Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEB04

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - II

B.Tech III Semester End Examinations, November/ December – 2019

Regulations: IARE - R18

MECHANICS OF SOLIDS

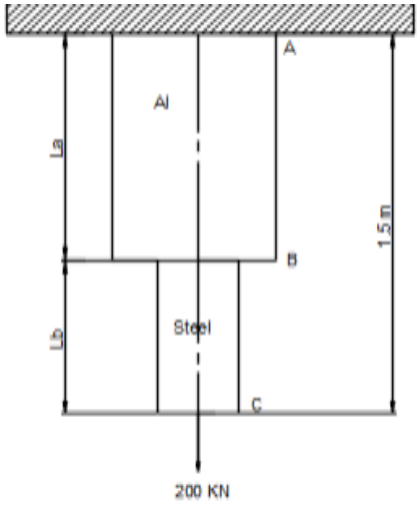
(AERONAUTICAL ENGINEERING)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each MODULE
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE– I

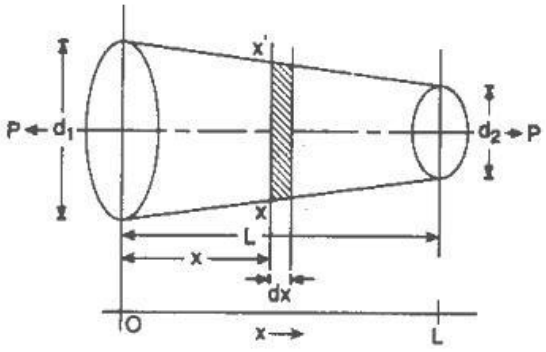
1. a) A compound bar ABC 1.5 m long is made up of two parts of Aluminium and steel and that cross sectional area of Aluminium bar is twice that of the steel bar. The rod is subjected to an axial tensile load of 200 KN. If the elongations of Aluminium and steel parts are equal, determine the lengths of the two parts of the compound bar. Take E for steel as 200 GPa and E for Aluminium as 1/3rd of E for steel. **[7M]**



b) A prismatic member of length l and unit weight w is suspended freely from its end. Determine the elongation of the member under gravity. **[7M]**

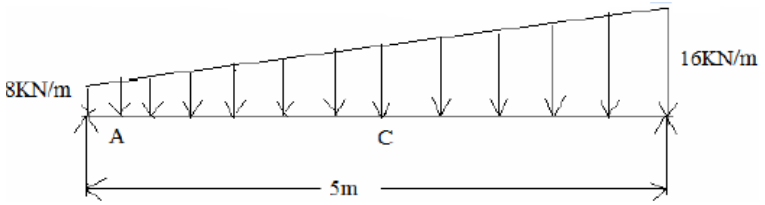
2. a) A straight bar of steel rectangular in section is 4m long and is18mm thick. The width of the rod varies uniformly from 130mm at one end 250mm at the other. If the rod is subjected to an axial tensile load of 50KN, determine the extension of the rod. Take E=2.0×10 N/mm2 **[7M]**

b) Derive an expression for total elongation of a uniformly tapering circular section **[7M]**



MODULE – II

3. a) The intensity of loading on a simply supported beam of 5.0m span increases uniformly from 8KN/m at one end to 16KN/m at the other end as shown in Fig.1. Find the position and magnitude of the maximum bending moment. Also draw S.F.D and B.M.D. **[7M]**



b) A cantilever beam AB, 1.8 m long carries a point load of 2.5 KN at its free end and a uniformly distributed load of 1KN/m from A to B. Draw shear force and bending moment diagrams for the beam. **[7M]**

4. a) A beam of length 6m is simply supported at it's ends, It is loaded with gradually varying load of 10KN/m from left support 750KN/m to right support then draw the shear force and bending moment diagrams for beam. **[7M]**

b) Define and explain the following terms i) Shear force ii) Bending moment iii) Shear force diagram iv) Bending moment diagram **[7M]**

MODULE – III

5. a) A cantilever of square section 200 mm × 200 mm, 2.0 m long, just fails in flexure when a load of 12 KN is placed at its free end. A beam of the same material and having a rectangular cross-section 150 mm wide and 300 mm deep is simply supported over a span of 3.0 m. Calculate the minimum central concentrated load required to break the beam **[7M]**

b) Compare the section moduli of two beams of the weight and length and the beam is solid Circular beam of diameter 'd' and the second is a circular tube of outer diameter 'D1' and inner diameter 'D2'. **[7M]**

6. a) A rectangular beam 300mm deep is simply supported over a span of 4.0m. Determine the uniformly distributed load per meter which the beam may carry, if bending stress should not exceed 120N/mm2. Take I=8.0x106mm4 **[7M]**

b) A cast iron beam section is of I-section with a top flange 80 mm x 20 mm thick, bottom flange 160 mm x 40 mm thick and the web 200 mm deep and 20 mm thick. The beam is freely supported on a span of 5 m. If the tensile stress is not to exceed 20 N/mm2, Determine the safe uniformly distributed load which the beam can carry. **[7M]**

MODULE – IV

7. a) A solid bar 4m long and 6 cm in diameter is used as a strut with both ends hinged. Determine the crippling load. Take E= 2 ×105N/mm2 **[7M]**

   b) A column of timber section 10cm× 15cm is 5m long both ends being fixed. If the Young's modulus for timber =17.5 kN/mm2. Determine **[7M]**
      i. Crippling load
      ii. Safe load for the column if the factor of safety is 3.

