INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	THEORY OF STRUCTURES
Course Code	:	AAE002
Regulation	:	IARE_R16
Class	:	B. Tech III Semester
Branch	:	Aeronautical Engineering
Year	:	2018 – 2019
Team of Instructors	:	Dr Y B Sudhir Sastry, Professor, Dept of AE. Mr. T Mahesh Kumar, Asst. Professor, Dept of AE.

COURSE OBJECTIVES

The course should enable the students to :

S. No	Description
I	Understand various aspects of mechanics of materials as applied to engineering problems in a systematic manner stressing the fundamentals.
II	Analyze problems on thermal stresses, shear force, bending moment and deflection of beams
III	Discuss the equilibrium and compatibility conditions for two-dimensional and three-dimensional elastic bodies.

COURSE LEARNING OUTCOMES

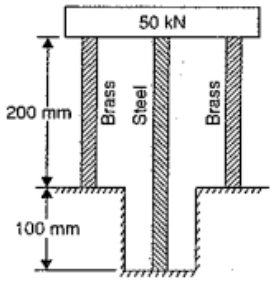
Students, who complete the course, will be able to demonstrate the ability to do the following :

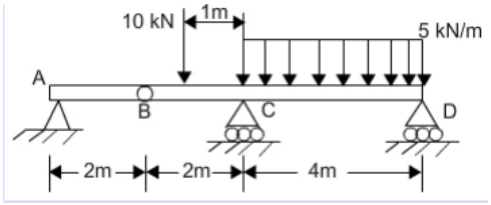
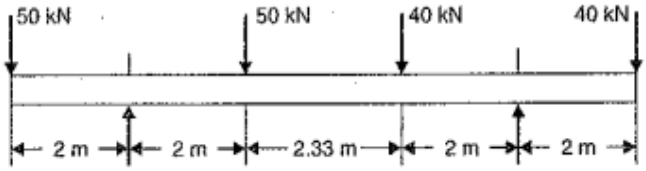
CAAE002.01	Calculate the stress strain relations in conjunction with elasticity and material properties
CAAE002.02	Describe the resistance and deformation in members which are subjected to axial, flexural and torsion loads.
CAAE002.03	Discuss thermal explanations in solid bars and induced thermal stresses
CAAE002.04	Solve for bending and shear stresses of symmetric and un-symmetric beams under loading conditions
CAAE002.05	Calculate the shear stresses developed in various sections of beams.
CAAE002.06	Calculate the flexural developed in various sections of beams of real field problems.
CAAE002.07	Differentiate between redundant structures and determinate structures.
CAAE002.08	Discuss the redundant complex structural components subjected to different loading and boundary conditions.
CAAE002.09	Solve for deflections of beams under loading with various approaches
CAAE002.10	Calculate the stability of structural elements and determine buckling loads.

CAAE002.11	Discuss critical buckling load for column with various loading and end conditions
CAAE002.12	Apply a theories and to predict the performance of bars under axial loading including buckling.
CAAE002.13	Describe the behavior of structural components subjected to various loading and support conditions based on principles of equilibrium and constitutional relationships.
CAAE002.14	Explain the stress transformation and concept of principle plane and principle stresses
CAAE002.15	Evaluate principal stresses, strains and apply the concept of failure theories for design
CAAE002.16	Acquire Basic knowledge to solve real time problems in Aircraft structure with different loading conditions
CAAE002.17	Apply the fundamental concepts of Theory of structures in competitive examinations.

