**Vidyavardhini's College of Engineering and Technology**

Program: **Mechanical Engineering**

Curriculum Scheme: CBCS (REV-2019 C Scheme)

Examination: SE | Semester- III

Course Code: MEC302 | Course Name: Strength of Materials

Time: 2 hour | Max. Marks: 80

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| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks. (2 Marks each)** |
|---|---|
| | |
| 1. | A steel rod 10mm in diameter and 1m long is heated from 20 to 100 $^{o}$C, E = 200 GPa and coefficient of thermal expansion is 12 x10-6 per degree Celsius, thermal stress developed is –<br>Assume complete expansion is prevented. |
| Option A: | 192 MPa(tensile) |
| Option B: | 212 MPa(tensile) |
| Option C: | **192MPa(compressive)** |
| Option D: | 212 MPa(compressive) |
| | |
| 2. | Which of the following statement is incorrect? |
| Option A: | Stress is directly proportional to strain within elastic limit |
| Option B: | Stress is force per unit area |
| Option C: | Hook's law holds good up to yield point |
| Option D: | The ratio of linear stress to linear strain is called Young's modulus. |
| | |
| 3. | Strain in a direction right angle to the direction of applied force is known as- |
| Option A: | Lateral strain |
| Option B: | Volumetric Strain |
| Option C: | Complementary shear strain |
| Option D: | None of the above |
| | |
| 4. | In a cantilever of length $l$ carrying a load whose intensity varies uniformly from zero at the free end to $w$ per unit run at the fixed end, The maximum bending moment is - |
| Option A: | $wl/3$ |
| Option B: | $wl^2/3$ |
| Option C: | $wl^2/6$ |
| Option D: | $wl^2/24$ |
| | |
| 5. | In a simply supported beam with uniformly distributed load, the shearing force varies following a – |
| Option A: | Linear law |
| Option B: | Parabolic law |
| Option C: | Cubic law |
| Option D: | None of the above |

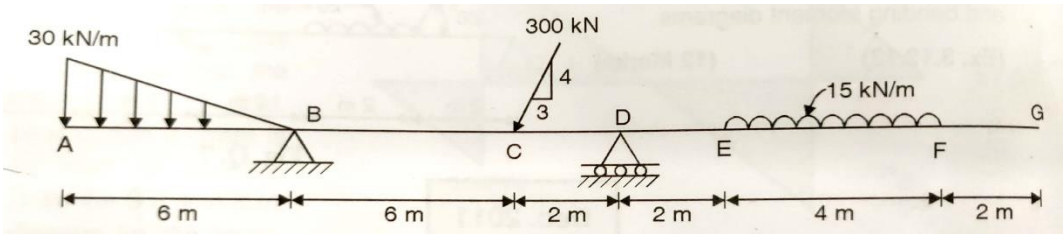
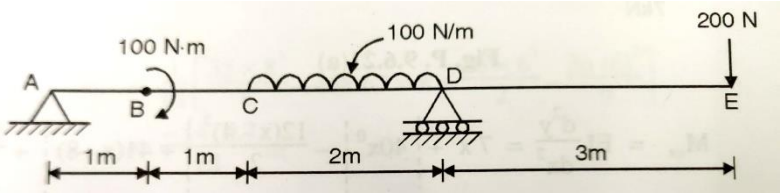
| | |
|---|---|
| 6. | At a point of contraflexure- |
| Option A: | Bending moment is maximum |
| Option B: | Bending moment is zero |
| Option C: | Shear force is Zero |
| Option D: | None of the above |
| | |
| 7. | To determine longitudinal stress, efficiency of _____ is to be considered |
| Option A: | Construction joint |
| Option B: | Transverse joint |
| Option C: | Longitudinal Joint |
| Option D: | Rivet joint |
| | |
| 8. | _____ stress does not exceed the permissible tensile stress for the shell material. |
| Option A: | Axial |
| Option B: | Longitudinal |
| Option C: | Hoop |
| Option D: | Lateral |
| | |
| 9. | When a thin cylindrical shell is subjected to internal pressure, which of the following stresses are not induced in shell- |
| Option A: | Circumferential stress |
| Option B: | Longitudinal stress |
| Option C: | Shear stress |
| Option D: | Bending Stress |
| | |
| 10. | A cylindrical vessel for air compressor is to be made of 15 mm thick plate having permissible tensile stress is 120 $N/mm^{2.}$ If the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively, determine –<br>Maximum permissible diameter of the shell for an internal pressure of 2 $MN/m^2$ |
| Option A: | 1.26 m |
| Option B: | 1.08 m |
| Option C: | 1.8 m |
| Option D: | 3.6 m |
| | |
| 11. | A cylindrical vessel for air compressor is to be made of 15 mm thick plate having permissible tensile stress is 120 $N/mm^{2.}$ If the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively, determine-<br>Permissible intensity of pressure when a shell diameter is 1.5 m. |
| Option A: | 1.26 $MN/m^2$ |
| Option B: | 1.44 $MN/m^2$ |
| Option C: | 1.08 $MN/m^2$ |
| Option D: | 1.8 $MN/m^2$ |
| | |
| 12. | Section modulus for a circular section of 40 mm diameter |
| Option A: | 314.16 $mm^3$ |
| Option B: | 12566.37 $mm^3$ |
| Option C: | 6283.19 $mm^3$ |
| Option D: | 125663.7 $mm^3$ |
| | |

