University of Mumbai

Examination 2021

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: **Civil Engineering**

Curriculum Scheme: **Revised 2019**

Examination: **SE** Semester: **III**

Course Code: **CE-C 302** Course Name: **Mechanics of Solids**

Time: **2 hours** Max. Marks: **80**

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Q1.	**Choose the correct option for the following questions. All the Questions are compulsory and carry 2 marks each.**
1.	A circular rod of diameter 20 mm and length 2 m. is subjected to an axial tensile load of 50 kN. The Young's modulus of the material is 200000 MPa. The increase in the length of rod is
Option A:	4.59 mm
Option B:	3.59 mm
Option C:	2.59 mm
Option D:	1.59 mm
2.	A sudden increase or decrease in shear force diagram between any two points indicates that there is
Option A:	No loading between the two points
Option B:	Point load between two points
Option C:	UDL between two points
Option D:	Couple between two points
3.	Relation between Load (W) and Shear Force (V)
Option A:	$(dV/dx) = W$
Option B:	$(dW/dx) = V$
Option C:	No relation
Option D:	$\int V dx = W$
4.	Calculate the Strain energy stored in a body of stress 0.0366 N/mm^2. The cross-sectional area is 60 m^2 and length of body is 1 m. Take $E = 2 \times 10^5$ N/mm^2.
Option A:	0.2009 N.mm
Option B:	0.0416 N.mm
Option C:	0.0987 N.mm
Option D:	0.1316 N.mm
5.	A shell can be called as thin when the ratio of its wall thickness (t) to its internal diameter (d) is
Option A:	1/5
Option B:	1/10
Option C:	1/15
Option D:	1/20
6.	A cantilever beam of length 4 m carries a UDL of 10 kN/m throughout its length and a point load of 10 kN at the free end. The maximum bending moment is

Option A:	100 kNm
Option B:	110 kNm
Option C:	120 kNm
Option D:	130 kNm
7.	For a simply supported beam carrying a UDL of 10 kN/m throughout its length and a point load of 20 kN at the centre, the maximum shear force is 35 kN. The length of the beam is
Option A:	5 m.
Option B:	6 m.
Option C:	7 m.
Option D:	8 m.
8.	A portal frame ABCD of height 5 m. is hinged at left support A as well as right support D. Left column AB carries a UDL of 8 kN/m throughout its length. At C, there is an internal hinge. Beam BC of length 4 m. carries a point load of 10 kN at its centre. The horizontal reaction at support D is
Option A:	Zero
Option B:	40 kN from right to left
Option C:	40 kN from left to right
Option D:	20 kN from right to left
9.	For a solid circular section, which of the following relations is correct?
Option A:	Maximum shear stress is 2 times the average shear stress
Option B:	Maximum shear stress is 3 times the average shear stress
Option C:	Maximum shear stress is 1.25 times the average shear stress
Option D:	Maximum shear stress is 1.33 times the average shear stress
10.	Resilience can also be termed as _____
Option A:	Stress energy
Option B:	Strain energy
Option C:	Modulus
Option D:	Flexural Rigidity
11.	The state of stress at a point is given by $\sigma_x = -6$MPa ,$\sigma_y = 4$MPa , and $\tau_{xy} = -8$MPa. The maximum tensile stress (in MPa) at the point is ____.
Option A:	8.43 MPa
Option B:	6.27 MPa
Option C:	7.43 MPa
Option D:	4 MPa
12.	The angle between normal stress and tangential stress is known as angle of _____
Option A:	Declination
Option B:	Orientation
Option C:	Obliquity
Option D:	Rotation
13.	A 70 mm diameter solid shaft is subjected to a torque of 5 kNm. The maximum shear stress induced in the shaft is