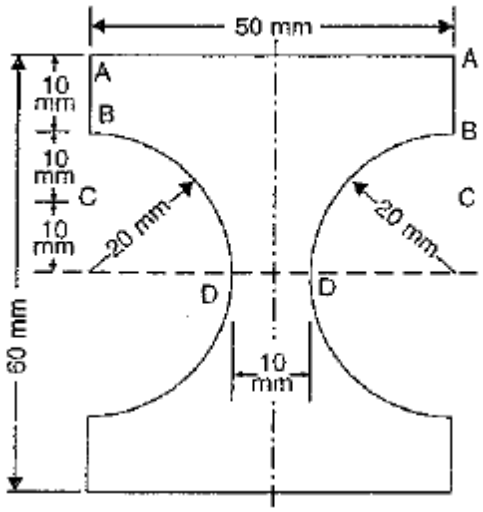
TUTORIAL QUESTION BANK

S No	QUESTIONS	Blooms Taxonomy Level	Course Learning Outcomes
UNIT - I			
INTRODUCTION - SIMPLE STRESSES AND STRAINS			
PART - A (SHORT ANSWER QUESTIONS)			
1	Define Longitudinal strain and lateral strain.	Remember	CAAE002:02
2	State Hooke's law	Remember	CAAE002:02
3	Define Modular ratio, Poisson's ratio	Remember	CAAE002:02
4	What is modulus of elasticity?	Understand	CAAE002:02
5	Explain lateral strain with a neat sketch	Understand	CAAE002:02
6	Write the relationship between bulk modulus, rigidity modulus and Poisson's Ratio	Remember	CAAE002:02
7	Explain shear force in a beam with neat sketches	Understand	CAAE002:04
8	What are the different types of beams? Differentiate between a point load and a uniformly distributed load.	Remember	CAAE002:04
9	What is the maximum bending moment for a simply supported beam subjected to uniformly distributed load and where it occurs?	Remember	CAAE002:04
10	Write the relation between bending moment, shear force and the applied load.	Remember	CAAE002:04
PART - B (LONG ANSWER QUESTIONS)			
1	Three sections of a bar are having different lengths and different diameters. The bar is subjected to an axial load P. Determine the total change in length of the bar. Take Young's modulus of different sections as same.	Remember	CAAE002:02
2	Prove that the total extension of a uniformly tapering rod of diameters D_1& D_2, when the rod is subjected to an axial load P is given by $dL= 4PL/(\pi E D_1 D_2)$ where L is total Length of the rod.	Remember	CAAE002:02
3	Find an expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at the lower end.	Remember	CAAE002:01
4	Find an expression for the total elongation of a uniformly tapering rectangular bar when it is subjected to an axial load P.	Understand	CAAE002:01
5	Derive the relation between three elastic modulii.	Understand	CAAE002:02
6	Define Volumetric Strain. Prove that the volumetric strain for a rectangular bar subjected to an axial load P in the direction of its length is given by $\varepsilon_v= (\delta l/l)(1-2\mu)$ Where μ= Poisson's Ratio and $\delta l/l$ = longitudinal strain.	Remember	CAAE002:02

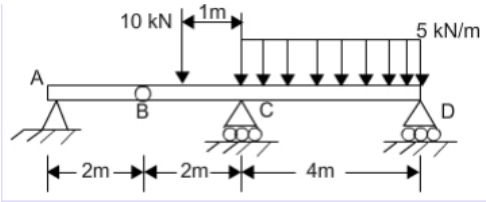
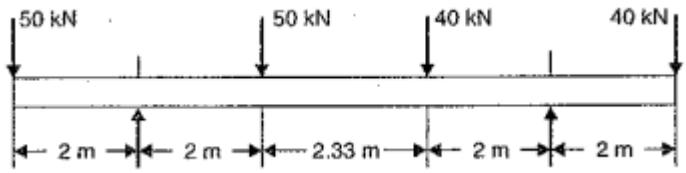
7	Draw the sheer force and bending moment diagrams for a cantilever of length L carrying a uniformly varying load zero at free end to w per unit length at the fixed end.	Remember	CAAE002:04
8	Draw the shear force and bending moment diagrams for a simply supported beam of length L carrying a uniformly varying load zero at each end to w per unit length at the centre.	Remember	CAAE002:04
9	How will you draw the S.F and B.M diagrams for a beam which is subjected to inclined loads?	Remember	CAAE002:04
10	A simply supported beam 6m long is carrying a uniformly distributed load of 5KN/m over a length of 3m from the right end. Draw the S.F and B.M diagrams for the beam and also calculate the maximum B.M on the section.	Remember	CAAE002:04
PART - C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)			
1	Find the minimum diameter of a steel wire with which a load of 3500N can be raised so that the stress in the wire may not exceed 130N/mm^2. For the size and the length of the middle portion if the stress there is 140N/mm^2 and the total extension of the bar is 0.14mm. take E= 2×10^5 N/mm^2.	Understand	CAAE002:01
2	A copper rod 5mm in diameter when subjected to a pull of 750 N extends by 0.125mm over a gauge length of 327mm. find the Young's Modulus for copper.	Remember	CAAE002:01
3	A steel punch can operate at a maximum compressive stress of 75N/mm^2. Find the minimum diameter of the hole which can be punched through a 10mm thick steel plate. Take the ultimate shearing strength as 375N/mm^2	Remember	CAAE002:01
4	A steel rod of cross-sectional area 1600mm^2 and two brass rods each of cross-sectional area of 1000mm^2 together support a load of 50KN as shown in figure. Find the stresses in the rods. Take E for steel 2×10^5 N/mm^2 and E for brass 1×10^5 N/mm^2 	Understand	CAAE002:01
5	A steel rod 5 cm diameter and 6 m long is connected to two grips and the rod is maintained at a temperature of 100^{0}C. determine the stress and pull exerted when the temperature falls to 20^{0}C if (i) The ends do not yield (ii) The ends yield by 0.15cm Take E = 2×10^5 N/mm^2 and $\alpha=12\times10^{-6}$/^{o}C	Understand	CAAE002:03
6	The extension in a rectangular steel bar of length 800mm and of thickness 20mm is found to be 0.21mm. The bar tapers uniformly in width from 80mm to 40mm. if E for the bar is 2×10^5 N/mm^2. Determine the axial tensile load on the bar.	Understand	CAAE002:02

