Hall Ticket No | | | | | | | | | | | Question Paper Code: AME004

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech III Semester End Examinations (Regular), November – 2018

Regulations: IARE-R16

MECHNICS OF SOLIDS

(MECHANICAL ENGINEERING)

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

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

UNIT – I

1. a) Derive the relation between E, C and K and also explain the importance of poisson's ratio. **[7M]**

   b) The ultimate tensile stress for a hollow steel column which carries an axial load of 2 MN is 500 N/mm. If the external diameter of the column is 250 mm, determine the internal diameter. Take FOS as 4.0. **[7M]**

2. a) Derive an expression for strain energy for the gradually applied load and Impact load. **[7M]**

   b) Calculate the strain energy that can be stored in a steel bar 2.4 m long and 1000 mm2 cross sectional area, when subjected to a tensile stress of 50 MPa. Take E = 200 GPa. **[7M]**

UNIT – II

3. a) Derive the equations of shear force and bending moment for the simply supported beam, which is subjected to uniformly distributed load throughout the length. **[7M]**

   b) A cantilever of length 5.0 m is loaded as shown in Fig.1below. Draw the S.F and B.M diagrams for the cantilever. **[7M]**

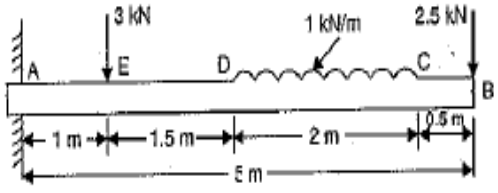

Fig.1

4. a) Derive the equations of shear force and bending moment for the overhanging beam, which is subjected to uniformly distributed load throughout the length. **[7M]**

   b) A horizontal beam AB of length 8m is hinged at A and placed on rollers at B. The beam carries three inclined point loads as shown in Fig.2. Draw the S.F and B.M and axial force diagrams of the beam. **[7M]**

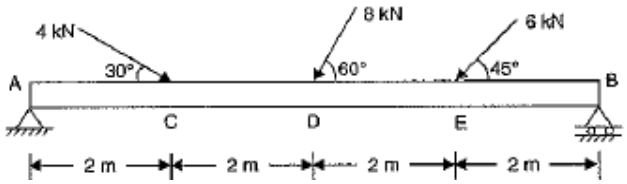

Fig.2

UNIT – III

5. a) Explain the following terms: i) Polar moment of inertia, ii) Moment of resistance, iii) Center of gravity, iv) Bending stress. **[7M]**

   b) A beam of I-section is having overall depth of 700 mm and overall width as 230 mm. The thickness of the flanges is 25 mm where as the thickness of the web is 20 mm. If the section carries a shear force of 64 kN. Calculate the shear stress at salient points **[7M]**

6. a) Derive an equation for the variation of shear stress of the rectangular cross sectioned beam. **[7M]**

   b) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4m. If shear force at a section of the beam is 4500 N, find the shear stress at a distance 25 mm above the N.A. **[7M]**

UNIT – IV

7. a) Derive the equations of principle stresses for the beam which is subjected to two mutually perpendicular normal stresses. **[7M]**

   b) At a point in a component a direct tensile stress of 70 N/mm^2 and a direct compressive stress of 50 N/mm^2 are applied on planes at right angles to each other. If the maximum principal stress is limited to 75 N/ mm^2. Find out the shear stress that may be allowed on the planes. Also determine magnitude and direction of the minimum principal stress and the maximum shear stress. **[7M]**

8. a) Explain the construction of Mohr's circle for two like stresses P1 and P2. **[7M]**

   b) At a point in a stressed element, the normal stresses in two mutually perpendicular directions are 45 MPa and 25 MPa both tensile. The complementary shear stress in these directions is 15 MPa. By using Mohr's circle method, or otherwise, determine the maximum and minimum principal stresses. **[7M]**

UNIT – V

9. a) Explain and derive the torsion equation. **[7M]**

   b) Find the angle of twist per metre length of a hollow shaft of 100 mm external and 60 mm internal diameter, if the shear stress is not to exceed 35 MPa. take C = 85Gpa. **[7M]**

10 a) Explain the following terms: i) Torsional rigidity, ii) Importance of angle of twist, iii) Modulus of rupture. **[7M]**

   b) The volume of a hollow cylinder of 800 mm diameter, 1.4 m length and 10 mm thickness increases by 1245 ml when Subjected to an internal pressure of 4.5 MPa. Determine the Poisson's ratio of the material, if E = 190 GPa. **[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

1	Solve real field problems through evaluating the relationship between stress and strain.
2	Understand the shear force and bending moment diagrams of symmetrical beams.
3	Determine bending and shear stresses developed in beams of various sections.
4	Understand various theories of failure, Mohr's circle of stresses, principle stresses and strains.
5	Understand and apply the concept of stress and strain to analyze and design structural members and machine parts under axial load, shear load, bending moment and torsion

COURSE LEARNING OUTCOMES:

