Reg No.:_____ Name:_____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Examination December 2021 (2019 scheme)

Course Code: CET201

Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks

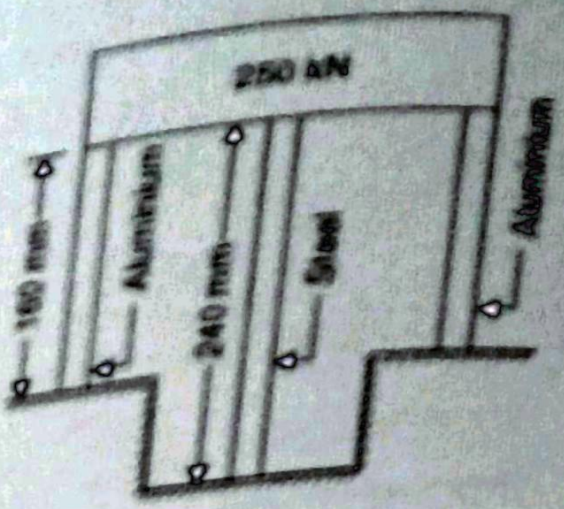
		Marks
1	Distinguish between (i) Elastic limit and yield point. (ii) Engineering stress and true stress.	(3)
2	Explain the analysis of axially loaded composite bar.	(3)
3	Define Poisson's ratio. Write the relationship between bulk modulus of elasticity and Young's modulus of elasticity	(3)
4	Define i)Strain energy ii)Modulus of resilience iii)Modulus of toughness	(3)
5	Derive the relation between bending moment and shear force in a beam	(3)
6	Draw the shear force diagram and bending moment diagram for simply supported beam with uniformly distributed load.	(3)
7	List three assumptions in theory of pure bending	(3)
8	Write down the governing relation to find the shear stress in beams. Sketch the variation of shear stress in rectangular beam sections.	(3)
9	Explain principal stresses and principal strains	(3)
10	Define slenderness ratio of a column. List any 2 limitations for Euler's buckling theory	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

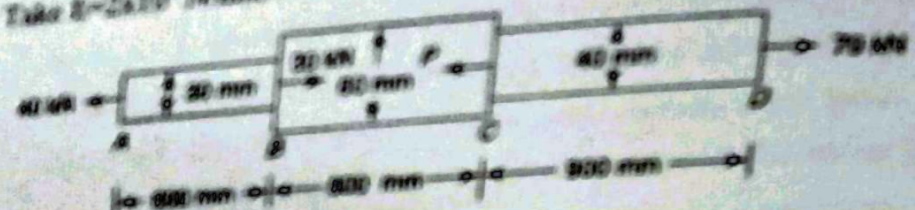
Module 1

11	a)	Three pillars, two of aluminium and one of steel support a rigid platform of 250 kN as shown in Fig. If area of each aluminium pillar is 1200 mm^2 and that of steel pillar is 1000mm^2, find the stresses developed in each pillar Take E(aluminium) =1x10^6N/mm^2, E(steel)=2x10^5N/mm^2	(9)



b) Derive expression for total elongation of bar due to its own weight

12 a) A circular steel bar having three segments is subjected to various forces at different cross-sections as shown in figure. Determine the necessary force to be applied at section C for the equilibrium of the bar. Also find the total elongation of the bar. Take $E=2\times10^5$ N/mm^2



b) Derive an expression to determine the elongation of a uniformly tapering circular section.

Module 2

13 a) An aluminium specimen has a diameter of 25mm and a gauge length of L= 250mm. If a force of 165 kN elongates the gauge length 1.20 mm, determine the modulus of elasticity. Also, determine the contraction in diameter of the specimen caused by the force. Take G=26GPa and σ_y=440MPa.

b) Deduce the expression for stress in case of impact loading.

14 a) A steel tube of 35 mm outer diameter and 30 mm inner diameter encloses a gunmetal rod of 25mm diameter and is rigidly joined at each end. If at a temperature of 40°C there is no longitudinal stress, determine the stresses developed in the rod and the tube when the temperature of the assembly is raised to 240 °C.

