arReg.No.

Karunya UNIVERSITY

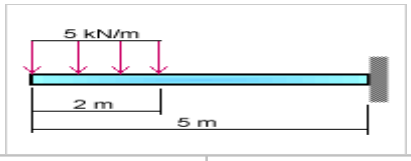
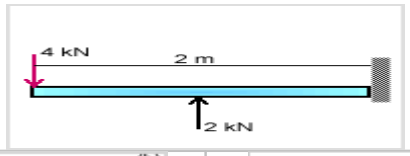
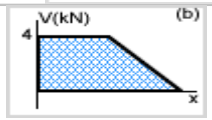
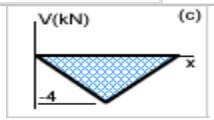
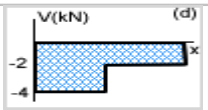
(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – Nov/Dec – 2016

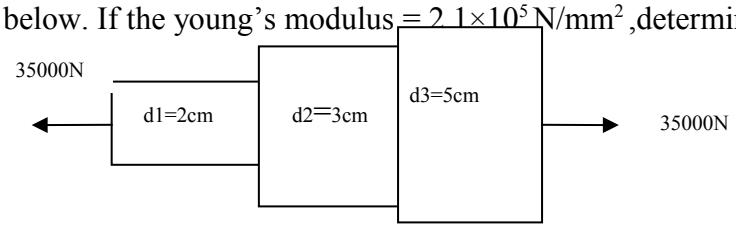
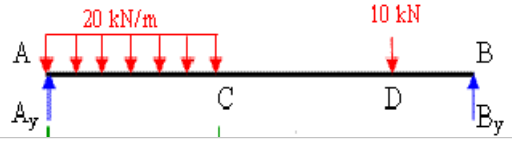
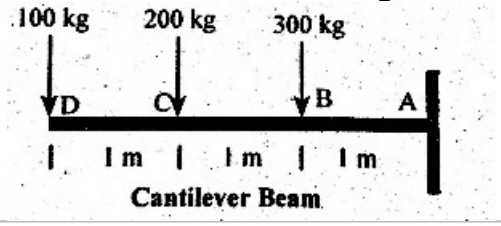
Code : 16AE2001 **Semester :** 2016-17 ODD
Sub. Name : Structural Mechanics **Duration :** 3hrs
Max. marks : 100

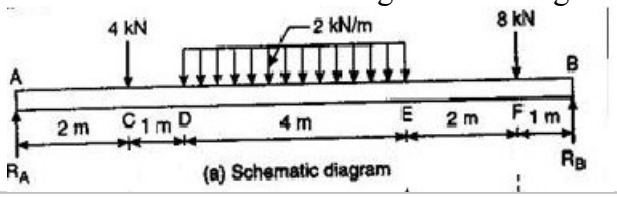
Q. No.	Questions				Course outcome	Marks
	PART-A (40X1=40 MULTIPLE CHOICE QUESTIONS)					
1.	Tensile Strain is_____.				CO1	
	a. (l+δl)/l	b. (l-δl)/l	c. (l+δl)	d. (l-δl)		(1)
2.	Stress is_____.				CO1	
	a. external force	b. internal resistive force	c. axial force	d. radial force		(1)
3.	When tensile stress is applied axially on a circular rod its _____. (i)diameter decreases (ii)length increases (iii)volume decreases Which of the above are true?				CO1	
a.	a. Only ib.	b. Only ii c.	c. i & ii	d. All of the above		(1)
4.	Hooke's law is applicable within_____.				CO1	
a.	a. Elasticb. limit	b. Plastic c. limit	c. Fractured. point	d. Ultimate strength		(1)
5.	Which stress is induced in a member, when expansion or contraction due to temperature variation is prevented?				CO1	
	a. Compressive stress	b. Tensile stress	c. Thermal stress	d. None of the above		(1)
6.	The thermal stress induced in a steel rod is compressive, if temperature _____.				CO1	
	a. decreases	b. increases	c. remains constant	d. None of the above		(1)
7.	Force of 100 kN is applied on 900 mm long rod of 20 mm diameter and is simultaneously heated at 70° C. What is the total elongation of the rod? (Assume coefficient of thermal expansion = 10 x 10^{-6} °C, Young's modulus = 150 Gpa)				CO1	
	a. 2.54 mm	b. 2.00 mm	c. 1.27 mm	d. 0.63 mm		(1)
8.	What is the value of thermal stress, if a rod of 3 m is heated at 50 °C and is fixed at both the ends? (Take α = 10 x 10^{-6} /°C & E= 200 x 10^{3} Mpa)				CO1	
	a. 25 Mpa	b. 50 Mpa	c. 100 Mpa	d. 150 Mpa		(1)
9.	A body is subjected to two normal stresses 20 kN/m^2 (tensile) and 10 kN/m^2 (compressive) acting perpendicular to each other. The maximum shear stress is				CO1	
	a. 5 kN/m^2	b. 10 kN/m^2	c. 15 kN/m^2	d. 20 kN/m^2		(1)
10.	The shape of the bending moment diagram over the length of a beam, having no external load, is always_____.				CO	
	a. circular	b. parabolic	c. linear	d. cubical		(1)
11.	The value of elasticity increases, when temperature _____				CO1	
	a. increases	b. decreases	c. remains constant	d. None of the above		(1)