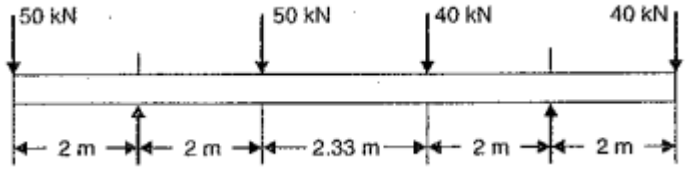
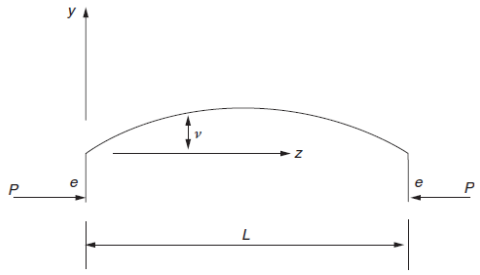
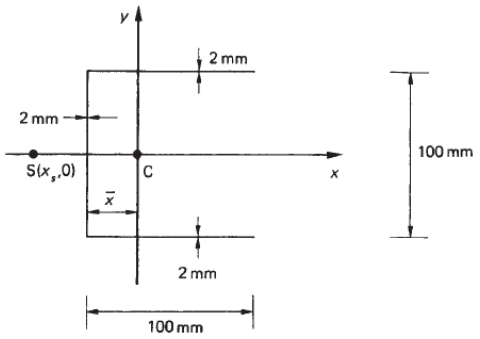
7	Draw the S.F.D and B.M.D for following beam 	Understand	CAAE002:04
8	A beam 10m long and simply supported at each end, has a uniformly distributed load of 1000N/m extending from the left end upto the centre of the beam. There is also an anti-clockwise couple of 15kN/m at a distance of 2.5m from the right end. Draw the S.F and B.M diagrams.	Remember	CAAE002:04
9	A cantilever of length 2m carries a udl of 2KN/m run over the length of 1m from the free end. It also carries a point load of 4KN at a distance of 0.5m from the free end. Draw the S.F.D and B.M.D.	Remember	CAAE002:04
10	A beam is loaded as shown in the figure. Draw S.F.D and B.M.D and find a) Maximum Shear Force b) Maximum Bending Moment c) Point of inflexion 	Understand	CAAE002:04
UNIT - II			
STRESSES IN BEAMS			
PART - A (SHORT ANSWER QUESTIONS)			
1	Define the terms: bending stress, neutral axis	Remember	CAAE002:04
2	What do you mean by simple bending?	Remember	CAAE002:04
3	What do you mean by pure bending?	Understand	CAAE002:04
4	What is the meaning of strength of section?	Understand	CAAE002:04
5	Define the terms : modular ratio, equivalent section	Remember	CAAE002:04
6	Define the terms: section modulus, flitched beams.	Remember	CAAE002:04
7	Write the Bending Equation	Remember	CAAE002:04
8	Write the expression for Section modulus of rectangular section of width b, and depth d.	Remember	CAAE002:04
9	Write the bending equation of a simple beam	Understand	CAAE002:04
10	Write the expression for Section modulus of circular section having radius R.	Understand	CAAE002:04
11	A wooden beam 100mm wide, 250mm deep and 3m long is carrying a u.d.l of 40KN/m. Determine the maximum shear stress and sketch the variation of shear stress along the depth of beam.	Understand	CAAE002:04

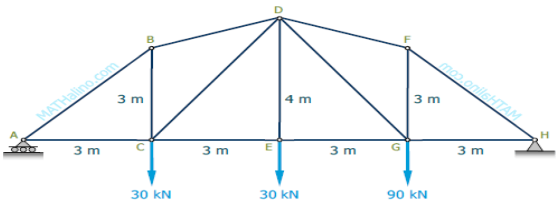
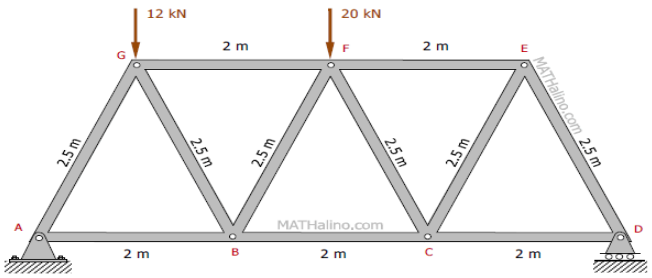
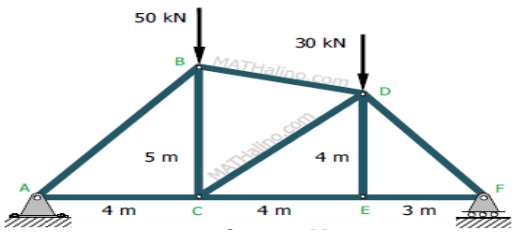
12	A beam of triangular cross section having base width of 100mm and height of 150mm is subjected to a shear force of 13.5KN. find the value of maximum shear stress.	Remember	CAAE002:04
13	A rectangular beam 80mm wide and 150mm deep is subjected to a shearing force of 30KN. Draw the distribution diagram for the shear stress.	Remember	CAAE002:04
14	A circular beam of diameter 150mm is subjected to a shear force of 70KN. Find the value of maximum shear stress.	Remember	CAAE002:04
15	An I-section, with rectangular ends, has the following dimensions: Flanges=150mm×20mm, Web=300mm×10mm. Find the maximum shearing stress developed in the beam for a shear force of 50KN.	Remember	CAAE002:04
16	Draw the distribution of shear stress for I-Section.	Understand	CAAE002:04
17	Draw the shear stress distribution for rectangular section	Understand	CAAE002:04
18	Sketch the variation of shear stress for T-section.	Understand	CAAE002:04
19	Sketch the variation of shear stress for triangular section.	Understand	CAAE002:04
20	Sketch the variation of shear stress for rectangular section.	Understand	CAAE002:04
PART - B (LONG ANSWER QUESTIONS)			
1	Derive an expression for bending stress	Remember	CAAE002:06
2	Show that for a rectangular section the max shear stress is 1.5 times the average stress.	Remember	CAAE002:05
3	The shear stress is not maximum at the neutral axis in case of a triangular section. Prove this statement.	Remember	CAAE002:05
4	A rectangular beam 100mm wideand 150mm deep is subjected to a shear force of 30kN. Determine the average stress, max shear stress	Remember	CAAE002:05
5	Derive bending equation M/I=f/y=E/R.	Remember	CAAE002:06
6	Discuss the assumptions involved in the theory of simple bending	Remember	CAAE002:06
7	Draw and explain shear stress distribution across I section	Remember	CAAE002:05
8	Explain by mathematical expression, that the shear stress abruptly changes at the junction of the flange and web of an I-section and a T-section.	Remember	CAAE002:05
9	Draw and explain shear stress distribution across Circular section.	Remember	CAAE002:05
10	Show that for a rectangular section, the distribution of shearing stress is parabolic.	Understand	CAAE002:05
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	A steel plate of width 60mm and thickness 10mm is bent into a circular arc of radius 10m. Determine the max stress induced and the bending moment which will produce the max stress. Take E= $2x10^5$ N/mm^2.	Understand	CAAE002:06
2	Calculate the max stress induced in a cast iron pipe of external diameter 40mm of internal diameter 20mm and of length 4m when the pipe is supported at its ends and carries a point load of 80N at the	Understand	CAAE002:06

