INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

TUTORIAL ASSIGNMENT

Course Name	:	**MECHANICS OF SOLIDS**
Course Code	:	**R15 - A30104**
Class	:	II B. Tech I Semester
Branch	:	Aeronautical
Year	:	2016 – 2017
Course Coordinator	:	Mr G S D Madhav Assistant Professor
Course Faculty	:	Mr G S D Madhav Assistant Professor

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT-I **UNIT – I SIMPLE STRESSES AND STRAINS**		
1	Define Longitudinal strain and lateral strain.	Knowledge	1
2	State Hooke's law	Knowledge	2
3	Define Modular ratio, Poisson's ratio	Knowledge	4
4	What is modulus of elasticity?	Understand	1
5	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.	Knowledge	1
6	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.	Knowledge	2
7	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.	Knowledge	2
8	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 $375N/mm^2$	Analyze	2
9	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 $2\times 10^5 N/mm^2$ and E for brass $1\times10^5 N/mm^2$	Analyze	2

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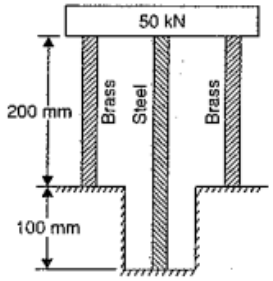
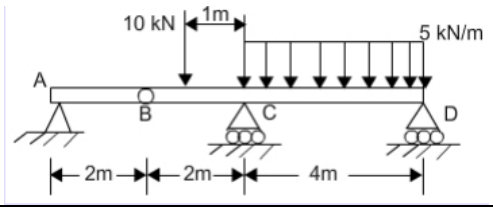
			
10	A steel rod 5 cm diameter and 6 m long is connected to two grips and the rod is maintained at a temperature of 100^0C. determine the stress and pull exerted when the temperature falls to 20^0C if The ends do not yield The ends yield by 0.15cm Take E = 2×10^5 N/mm^2 and $\alpha = 12 \times 10^{-6}/^o$C	Analyze	1
	ASSIGNMENT – I **UNIT – II SHEAR FORCE AND BENDING MOMENT**		
1	What is the maximum bending moment for a simply supported beam subjected to uniformly distributed load and where it occurs?	Knowledge	2
2	Write the relation between bending moment, shear force and the applied load.	Create	2
3	Define point of contra flexure.	Knowledge	1
4	Define moment of resistance of a beam	Knowledge	3
5	Draw the shear force and bending moment diagrams for a cantilever of length L carrying a uniformly distributed load w per unit length over its entire length. Also calculate maximum bending moment.	Apply	2
6	Draw the shear force and bending moment diagrams for a simply supported beam of length L carrying a uniformly distributed load w per unit length over its entire length.	Apply	2
7	Derive the relation between Load, shear force and bending moment.	Apply	3
8	Draw the S.F.D and B.M.D for following beam 	Analyze	2
9	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.	Analyze	2
10	A simply supported beam of length 8m rests on supports 6m apart, the right hand end is overhanging by 2m. The beam carries a udl of 1500N/m over the entire length. Draw S.F.D and B.M.D	Analyze	2
	ASSIGNMENT – II **UNIT – III FLEXURAL STRESSES**		
1	What do you mean by pure bending	Understand	1
2	What is the meaning of strength of section	Understand	1
3	Define the terms : modular ratio, equivalent section	Knowledge	1
4	Define the terms: section modulus, flitched beams.	knowledge	1
5	Derive bending equation M/I=f/y=E/R.	Knowledge	2
6	Discuss the assumptions involved in the theory of simple bending	Knowledge	3
7	Draw and explain shear stress distribution across I section	Knowledge	2
8	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.	Analyze	1
9	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 centre.	Analyze	4

S. No	Question	Blooms Taxonomy Level	Course Outcome
10	Derive an expression for bending stress	Analyze	3
	ASSIGNMENT – II **UNIT – IV PRINCIPAL SRRESSES AND STRAINS**		
1	Define terms of principle plane and principle Stress	knowledge	2
2	Define the term obliquity and how it is determined	knowledge	2
3	Write a note on mohr's circle of stress	create	2
4	Derive the expression for the stresses on an oblique plane of a rectangular body When the body is subjected to to simple shear stress	Evaluate	2
5	Derive the strain equations for three mutually perpendicular line elements in terms of displacement functions and deduce compatibility equations.	Knowledge	2
6	Derive equations for stains on inclined planes and deduce strain for principal planes.	Knowledge	2
7	Draw the Mohr's Circle to determine stains on inclined plane.	Knowledge	1
8	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.	Analyze	3
9	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?	Analyze	3
10	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.	Analyze	3
	UNIT-V **RECEIVERS**		
1	Write an expression for change in volume of a thin cylindrical shell subjected to internal fluid pressure.	Create	2
2	Define the term efficiency of a joint and write the equation	Understand	4
3	What is hoop stress and explain why hoop stress is required.	understand	2
4	Define the terms torsion, torsional rigidity and polar moment of inertia.	understand	3
5	Prove that the torque transmitted by the solid shaft when subjected to torsion is given by $$T = \frac{\pi}{16}\tau D^3$$	Apply	1
6	Derive the relation for a circular shaft when subjected to torsion as given below $$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$	Apply	2
7	Find the expression for strain energy stored in a body due to torsion.	Apply	2
8	A solid shaft has to transmit 12.5KW at 250 r.p.m taking allowable shear stress as 70N/mm^2. Find suitable diameter for the shaft if maximum torque transmitted at each revolution exceeds the main by 20%.	Analyze	1
9	A cylindrical pipe of diameter 2m and thickness 2cm is subjected to an internal fluid pressure of 1.5N/mm^2. Determine longitudinal stress and circumferential stress developed in the pipe material.	Analyze	2
10	A cylinder of internal diameter 0.60m contains air at a pressure of 7.5N/mm^2 (gauge). If the maximum permissible stress induced in the material is 75N/mm^2 find the thickness of the material.	Analyze	2

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