α_s=11 x10^{-6}/°C

α_g=18 x 10^{-6}/°C

E_s=205GPa

E_g=91.5GPa

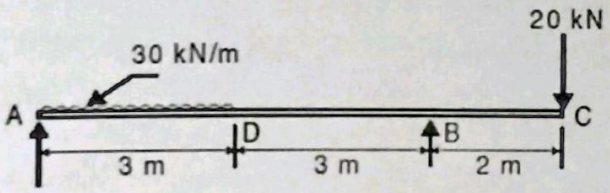
Also find the increase in length if the original length of the assembly is 1m.

b) Show that in thin cylinders subjected to internal fluid pressure, the circumferential stress is twice the longitudinal stress (4)

Module 3

15 A 10 m long simply supported beam carries two point loads of 10 kN and 6kN at 2m and 9m respectively from the left end . It also has a uniformly distributed load of 4kN/m run for the length between 4m and 7m from the left end. Draw shear force and bending moment diagrams. State the position and amount of maximum bending moment (14)

16 Draw the SFD and BMD of the beam loaded as shown in figure. Find the maximum BM and locate the point of maximum BM also. (14)



Module 4

17 The tension flange of a girder of I-section is 240mm x40mm whereas the compression flange is 120mm x20mm. The web is 300mm deep and 20 mm. If the girder is used as a simply supported beam of 8m span, determine the load/m run if the allowable stress is 90MPa in compression and 30 MPa in tension. (14)

18 a) A simply supported wooden beam of span 1.3 m having a cross-section 150 mm wide and 250 mm deep carries a point load W at the centre. The permissible stresses are 7 N/mm^2 in bending and 1 N/mm^2 in shear. Calculate the safe load W. (10)

b) What is section modulus? Express the section modulus of (i) rectangular section (width=b, depth=d) , (ii) circular section (diameter=d) (4)

Module 5

19 a) A solid steel shaft has to transmit 75kW at 200rpm.Determine the suitable diameter of shaft if the maximum torque transmitted is not to exceed the mean by 30% in each revolution. The shear stress is not to exceed 70N/mm^2.Also calculate the maximum angle of twist in a length of 4m of the shaft. G=80Gpa (7)

b) A hollow cast iron column 10m long and 10cm internal diameter and 15cm external (7)

diameter is having its one end hinged and other rigidly fixed. Find the crippling load and safe load taking factor of safety as 5. Take E=95kN/mm^2. Use Euler's formula

a) An elemental cube is subjected to tensile stresses of 30N/mm^2 and 15N/mm^2 acting on two mutually perpendicular planes and a shear stress of 25N/mm^2 on these planes. Determine magnitude and directions of principal stresses. Also calculate greatest shear stress and its planes.

b) Differentiate between long column and short column.

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Reg. No._____ Name:_____

A P J ABUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

CE 201: MECHANICS OF SOLIDS (CE)

Max. Marks:100 Duration: 3 Hours

PART A

Answer any 2 complete questions each having 15 marks

1. (a) In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on a guage length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the value of the three moduli. (10)

(b) Define the terms stress and strain. What ate the different types of stresses and strains? (5)

2. (a) A compound bar consists of a circular rod of steel of diameter 20 mm rigidly fitted into a copper tube of internal diameter 20 mm and thickness 5 mm. If the bar is subjected to a load of 100 kN , find the stresses developed in the two materials. Take Es = $2x10^5$ N/mm^2 and Ec =$1.2x10^5$ N/mm^2 (10)

(b) What is strain energy? Give the expression for strain energy due to axial force. (5)

3. (a) A railway line is laid so that there is no stress in the rails at 8^0C. Calculate (a) the stress on the rails at 50^0C if there is no allowance for expansion. (b) the stress in the rails if there is an expansion allowance of 8 mm. (c) the expansion allowance if the stress in the rails is to be zero . (d) the maximum temperature to have no stress in the rails if the expansion allowance is 12 mm. The rails are 30 mm long. Take $\alpha = 12 \times 10^{-6}$ per ^{0}C and $E = 2 \times 10^5$ N/mm^2 (10)

(b)Derive the expression for deformation of a bar of constant section due to self weight. (5)

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Reg. No. _____ Name: _____

A P J ABUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

CE 201: MECHANICS OF SOLIDS (CE)

Max. Marks:100 Duration: 3 Hours

PART A

Answer any 2 complete questions each having 15 marks

1. (a) In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on a guage length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the value of the three moduli. (10)

(b) Define the terms stress and strain. What ate the different types of stresses and strains? (5)

2. (a) A compound bar consists of a circular rod of steel of diameter 20 mm rigidly fitted into a copper tube of internal diameter 20 mm and thickness 5 mm. If the bar is subjected to a load of 100 kN , find the stresses developed in the two materials. Take Es = 2×10^5 N/mm^2 and Ec = 1.2×10^5 N/mm^2 (10)

(b) What is strain energy? Give the expression for strain energy due to axial force. (5)