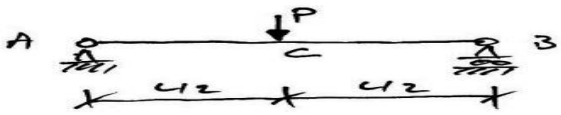
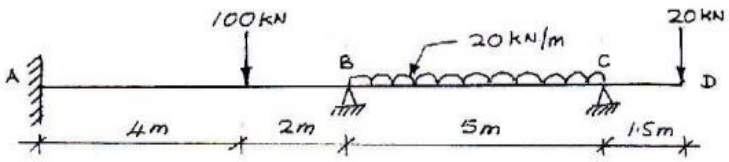
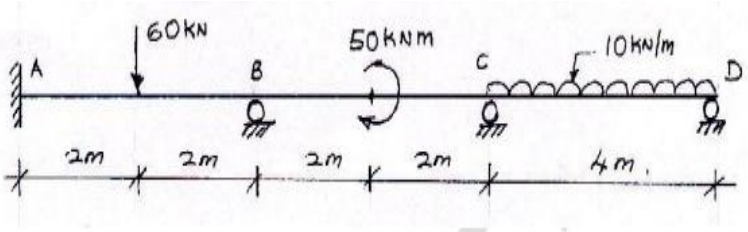
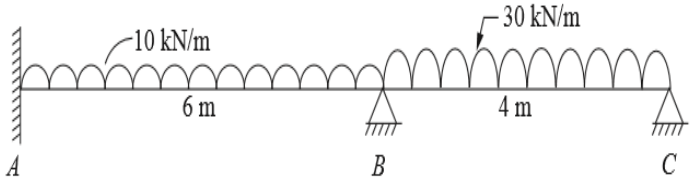
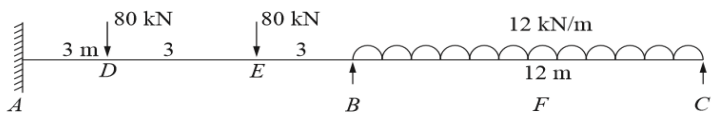
	centre.		
3	Derive an expression for bending stress	Remember	CAAE002:06
4	Show that for a rectangular section the max shear stress is 1.5 times the average stress.	Remember	CAAE002:05
5	The shear stress is not maximum at the neutral axis in case of a triangular section. Prove this statement.	Remember	CAAE002:05
6	A rectangular beam 100mm wide and 150mm deep is subjected to a shear force of 30kN. Determine the average stress, max shear stress	Remember	CAAE002:05
7	The vertical post of a crane consists of an I-section 550mm×190mm. when a load of 60KN was lifted by the crane the distance of the load line from the centroid of the section is 4000mm. find the extreme stresses for the section. Take for the 550mm×190mm. area of I section = 10997mm^2. I_{xx}=5.316×10^{8}mm^4	Understand	CAAE002:05
8	A tie rod of solid circular section is subjected to a tensile force of 94.25KN at an eccentricity of 5mm from the longitudinal axis. If the maximum tensile stress is limited to 150N/mm^2 find the minimum diameter of the rod.	Understand	CAAE002:06
9	An I-section consists of the following sections: upper flange=130mm×50mm Wdb=200mm×50mm, lower flange=200mm×50mm. If the beam is subjected to a shearing force of 50KN, find the maximum shear stress across the section. Also draw the shear stress distribution diagram. Take I=284.9×10^6 mm^4	Understand	CAAE002:05
10	For the section shown in the figure. Determine the average shearing stress at A, B, C & D for shearing force of 20KN. Draw the shear stress distribution. 	Understand	CAAE002:05
UNIT-III			
BEAMS AND COLUMS			
Part - A (Short Answer Questions)			
1	Discuss principle of virtual work for a particle	Understand	CAAE002:09
2	State and explain Maxwell's reciprocal Theorem	Understand	CAAE002:09