| | |
|---|---|
| 13. | The strength of the beam is mainly depending on- |
| Option A: | Bending moment |
| Option B: | C.G. of the section |
| Option C: | Section modulus |
| Option D: | Its weight |
| | |
| 14. | A rectangular beam 120 mm wide and 300 mm deep is simply supported over a span of 4 m. what u.d.l. the beam may carry if the bending stress is not to exceed 120 MPa. |
| Option A: | 108 N/m |
| Option B: | 108 kN/m |
| Option C: | 108 N/mm |
| Option D: | 108 kN/mm |
| | |
| 15. | A torque which may be applied to a solid shaft of 90 mm outer diameter without exceeding an allowable shearing stress of 75 MPa, is - |
| Option A: | 21.6 kN-m |
| Option B: | 10.8 kN-m |
| Option C: | 16.3 kN-m |
| Option D: | 5.4 kN-m |
| | |
| 16. | What must be the length of a 8 mm diameter aluminum wire so that it can be twisted through one complete revolution without exceeding a shearing stress of 45 MPa? G = 27 GPa |
| Option A: | 15.08 m |
| Option B: | 10.08 m |
| Option C: | 16.08 m |
| Option D: | 20.08 m |
| | |
| 17. | The plane on which only direct stress is acting is called- |
| Option A: | Principal Plane |
| Option B: | Complementary plane |
| Option C: | Shear plane |
| Option D: | Mohr's plane |
| | |
| 18. | On the principal plane, shear stress is ------ |
| Option A: | Zero |
| Option B: | Maximum |
| Option C: | Minimum |
| Option D: | infinity |
| | |
| 19. | When a body is subjected to two tensile stresses of equal magnitude on two mutually perpendicular planes, the radius of mohr circle will be |
| Option A: | Zero |
| Option B: | Maximum |
| Option C: | Minimum |
| Option D: | infinity |
| | |

| | |
|---|---|
| 20. | When a body is subjected to direct stresses in two mutually perpendicular directions, tangential stress across inclined plane will be maximum when- |
| Option A: | $\Theta = 0^o$ |
| Option B: | $\Theta = 45^o$ |
| Option C: | $\Theta = 90^o$ |
| Option D: | $\Theta = 180^o$ |

# Section 2-

| **Q2.** | **Solve any FOUR Questions.** **5 marks each** |
|---|---|
| A | A material has Young's modulus of elasticity 2 x $10^5$ N/mm$^2$ and Poisson's ratio of 0.32. Calculate the modulus of rigidity and bulk modulus of the material. |
| B | A steel rod 3 m long and 50 mm diameter is used as a column with both ends are hinged. Find crippling load by Euler's formula Take E = 2 x$10^5$ N/mm$^2$ |
| C | Derive an expression for circumferential and longitudinal stress for this cylindrical shell. |
| D | A steel bar of 50 mm x 50 mm in section and 3 m long is subjected to an axial pull of 140 kN. Calculate the strain energy stored in the bar. Also find the extension of the bar. Take E = 200 GPa |
| E | What must be the length of a 5 mm diameter aluminium wire so that it can be twisted through one complete revolution without exceeding a shearing stress of 42 MN/m$^2$. Modulus of rigidity = 27 GN/m$^2$ |

| **Q3.** | **Solve any TWO Questions.** **10 marks each** |
|---|---|
| A | For the beam shown in figure draw SFD, BMD and AFD   |
| B | A beam ABCD of 7 m span is supported at A and D and loaded as hown in figure. Find<br>(i) Deflection at point E<br>(ii) Slope at end A   |
| C | An aluminium solid cylinder of 7.5 cm diameter fits loosely inside a steel tube having 10 cm external diameter and 8 cm internal dimeter, the steel tube is 0.02 cm longer than aluminium cylinder and is 250 cm long before the load is applied.<br>Calculate the safe load which can be placed on a rigid flat plate on the top of the steel tube. Safe stress for steel 95 MPA and for aluminium 65 MPa. ES = 210 GPa, EAl = 70 GPa |