a) Moment of Resistance
- b) Section Modulus

Q.29 Classify columns on the basis of slenderness ratio.

Q.30 A column with both ends fixed is 3m long with cross section 20mm x 20mm. Calculate the load at which it will buckle. Take E for the material of column = 60 GPa.

Q.31 Write any five assumptions in the theory of pure torsion.

Q.32 A circular shaft of 70 mm diamater is required to transmit torque is another shaft. Fund the safe torque, which the shaft can transmit, if the shear stress cannot exceed 40 Mpa.

Q.33 Define springs. Also explain different types of springs.

Q.34 A springs is having 100 coils, 65mm mean diameter and the wire diameter is 6.5mm. The modulus of rigidity of spring material is 80GPa. Calculate the deflection in spring (in mm) under the load of 800N.

Q.35 Explain the Theorem of Parallel Axis.

SECTION-D

Note: Long answer type questions. Attempt any two questions out of three questions. (2x10=20)

Q.36 Explain the following terms-

- a) Hooke's law
- b) Poisson's ratio
- c) Hardness
- d) Creep

Q.37 A cantilever beam of length 4m carries a uniformly distributed load of 2kN/m which runs over a length of 2m from the free end. In addition to this there is a point load of 1kN at a distance of 2m from the free end. Draw SFD and BMD.

Q.38 A steel bar of 30 mm diameter and 3m long is rigidly fixed between the two walls. The temperature of the bar is raised by 30°C . If the coefficient of thermal expansion of steel is $13.5 \times 10^{-6}/^\circ\text{C}$. Determine-

- i) Stress developed in the bar
- ii) Force exerted by the wall on the bar
- iii) Nature of the force exerted.