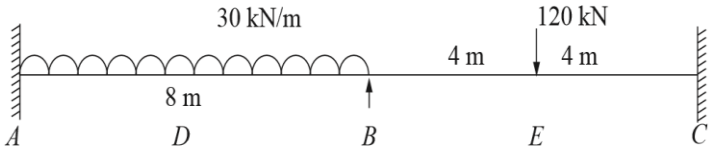
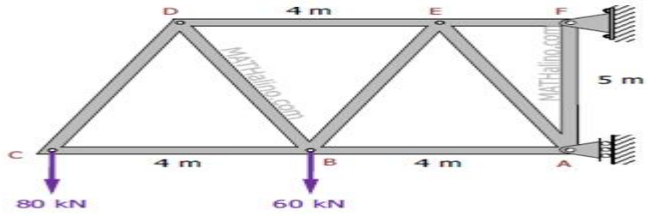
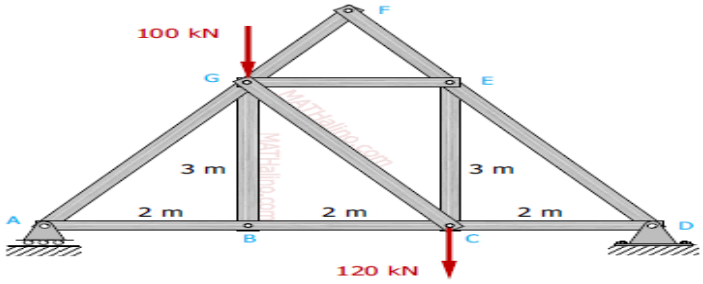
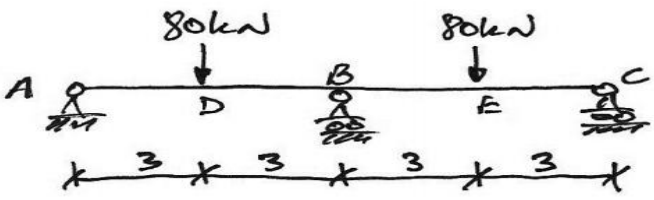
3	Explain Principle of Superposition with neat sketches.	Remember	CAAE002:09
4	Discuss of beams by Macaulay‘s method,	Understand	CAAE002:09
5	State and explain moment area method	Remember	CAAE002:09
6	Discuss of beams by conjugate beam method	Remember	CAAE002:09
7	Explain principle of virtual Displacement for a particle	Understand	CAAE002:09
8	Discuss principle of virtual work for a particle	Understand	CAAE002:09
9	State and explain Maxwell’s reciprocal Theorem	Understand	CAAE002:09
10	Define buckling load.	Remember	CAAE002:09
11	Discuss two types of instability in columns	Remember	CAAE002:11
12	Discuss limitations of Euler’s column theory.	Understand	CAAE002:11
13	Classify types of columns with neat sketches.	Remember	CAAE002:11
14	What are Eigen value functions and Eigen value Problems?	Remember	CAAE002:11
15	Define Bifurcation Point for a column with neat sketches.	Remember	CAAE002:11
16	Write a note on effective length of column. Write effective lengths for different end conditions of columns.	Understand	CAAE002:11
17	Derive the Rankine’s semi empirical formula for columns	Remember	CAAE002:11
18	Explain failure of columns with neat sketches. Also give sign convention for bending of columns.	Remember	CAAE002:11
19	Write the assumptions made in Euler’s Column Theory	Understand	CAAE002:11
20	Define equivalent length.	Remember	CAAE002:11
21	Write Euler’s formula for buckilng load.	Remember	CAAE002:11
Part – B (Long Answer Questions)			
1	Explain Deflection of beams by Double integration method	Remember	CAAE002:09
2	Explain Deflection of beams by Macaulay‘s method,	Understand	CAAE002:09
3	Explain Deflection of beams by moment area method	Remember	CAAE002:09
4	Explain Deflection of beams by conjugate beam method	Remember	CAAE002:09
5	State and Prove Castigliano’s first theorem.	Remember	CAAE002:09
6	Discuss principle of virtual work for a particle	Remember	CAAE002:09
7	Discuss principle of virtual displacement for a particle	Understand	CAAE002:09
8	Explain Deflection of beams by moment area method	Understand	CAAE002:09
9	A beam of length 6m is simply supported at its ends and carries two point loads of 48kN and 40kN at a distance of 1m and 3m respectively from the left support. Find: i) deflection under each load, ii) maximum deflection, and iii) the point at which maximum	Understand	CAAE002:09