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

S.NO	Description	Blooms Taxonomy Level
CAME004.01	Demonstrate the statically determinate and indeterminate problems. Use algebraic equations to determine the effect of stress and strain in the bars which are made up of various materials.	Understand
CAME004.02	Understand extension and reduction of length of different bars. Explain the various stresses and strains and their relations, also comprehend the importance of elastic moduli.	Remember
CAME004.03	Explore the shear force diagrams under various loads. Explain the importance of beams in the real field by understanding the types of loads.	Analyze
CAME004.04	Comprehend bending moment and its variation at various loads. Explain the bending moment diagram and its importance, understanding the supports and beams.	Understand
CAME004.05	Determine the resistance and deformation in members which are subjected to axial, flexural and torsional loads.	Remember
CAME004.06	Evaluate the principal stresses, strains and apply the concept of failure theories for design of shafts and other designed products.	Understand
CAME004.07	Able to calculate the shear stresses developed in various sections of beams.	Remember
CAME004.08	Capable of understand the loads which occur in crash analysis.	Remember
CAME004.09	Understand the effect of gradual loads on the various materials.	
CAME004.10	Understand the effect of stress on materials in relation to strains.	Understand
CAME004.11	Able to calculate the flexural developed in various sections of beams of real field problems.	Remember
CAME004.12	Find principle stresses and strains and to apply theories of failure in the design of various mechanical parts.	Remember
CAME004.13	Determine stresses developed in a shaft and design of a shaft.	Understand
CAME004.14	Understand the real field problems of various pressure vessels which are made up of different materials.	Remember
CAME004.15	Able to design the thin vessels which are subjected to different stresses.	Understand
CAME004.16	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc	Remember

CAME004.17	Understand the significance of elastic constants for predicting the strengths of structures for long lasting.	Understand
CAME004.18	Understand the effect of suddenly applied loads on the various materials for anticipating the fatigue life under cyclic.	Remember
CAME004.19	Able to optimize the design of shafts by using theories of failure for minimizing the wastage of materials and product cost.	Understand
CAME004.20	Determine the stresses and strains by using graphical method for validating the analytical results in the research of self healing composite structures.	Remember

Mapping of Semester End Examinations to Course Learning Outcomes:

SEE Question No	Course Learning Outcomes			Blooms Taxonomy Level
1	a	CAME004.01	Demonstrate the statically determinate and indeterminate problems. Use algebraic equations to determine the effect of stress and strain in the bars which are made up of various materials.	Understand
	b	CAME004.02	Understand extension and reduction of length of different bars. Explain the various stresses and strains and their relations, also comprehend the importance of elastic moduli.	Remember
2	a	CAME004.01	Demonstrate the statically determinate and indeterminate problems. Use algebraic equations to determine the effect of stress and strain in the bars which are made up of various materials.	Understand
	b	CAME004.02	Understand extension and reduction of length of different bars. Explain the various stresses and strains and their relations, also comprehend the importance of elastic moduli.	Remember
3	a	CAME004.03	Explore the shear force diagrams under various loads. Explain the importance of beams in the real field by understanding the types of loads.	Understand
	b	CAME004.04	Comprehend bending moment and its variation at various loads. Explain the bending moment diagram and its importance, understanding the supports and beams.	Understand
4	a	CAME004.03	Explore the shear force diagrams under various loads. Explain the importance of beams in the real field by understanding the types of loads.	Understand
	b	CAME004.04	Comprehend bending moment and its variation at various loads. Explain the bending moment diagram and it's importance, understanding the supports and beams.	Understand
5	a	CAME004.06	Evaluate the principal stresses, strains and apply the concept of failure theories for design of shafts and other designed products.	Understand
	b	CAME004.07	Able to calculate the shear stresses developed in various sections of beams.	Remember
6	a	CAME004.08	Capable of understand the loads which occur in crash analysis.	Remember
	b	CAME004.06	Evaluate the principal stresses, strains and apply the	Understand

			concept of failure theories for design of shafts and other designed products.	
7	a	CAME004.11	Able to calculate the flexural developed in various sections of beams of real field problems.	Remember
	b	CAME004.12	Find principle stresses and strains and to apply theories of failure in the design of various mechanical parts.	Remember
8	a	CAME004.10	Able to calculate the flexural developed in various sections of beams of real field problems.	Understand
	b	CAME004.02	Understand extension and reduction of length of different bars. Explain the various stresses and strains and their relations, also comprehend the importance of elastic moduli.	Remember
9	a	CAME004.14	Understand the real field problems of various pressure vessels which are made up of different materials.	Remember
	b	CAME004.02	Understand extension and reduction of length of different bars. Explain the various stresses and strains and their relations, also comprehend the importance of elastic moduli.	Remember
10	a	CAME004.14	Understand the real field problems of various pressure vessels which are made up of different materials.	Remember
	b	CAME004.15	Able to design the thin vessels which are subjected to different stresses.	Understand

Signature of Course Coordinator

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