Option A:	74.24 MPa
Option B:	84.24 MPa
Option C:	94.24 MPa
Option D:	104.24 MPa
14.	The maximum shear stress produced in a shaft is 8 MPa. The shaft is of 50 mm diameter. The twisting moment is
Option A:	0.1563 kNm
Option B:	0.1963 kNm
Option C:	0.2363 kNm
Option D:	0.3363 KNm
15.	The graphical method of Mohr's circle represents shear stress (τ) on _____
Option A:	X-axis
Option B:	Y-axis
Option C:	Z-axis
Option D:	In between X and Y axis
16.	For a Circular cross-section Maximum Shear Stress= _____ of Average Shear Stress
Option A:	2/3
Option B:	3/2
Option C:	4/3
Option D:	2
17.	If an element is subjected to pure shearing stress (q) then the maximum principal stress is equal to
Option A:	4q
Option B:	3q
Option C:	2q
Option D:	q
18.	Strain energy stored in an element is equal to
Option A:	0.5 X stress
Option B:	0.5 X stress X strain
Option C:	0.5 X strain
Option D:	0.5 X stress X strain X volume
19.	The power transmitted by shaft SI system is given by _____
Option A:	2πNT/60
Option B:	3πNT/60
Option C:	2πNT/45
Option D:	NT/60 W
20.	A cantilever beam of length (l) is subjected to a point load (W) at the free end. The beam has constant flexural rigidity. The strain energy stored in beam due to bending is
Option A:	Wl / 3 EI
Option B:	W^2l^3 / 6 EI
Option C:	W^2l^2/ EI

Option D:	W^2l^3 / 16 EI

Q. 2	Solve following Questions **10 marks each**
A	Determine the maximum allowable torque which a solid circular bar 3 m long and 100 mm diameter can be subjected to, when specifications require that the shear stress must not exceed 56 MN/m^2 and the angle of twist must not exceed 3.5° in this length. Take shear modulus G = 70 GN/m^2.
B	A brass tube of external diameter 60 mm is shrunk tightly on a steel rod of 40 mm diameter to form a composite shaft. The shaft has to transmit 500 kW of power at 150 RPM. Determine the maximum stresses developed in each material and the relative angle of twist in a length of 3 m. Take Gs 80 GPa and Gp = 40 GPa.

Q. 3	**Solve both questions (A) and (B)** **Total 20 Marks**
A	**Solve *Any Two*.** **5 marks each**
i.	A steel cantilever rod 40 mm in diameter and 3 m in length supports a u.d.l. of 5 kN/m over its entire span. Determine the Strain Energy stored in the rod. Take E = 2 x 10^5 N/mm^2.
ii.	A solid circular shaft transmits 80 kW power at 210 RPM. Calculate the shaft diameter if the twist in the shaft is not to exceed 1 degree in 2 m. length of shaft. Take modulus of rigidity as 100000 MPa.
iii.	A spherical shell 40 cm internal diameter, 10 mm thick is filled with a fluid at atmospheric pressure. An additional 80 cm^3 of the fluid is pumped into the shell. Find the pressure exerted by the fluid on the walls of the shell. Also find hoop stress induced. Take E = 2 x 10^5 N/mm^2 and 1/m 0.3
B	Solve***Any One.*****10 marks each**
i.	The principal stresses at a point across two perpendicular planes are 85 MPa horizontal (Tensile) and 45 MPa vertical (Tensile). Find the normal stress, tangential stress and resultant stress and its obliquity on a plane at 25 degrees with the major principal plane.
ii.	At a point in an elastic material under strain there are normal stresses 50 N/mm^2 and 30 N/mm^2 respectively at right angles to each other with a shearing stress of 25 N/mm^2. Find the principal stresses and the position of principal planes analytically and graphically if a. 50 N/mm^2 is tensile and 30 N/mm^2 is also tensile. if a. 50 N/mm^2 is tensile and 30 N/mm^2 is also tensile b. 50 N/mm^2 is tensile and 30 N/mm^2 is compressive. Find also the maximum shear stress and its plane in both the cases.