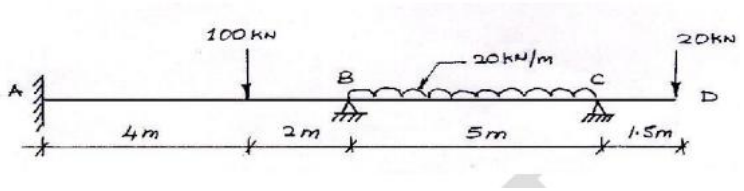
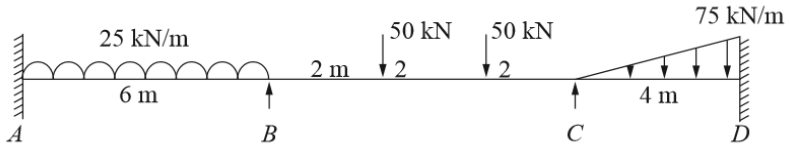
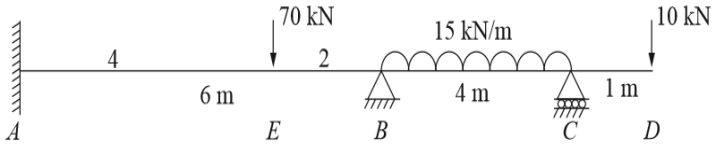
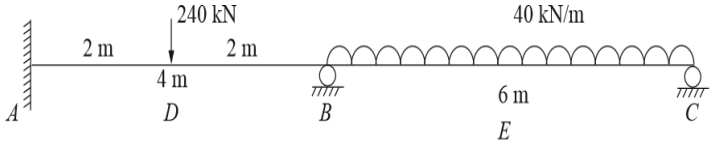
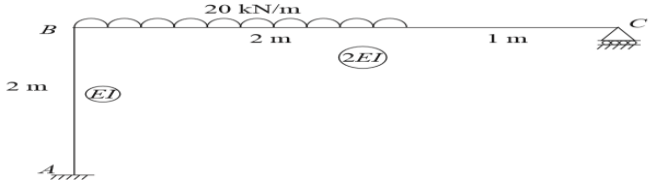
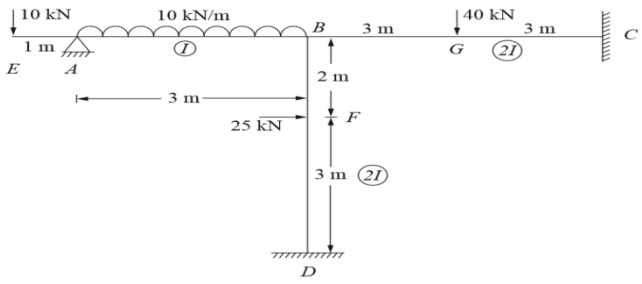
	deflection occurs. Take $E = 2x10^5 N/mm^2$ and $I=85x10^6 mm^4$.		
10	Prove that the relation that $M = EI(d^2y/dx^2)$	Remember	CAAE002:09
11	Discuss two types of instability in columns	Remember	CAAE002:11
12	Discuss limitations of Euler's column theory.	Understand	CAAE002:11
13	Classify types of columns with neat sketches.	Remember	CAAE002:11
14	What are Eigen value functions and Eigen value Problems?	Remember	CAAE002:11
15	Define Bifurcation Point for a column with neat sketches.	Remember	CAAE002:11
16	Write a note on effective length of column. Write effective lengths for different end conditions of columns.	Understand	CAAE002:11
17	Derive the Rankine's semi empirical formula for columns	Remember	CAAE002:11
18	Explain failure of columns with neat sketches. Also give sign convention for bending of columns.	Understand	CAAE002:11
19	Write the assumptions made in Euler's Column Theory	Understand	CAAE002:11
20	Derive Johnson's Parabolic Formula for Short Columns	Remember	CAAE002:09
21	Derive the expression for crippling load when one end of the column is fixed and the other end is free.	Understand	CAAE002:11
22	Derive the expression for crippling load when one end of the column is fixed and the other end is hinged (or pinned).	Understand	CAAE002:11
Part – C (Problem Solving and Critical Thinking)			
1	Derive the expression for maximum deflection when strut is subjected to compressive axial load with both ends pinned.	Understand	CAAE002:10
2	Evaluate deflection of beam by Double integration method 	Understand	CAAE002:09
3	A beam is loaded as shown in the figure Evaluate deflection of beam by Macauley's method 	Understand	CAAE002:09
4	A beam is loaded as shown in the figure Evaluate deflection of beam by Moment Area method	Understand	CAAE002:09

			
5	A strut length l, moment of inertia of cross section I uniform throughout and modulus of material E, is fixed at its lower end, and its upper end is elastically supported laterally by a spring of stiffness k. show from the first principles that the crippling load P is given by $(\tan \alpha l)/(\alpha l) = [1- (P/kL)]$, where $\alpha^2 = (P/EI)$	Remember	CAAE002:10
6	The pin-jointed column shown in Figure carries a compressive load *P* applied eccentrically at a distance *e* from the axis of the column. Determine the maximum bending moment in the column 	Understand	CAAE002:10
7	A column of length 1m has the cross-section shown in Figure. If the ends of the column are pinned and free to warp, calculate its buckling load; E =70 000 N/mm^2, G=30 000 N/mm^2. 	Understand	CAAE002:10
8	A column of timber section 15cm×20cm is 6m long. If E=17.5KN/mm^2. Determine crippling load and safe load for the column if both ends are fixed and factor of safety is 3.	Understand	CAAE002:10
9	A solid round bar 3m long and 5cm in diameter is used as a strut. Determine the crippling load if a. Both ends of strut are hinged b. One end of strut is fixed and other end is free c. Both ends of strut are fixed d. One end is fixed and other is hinged	Understand	CAAE002:10
UNIT-IV			
REDUNDANT STRUCTURES			
PART – A (SHORT ANSWER QUESTIONS)			
1	Distinguish statically determinate and redundant structures.	Understand	CAAE002:07