12.	If a composite bar of copper and steel is heated at 120^{o} C, the stress induced in copper bar is _____ .				CO1	
	a. compressive stress	b. shear stress	c. tensile stress	d. thermal stress		(1)
13.	In a cantilever carrying a uniformly varying load starting from zero at the free end, the shear force diagram is_____.				CO2	
	a. A horizontal line parallel to x-axis	b. A line inclined to x-axis	c. Follows a parabolic law	d. Follows a cubic law		(1)
14.	In a simply supported beam, bending moment at the end_____.				CO2	
	a. Is always zero if it does not carry couple at the end	b. Is zero, if the beam has uniformly distributed load only	c. Is zero if the beam has concentrated loads only	d. May or may not be zero		(1)
15.	For any part of a beam subjected to uniformly distributed load, bending moment diagram is_____.				CO2	
	a. Horizontal straight line	b. Vertical straight line	c. Line inclined to x-axis	d. Parabola		(1)
16.	A beam is a structural member which is subjected to_____.				CO2	
	a. Axial tension or compression	b. Transverse loads and couples	c. Twisting moment	d. No load,but its axis should be horizontal and xsection rectangular or circular		(1)
17.	Identify the differential equation for finding slope and deflection				CO4	
	a. EI $d^2y/dx_2 = -M$	b. EI $d^2y/dx_2 = +M$	c. EI $d^2y/dx_2 = \pm M$	d. None of the above		(1)
18.	Which of the following formulae is used to calculate tangential stress, when a member is subjected to stress in mutually perpendicular axis and accompanied by a shear stress?				CO1	
	a.$[(\sigma_x - \sigma_y)/2]\sin\theta - \tau\cos 2\theta$	b.$[(\sigma_x - \sigma_y)/2] - \tau\cos 2\theta$	c. $[(\sigma_x - \sigma_y)/2]\sin\theta - \tau^2\cos\theta$	d. None of the above		(1)
19.	Minor principal stress has minimum _____ .				CO1	
	a. value of shear stress acting on the plane	b. intensity of direct stress	c. both a and b	d. None of the above		(1)
20.	The angle between normal stress and tangential stress is known as angle of _____.				CO1	
	a. declination	b. orientation	c. obliquity	d. rotation		(1)
21.	A shaft is said to be in pure torsion if _____.				CO3	
	a. Turning moment is applied at one end and other end is free	b. Turning force is applied at one end and other end is free	c. Two opposite turning moments are applied to the shaft	d. Combination of torsional load and bending load is applied to the shaft		(1)
22.	If diameter of a shaft is doubled the power transmitted capacity will be_____.				CO3	
	a. Either twice or half	b. Four times	c. Eight times	d. Same		(1)
23.	Which of the following is not designed under torsion equation?				CO3	
	a. Spindle	b. Axle	c. Low cost shaft	d. Shaft with		(1)

				variable diameter		
24.	For two shafts in series or having				CO3	
	a. T = T1 + T2	b. T = T1 = T2	c. T = T1 – T2	d. T = (T1.T2)^1/2		(1)
25.	A circular bar is subjected to an axial force and shear force, the difference between two principle stresses is 120 MPa. Based on maximum shear stress theory what is the factor of safety, if elastic limit of the bar is 300 MPa?				CO1	
	a. 5	b. 2	c. 2.5	d. 3		(1)
26.	For designing ductile materials, which of the following theories is/are used?				CO1	
a.	a. Maximum shear stress theory	b. Shear strain energy theory	c. Both a and b	d. None of the above		(1)
27.	Maximum principal stress theory is applicable to_____.				CO1	
	a. Ductile materials	b. Brittle materials	c. composite materials	d. None of the above		(1)
28.	Shear strain energy is equal to_____.				CO1	
	a. $[(\sigma1^2 + \sigma2^2 + (\sigma1 + \sigma2)^2]/12E$	b. $[(\sigma1^2 + \sigma2^2 + (\sigma1 — \sigma2)^2]/12C$	c. $[(\sigma1^2 + \sigma2^2 + (\sigma1 + \sigma2)^2]/12G$	d. None of the above		(1)
29.	What is the bending moment at the point where this cantilever beam attaches to the wall? 				CO2	
	a. 0 kN-m	b. 15 kN-m	c. 30 kN-m	d. 40 kN-m		(1)
30.	A 2-m-long, cantilevered beam has a 4 kN load applied at its free end and a 2 kN load applied at the beam midpoint as illustrated here. The correct shear diagram for this beam is: 				CO2	
	a. 	b. 	c. 	d. 		(1)
31.	The maximum tangential stress $\sigma_t = (\sigma_x \sin 2\theta)/2$ is maximum if, θ is equal to ____.				CO1	
	a. 45°	b. 90°	c. 270°	d. All of the above		(1)
32.	Slope at a point in a beam is the_____.				CO4	
	a. Vertical displacement	b. Angular displacement	c. Horizontal displacement	d. None of the above		(1)
33.	Deflection at a point in a beam is the_____.				CO4	
	a. Vertical displacement	b. Angular displacement	c. Horizontal displacement	d. None of the above		(1)
34.	Maximum deflection in a S.S. beam with W at centre will be_____.				CO4	
	a. $WL^3/36EI$	b. $WL^3/24EI$	c. $WL^3/48EI$	d. None of the above		(1)
35.	Maximum deflection in a Simply supported beam with W at center will be_____ .				CO4	
	a. At the left hand support	b. At the Right support	c. At the center	d. None of the above		(1)
36.	The layer which is neither shortened nor elongated is known as_____.				CO2	
	a. Neutral layer	b. Top layer	c. Bottom layer	d. elastic layer		(1)