8. a) A hollow mild steel tube 5m long, 4cm internal diameter and 5mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Taking E= 2 ×105N/mm2 **[7M]**

   b) A tubular steel strut is of 65mm external diameter and 50 mm internal diameter. It is 2.5 m long and hinged at both ends. The load acting is eccentric. Find the maximum eccentricity for a crippling load of 0.75 of the Euler load, the yield stress being 330 MPa, E = 210 GPa. **[7M]**

MODULE – V

9. a) Derive equations for normal stress, shear stress and resultant stress on a plane the normal to which is inclined at 300 to the axis of the bar. **[7M]**

   b) A tie bar is subjected to a uniform tensile stress of 100N/mm2. Find the intensity of normal stress, shear stress and resultant stress on a plane the normal to which is inclined to the axis at 300 to the axis of the bar. Also estimate the max shear stress in the bar. **[7M]**

10. a) A piece of material is subjected to tensile stresses of 70 N/mm2 and 50 N/mm2 at right angles to each other. Find the stresses on a plane the normal of which makes an angle 350 with the 70 N/ mm2 stress. **[7M]**

    b) Explain the construction of Mohr's circle for two like stresses P1 and P2. (Where P1 and P2 are two principal stresses, N/mm2) **[7M]**

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MECHANICS OF SOLIDS

COURSE OBJECTIVES:

The course should enable the students to:

I	Understand the behavior of structure basic structural components under loading conditions
II	Apply the shear force, bending moment and deflection methods to the beam in different load conditions
III	Relate the bending and flexural stress solving methods to real time problems
IV	Pertain the concept of buckling behavior of the columns along with eigen modes

COURSE OUTCOMES (COs):

CO 1	To understand the basics of material properties, stress and strain.
CO 2	To apply knowledge of various kinds of beams for engineering applications.
CO 3	Ability to identify, formulate, and solve engineering & real life problems.
CO 4	Ability to design and conduct experiments, as well as to analyze and interpret data
CO 5	Ability to design a component to meet desired needs within realistic constraints of safety.

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

AAEB04.01	Calculate the stress strain relations in conjunction with elasticity and material properties
AAEB04.02	Describe the resistance and deformation in members which are subjected to axial, flexural and torsion loads.
AAEB04.03	Discuss thermal explanations in solid bars and induced thermal stresses
AAEB04.04	Solve for bending and shear parameters of beams under loading conditions
AAEB04.05	Explain for deflections of beams under loading with various approaches.
AAEB04.06	Determine the deflections of different beams under different loading conditions.
AAEB04.07	Compute the bending stresses developed in various sections of beams of real field problems.
AAEB04.08	Apply the bending equation on various sections
AAEB04.09	Determine the shear stresses developed in various sections of beams
AAEB04.10	Calculate the stability of structural elements and determine buckling loads.
AAEB04.11	Discuss critical buckling load for column with various loading and end conditions

AAEB04.12	Apply theories and to predict the performance of bars under axial loading including buckling.
AAEB04.13	Understand the theory of beam column & determine buckling loads on it.
AAEB04.14	Solve the principal stress problems by graphical methods.
AAEB04.15	Explain the stress transformation and concept of principle plane and principle stresses
AAEB04.16	Evaluate principal stresses, strains and apply the concept of failure theories for design
AAEB04.17	Acquire knowledge to solve real time problems in Aircraft structure subjected loading conditions

MAPPING OF SEE – COURSE OUTCOMES

SEE Question No.		Course Outcomes		Course Outcomes	Blooms' Taxonomy Level
1	a	AAEB04.01	Calculate the stress strain relations in conjunction with elasticity and material properties	CO1	Remember
	b	AAEB04.02	Describe the resistance and deformation in members which are subjected to axial, flexural and torsion loads.	CO1	Remember
2	a	AAEB04.03	Discuss thermal explanations in solid bars and induced thermal stresses	CO1	Remember
	b	AAEB04.01	Calculate the stress strain relations in conjunction with elasticity and material properties	CO1	Understand
3	a	AAEB04.04	Solve for bending and shear parameters of beams under loading conditions	CO2	Remember
	b	AAEB04.05	Explain for deflections of beams under loading with various approaches.	CO2	Remember
4	a	AAEB04.04	Solve for bending and shear parameters of beams under loading conditions	CO2	Remember
	b	AAEB04.05	Explain for deflections of beams under loading with various approaches.	CO2	Remember
5	a	AAEB04.07	Compute the bending stresses developed in various sections of beams of real field problems.	CO3	Understand
	b	AAEB04.07	Compute the bending stresses developed in various sections of beams of real field problems.	CO3	Remember
6	a	AAEB04.09	Determine the shear stresses developed in various sections of beams	CO3	Understand
	b	AAEB04.09	Determine the shear stresses developed in various sections of beams	CO3	Understand
7	a	AAEB04.10	Calculate the stability of structural elements and determine buckling loads.	CO4	Understand
	b	AAEB04.11	Discuss critical buckling load for column with various loading and end conditions	CO4	Remember
8	a	AAEB04.12	Apply theories and to predict the performance of bars under axial loading including buckling.	CO4	Understand
	b	AAEB04.13	Understand the theory of beam column & determine buckling loads on it.	CO4	Understand
9	a	AAEB04.14	Solve the principal stress problems by graphical methods.	CO5	Remember

	b	AAEB04.15	Explain the stress transformation and concept of principle plane and principle stresses	CO5	Understand
10	a	AAEB04.16	Evaluate principal stresses, strains and apply the concept of failure theories for design	CO5	Remember
	b	AAEB04.17	Acquire knowledge to solve real time problems in Aircraft structure subjected loading conditions	CO5	Remember

Signature of Course Coordinator **HOD, AE**