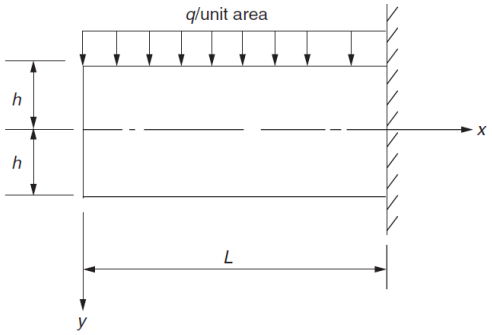
2	Determine degree of redundancy for articulated structures.	Understand	CAAE002:07
3	Define order of redundancy.	Understand	CAAE002:07
4	Classify different types of supports and write the reactions components.	Remember	CAAE002:07
5	Define singularity function.	Remember	CAAE002:07
6	Explain Claypron's method for statically indeterminate structures.	Understand	CAAE002:09
7	Derive Bending Equation for a beam subjected to uniform loading.	Understand	CAAE002:09
8	Develop relation between shear force, bending moment and rate of loading.	Understand	CAAE002:09
9	Explain Claypron's method to determine the deflection in statically indeterminate beam.	Understand	CAAE002:09
10	Explain area moment method with neat sketches.	Understand	CAAE002:09
PART – B (LONG ANSWER QUESTIONS)			
1	Determine the force in members AB, BD, and CD of the truss shown in Fig. Also solve for the force on members FH, DF, and DG. 	Remember	CAAE002:08
2	The structure in Fig is a truss which is pinned to the floor at point A, and supported by a roller at point D. Determine the force to all members of the truss. 	Understand	CAAE002:08
3	Compute the force in all members of the truss shown in Fig 	Understand	CAAE002:08

4	For the following simply-supported beam, we can find the slope at A using Mohr's Second Theorem. The deflected shape diagram is used to identify relationships between vertical intercepts and slopes. 	Understand	CAAE002:08
5	Analyze continuous beam ABCD shown in figure by slope deflection method. The support sinks by 15mm 	Understand	CAAE002:08
6	For a simply-supported beam AB of length L and stiffness EI, subjected to a UDL, show that: $\theta_A = \frac{wL^3}{24EI}; \quad \theta_B = -\frac{wL^3}{24EI}; \quad \delta_C = \frac{5wL^4}{384EI}$	Understand	CAAE002:08
7	Three span continuous beam ABCD is fixed at A and continuous over B, C and D. The beam subjected to loads as shown. Analyze the beam by slope deflection method and draw bending moment and shear force diagram 	Understand	CAAE002:08
8	Analyze the continuous beam shown by the moment distribution method. Draw the bending moment diagram and shear force diagram. The beam is of uniform section 	Understand	CAAE002:08
9	Analyze the continuous beam by moment distribution method. Draw the shear force diagram and bending moment diagram. 	Understand	CAAE002:08

10	Analyze the continuous beam by the moment distribution method. Draw the shear force diagram and bending moment diagram. 	Understand	CAAE002:08
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	Find the force in each member of the truss shown in Fig. 	Understand	CAAE002:09
2	The truss pinned to the floor at D, and supported by a roller at point A is loaded as shown in Fig. Determine the force in member CG. 	Understand	CAAE002:09
3	(a) Define Determinacy and Indeterminacy and explain about their types. (b) Classify each of the frames shown in figure below as statically determinate or statically indeterminate. If statically indeterminate, report the number of degrees of indeterminacy. The frames are subjected to external loadings that are assumed to be known and can act anywhere on the frames. 	Understand	CAAE002:08
4	For the following beam of constant EI, using Mohr's theorems: (a) Draw the bending moment diagram; (b) Determine, Dδ and Eδ ; Give your answers in terms of EI. 	Understand	CAAE002:09

5	Analyze continuous beam ABCD by Slope deflection method and then draw bending moment diagram. Take EI constant. 	Understand	CAAE002:09
6	Determine the end moments for the continuous beam shown , EI is constant. Use the moment distribution method 	Understand	CAAE002:09
7	Analyse the beam shown by the moment distribution method. Support B sinks by 10 mm. E = 200 kN/mm2. I = 4000 × 104 mm4. Draw BMD and SFD 	Understand	CAAE002:09
8	Analyze the continuous beam by the moment distribution. The supports B and C settle by 8 mm and 4 mm respectively. EI = 30000 kNm2. Sketch the SFD and BMD 	Understand	CAAE002:09
9	Analyze the frame shown by moment distribution method. Draw the bending moment diagram 	Understand	CAAE002:09
10	Analyze the frame shown by the moment distribution method. Draw the bending moment diagram. 	Understand	CAAE002:09