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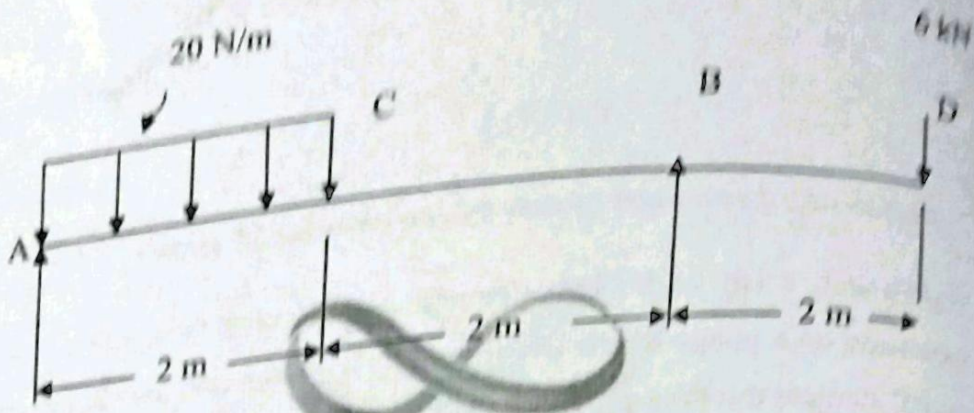
(b)Derive the expression for deformation of a bar of constant section due to self weight. (5)

B

Answer any 2 complete questions each having 15 marks

4. (a) Draw the shear force and bending moment diagram for the beam given.



(10)

(b) Derive the relation between intensity of loading, shear force and bending moment. (5)

5. (a) A simply supported beam AB of 4 m span carries a uniform load of 30 kN/m over the right hand half of the span. Draw SFD and BMD. (10)

(b) Distinguish between bending moment and moment of resistance (5)

6. (a) A cast iron beam has an I-section with top flange 80 mm x 40 mm, web 120 mm x 20 mm and bottom flange 160 mm x 40 mm. If tensile stress is not to exceed 30 N/mm^2 and compressive stress 90 N/mm^2, what is the maximum UDL the beam can carry over a simply supported span of 6 m if the larger flange is in tension? (10)

(b) Sketch the bending stress as well as shear stress distribution diagram for a beam of rectangular cross section. (5)

PART C

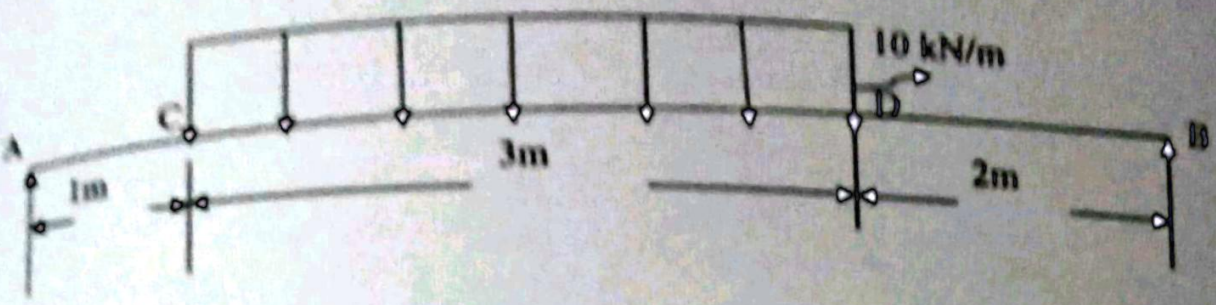
Answer any 2 complete questions each having 20 marks

7. (a) At a point in a material stress components are p_x = 500 MPa (tensile), p_y = 10 MPa (tensile) and q = 20 MPa. Determine (i) the planes on which shear stress is maximum, (ii) principal planes and (iii) stress components on these planes. (12)

(b) Derive the torsion equation for a solid circular shaft. (8)

8. (a) A beam AB is 6m long and has a moment of inertia of 450×10^6 mm^4. It is supported at A and B and carries a UDL of 10 kN/m as shown in figure. Calculate (i) Slope at A and (ii) maximum deflection.

Take E = 200 kN/mm^2



(15)

(b) State and explain moment area theorems. (5)

9. (a) A hollow metallic tube of 60 mm external diameter, 50 mm internal diameter and 3 m long is fixed at one end and its other end is free. Calculate the maximum load that it can withstand. Crushing strength of the material = 300 MPa, Rankine's constant = 1/7500.