37.	A cantilever is a beam whose_____.					
	a. Both ends are supported either on rollers or hinges	b. One end is fixed and other end is free	c. Both ends are fixed	d.Whose both or one of the a. end has overhang		(1)
38.	In Mohr's circle method, compressive direct stress is represented on ____.				CO1	
	a. positive x-axis	b. positive y-axis	c. negative x-axis	d. negative y-axis		(1)
39.	What is the value of shear stress acting on a plane of circular bar which is subjected to axial tensile load of 100 kN? (Diameter of bar = 40 mm , $\theta = 42.3^{o}$)				CO1	
	a. 58.73 Mpa	b. 40.23 Mpa	c. 39.60 Mpa	d. Insufficient data		(1)
40.	The unit of strain_____.				CO1	
	a. No unit	b. kN	c. N/mm^2	d. N/mm^3		(1)

	PART B(8 X 5 = 40 MARKS) (ANSWER ANY EIGHT)		
41.	An axial pull of 35000N is acting on a bar consisting of three lengths as shown in fig. below. If the young's modulus = 2.1×10^5 N/mm^2 ,determine Stresses in each section. 	CO1	(5)
42.	Derive an expression for the stresses on an oblique plane of a rectangular body, when the body is subjected to a simple shear stress.	CO1	(5)
43.	Draw shear force and bending for the simply supported beam given below 	CO2	(5)
44.	Draw shear force and bending for the beam given below 	CO2	(5)
45.	A cantilever of length 2.5 metre carries a uniformly distributed load of 16.4 kN per metre length over the entire length. If the moment of inertia of the beam $=7.95\times10^7 mm^4$ and value of young's modulus $E=2\times10^5$ N/mm^2 , determine the deflection at the free end.	CO4	(5)
46.	Find an expression for slope and maximum deflection for a simply supported beam carrying a point load at the centre using double integration method.	CO4	(5)
47.	According to the theory of maximum shear stress, determine the diameter of a bolt which is subjected to an axial pull of 9kN together with a transverse shear force of 4.5kN. Elastic limit in tension is 225 N/mm^2 , factor of safety=3 and Poisson's ratio=0.3.	CO1	(5)
48.	A body is subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress.Draw the Mohr's circle of stresses and explain	CO1	(5)

	the methods to obtain the principal stresses and principal planes.		
49.	A solid shaft of diameter 80 mm is subjected to a twisting moment of 8 MN-mm and a bending moment of 5 MN-mm at a point. Determine: (i) Principal stresses (ii) Position of the plane on which they act	CO3	(5)
50.	Find the maximum shear stress induced in a solid circular shaft of diameter 15 cm when the shaft transmits 150 kW power at 180 r.p.m.	CO3	(5)
	PART C(2 X 10 = 20 MARKS) (ANSWER ANY TWO)		
51.	A steel rod of 3cm diameter is enclosed centrally in a hollow copper tube of external diameter of 5 cm and internal diameter of 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 15 cm, determine : (i) The stresses in the rod and tube (ii) Load carried by each bar	CO1	(10)
52.	Draw shear force and bending moment diagram for the following beam 	CO2	(10)
53.	A hollow shaft of diameter ratio 3/8 (internal dia. To outer dia.) is to transmit 375 kW power at 100 r.p.m. The maximum torque being 20% greater than the mean. The shear stress is not to exceed 60 N/ mm^2 and twist in a length of 4 m not to exceed 2˚. Calculate its external and internal diameters which would satify both the above conditions. Assume modulus of rigidity, $C=0.85\times10^5$ N/mm^2.	CO3	(10)

ALL THE BEST