UNIT-V			
THEORY OF ELASTISITY			
PART - A (SHORT ANSWER QUESTIONS)			
1	Write equations of equilibrium for elastic body under three dimensional force systems. Also draw neat sketch representing forces	Understand	CAAE002:13
2	Write the equations for direct strains in terms of displacement functions for a three mutually perpendicular line elements	Understand	CAAE002:09
3	Derive the compatibility equation for two-dimensional problem.	Understand	CAAE002:09
4	Write condition equations for plane stress and plane strain for 2D elastic body.	Remember	CAAE002:09
5	Define Airy's stress function for two dimensional problems in elasticity.	Remember	CAAE002:09
6	Give stress strain relationship for 2D elastic body.	Understand	CAAE002:09
7	Derive equations of static equilibrium for a three dimensional elastic body.	Understand	CAAE002:09
8	Derive the equations for stresses acting on inclined planes and deduce stress equations for principal planes.	Understand	CAAE002:14
9	Determine graphically state of stress on inclined plane for a deformable body.	Understand	CAAE002:14
10	Derive the strain equations for three mutually perpendicular line elements in terms of displacement functions and deduce compatibility equations.	Understand	CAAE002:14
11	Define terms of principle plane and principle Stress	Remember	CAAE002:14
12	Define the term obliquity and how it is determined	Remember	CAAE002:14
13	Write a note on mohr's circle of stress	Understand	CAAE002:14
14	Derive the expression for the stresses on an oblique plane of a rectangular body When the body is subjected to to simple shear stress	Understand	CAAE002:14
15	Discuss about theories of failure	Understand	CAAE002:14
PART - B (LONG ANSWER QUESTIONS)			
1	Derive equations of static equilibrium for a three dimensional elastic body.	Remember	CAAE002:13
2	Derive the equations for stresses acting on inclined planes and deduce stress equations for principal planes.	Remember	CAAE002:13
3	Determine graphically state of stress on inclined plane for a deformable body.	Remember	CAAE002:13
4	Derive the strain equations for three mutually perpendicular line elements in terms of displacement functions and deduce compatibility equations.	Remember	CAAE002:13
5	Derive equations for stains on inclined planes and deduce strain for principal planes.	Remember	CAAE002:14
6	Draw the Mohr's Circle to determine stains on inclined plane.	Remember	CAAE002:14

7	The stresses at point of a machine component are 150MPa and 50MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55 with axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.	Remember	CAAE002:14
8	A bar is subjected to a tensile stress of 100MPa, determine the normal and tangential stresses on a plane making an angle of 30^o with the direction of the tensile stress.	Remember	CAAE002:14
9	Write the expression for major and minor principal stresses for an oblique plane subjected to direct stress in two mutually perpendicular directions and accompanied with shear stress.	Remember	CAAE002:14
10	The principal stresses or a point in the section of a member are 50MPa or 20MPa both tensile. If there is a clockwise shear stress of 30MPa, find the normal and shear stresses on a section inclined at an angle of 15^o with the normal to the major tensile stress.	Remember	CAAE002:14
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)			
1	A structural member supports loads which produce, at a particular point, a direct tensile stress of 80N/mm² and a shear stress of 45N/mm² on the same plane .calculate the values and directions Of the principal stresses at the point and also the maximum stress, stating on which planes this will act.	Understand	CAAE002:14
2	A solid shaft of circular cross-section supports a torque of 50KNm and a bending moment of 25KNm. If the diameter of the shaft is 150mm calculate the values of the principal stresses and their directions at a point on the surface of the shaft?	Understand	CAAE002:14
3	A shear stress τ_{xy} acts in a two-dimensional field in which the maximum allowable shear stress is denoted by τ_{max} and the major principal stress by σ_1. Derive using the geometry of Mohr's circle of stress, expressions for the maximum values of direct stress which may be applied to the x and y planes in terms of three parameters given above.	Understand	CAAE002:14
4	A cantilever of length L and depth 2h is in a state of plane stress. The cantilever is of unit thickness, is rigidly supported at the end x=L and is located as shown in figure. Show that stress function $\phi = Ax^2+Bx^2y+Cy^3+D(5x^2y^3-y^5)$ is valid for the beam and evaluate the constants A,B,C and D. 	Understand	CAAE002:13
5	The principal stresses at a point in the section of a member are 50MPa and 20MPa both tensile. If there is a clockwise shear of 30MPa, find graphically the normal and shear stresses on a section inclined at an angle of 15^o with the normal to the major tensile stress.	Understand	CAAE002:14

6	A point in the stressed element, the normal stresses in two mutually perpendicular directions are45MPa and 25MPa both tensile. The complimentary shear stress in these directions is 15MPa. By using Mohr's circle method determine the maximum and minimum principal stresses.	Understand	CAAE002:14
7	A plane element in a boiler is subjected to tensile stresses of 400MPa on one plane and 150MPa on the other	Understand	CAAE002:14
8	The stresses at point of a machine component are 150MPa and 50MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55 with axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.	Understand	CAAE002:14
9	A bar is subjected to a tensile stress of 100 MPa, determine the normal and tangential stresses on a plane making an angle of 30^{o} with the direction of the tensile stress.	Understand	CAAE002:14
10	Write the expression for major and minor principal stresses for an oblique plane subjected to direct stress in two mutually perpendicular directions and accompanied with shear stress.	Understand	CAAE002:14

Prepared By:
Mr. T Mahesh Kumar, Asst. Professor, Dept of AE

HOD, AE