(12)

(b) What are the assumptions made in Euler's column theory? (8)

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TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

Course Code: CE201

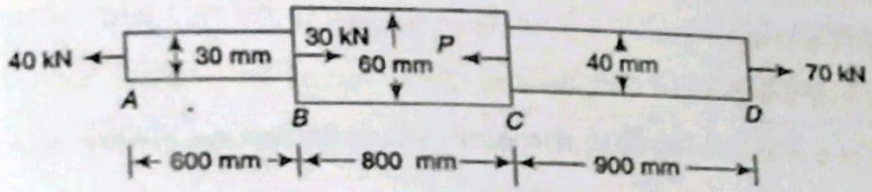
Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

			Marks
1	a)	Plot stress strain diagram for mild steel. Explain its salient features.	(7)
	b)	Calculate the diameter of a circular bar of length 10m, if the elongation of the bar due to an axial load of 100kN is 0.15mm. E=200GN/m^2	(4)
	c)	Define the following terms a) Poissons's ratio b)Bulk modulus c)Modulus of resilience d) Rigidity modulus	(4)
2	a)	Derive an expression to determine the elongation of a uniformly tapering circular section.	(7)
	b)	A circular steel bar having three segments is subjected to various forces at different cross-sections as shown in figure. Determine the necessary force to be applied at section C for the equilibrium of the bar. Also find the total elongation of the bar. Take E=2x10^{5}N/mm^2.	(8)



3	a)	A mild steel rod of 20mm diameter and 300mm long is enclosed centrally inside a hollow brass tube of external diameter 30mm and internal diameter of 25 mm. The ends of the tube and rods are brazed together and the composite bar is subjected to an axial pull of 40kN. If E for steel and brass is 200 GN/mm^2 and 100 GN/mm^2 respectively, find the stresses developed in the rod and tube. Also, find the extension of the rod.	(10)
	b)	A rod is 2 m long at a temperature of 10°C. Find the expansion of the rod when the temperature is raised to 80°C. If this expansion is prevented, find the stress induced in the material of the rod. Take E=1x10^{5}N/mm^2 and α=0.000012 per degree centigrade.	(5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) A 10 m long simply supported beam carries two point loads of 10kN and 6kN 2m and 9m respectively from the left end. It also carries a uniformly distribute load of 4kN/m run for the length between 4m to 7m from the left end. Dra shears force and bending moment diagrams. State the position and magnitude o maximum bending moment.

b) What are the assumptions in theory of simple bending?

5 a) A cantilever beam of span L, fixed at the left end, carries a gradually varied load from zero at free end to w per m length at fixed end. Draw the SFD and BMD.

b) A 225mm x 100mm I beam is simply supported over a span of 12m. The web thickness is 7.5mm and flange thickness is 11.5mm. If the maximum permissible stress is 80N/mm^2, what concentrated load can be carried at a distance of 4m from the support?

c) Define a)point of contra flexure b)Moment of resistance

6 a) A cast iron tee section having overall depth 150mm with flange width and thickness as 100mm and 30mm respectively is used as a cantilever bracket of length 300mm. Web thickness is 30mm. If the tensile stress is restricted to 20N/mm^2, calculate the point load that can be placed at the free end of bracket. Also calculate the compressive stress developed.

b) State the governing relation to find the shear stress in beams. Sketch the shear stress distribution across depth in a)rectangular section b)I section (5)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. State the assumptions made in derivation. (8)

b) An elemental cube is subjected to tensile stresses of 30N/mm^2 and 15N/mm^2 acting on two mutually perpendicular planes and a shear stress of 25N/mm^2 on these planes. Determine magnitude and directions of principal stresses. Also calculate greatest shear stress and its planes. (9)

c) Differentiate between closed coiled and open coiled helical springs. (3)

a) Show that in thin cylinders, the circumferential stress is twice the longitudinal stress when subjected to internal pressure. (6)

b) A hollow cast iron column 10m long and 10cm internal diameter and 15cm external diameter is having its one end hinged and other rigidly fixed. Find the crippling load and safe load taking factor of safety as 5. Take E=95kN/mm^2. Use Eulers formula. (7)

c) A solid steel shaft has to transmit 75kW at 200rpm. Determine the suitable diameter of shaft if the maximum torque transmitted is not to exceed the mean by 30% in each revolution. The shear stress is not to exceed 70N/mm^2. Also calculate the maximum angle of twist in a length of 4m of the shaft. G=80Gpa (7)

9 a) A beam of length 6m is simply supported at its ends and carries a point load of 48kN and 40kN at a distance of 1m and 3m respectively from the left support. Find a) deflection under each load b) maximum deflection c) point at which maximum deflection occurs by double integration method. Given E=2x10^{5}N/mm^2 and I=85x10^{6}mm^4. (10)

b) Define slenderness ratio. State the equations for Euler's crippling load for columns with different end conditions. (5)

c) Explain moment area theorems. (5)

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