INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

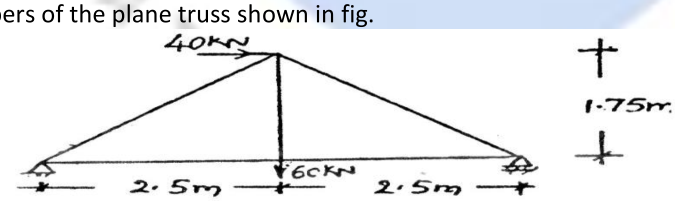
ASSIGNMENT– I AND II QUESTIONS

Course Name	:	**STRUCTURAL ANALYSIS -I**
Course Code	:	A40115
Class	:	II B. Tech II Semester
Branch	:	CIVIL ENGINEERING
Year	:	2016 – 2017
Course Faculty	:	Mr. G. Anil Kumar, Assistant Professor, CE

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
	UNIT-I		
1.	Using method of Tension Coefficient analysis, determine the forces in the members of the plane truss shown in fig. 	Analyze and evaluate	2,5,11
2	Using Method Of sections determine the forces in the members BC, GC and GF of the pin jointed plane truss as shown in fig.	Analyze and evaluate	c

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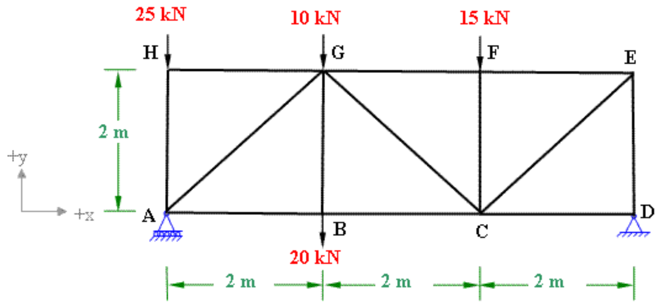
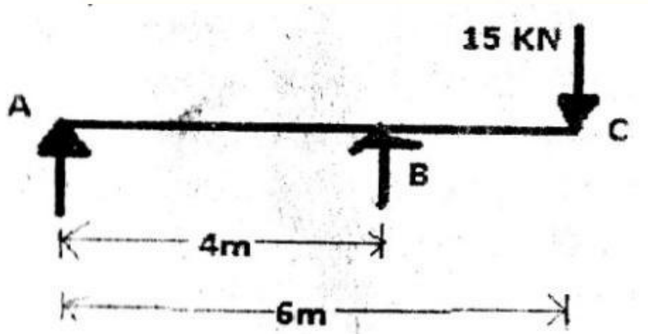
			
3	Evaluate slope at point A and deflection at point C for the beam shown in fig no. 5, using castigliano‟s theorems. Take e = 2×105 N/mm2 and I = 2×108mm4. 	Analyze and evaluate	b
4	A cantilever of length 8 m carries UDL of 0.8Kn/m length over the whole length. The free end of the cantilever is supported on a prop. The prop sinks by 5mm. If E=2X105N/mm2 and I=10 8 mm 4 , then the prop reaction	Analyze and evaluate	2,5,11
5	A cantilever of length 8m carries udl of 2Kn/m run over the whole length. The cantilever is propped rigidly at the free end. If E=1X105N/mm2 and I=10 8 mm 4, then determine reaction at the rigid prop and deflection at the center	Analyze and evaluate	1
6	What are the different methods for analysis of Frames? Write the assumptions made in analyzing perfect frame.	Understanding	1
7	A closed coil cylindrical spring of circular cross-section has coils with a 75mm mean diameter. When loaded with an axial load of 250N, it is found to extend 160mm and when subjected to a twisting couple of 3Nm, there is an angular rotation of 60 degrees. Determine the poisons ratio for the material.	evaluate	1
8	Determine the diameter of a solid steel shaft which will transmit 112.5kW at 200rpm. Also determine the length of the shaft if the twist must not exceed 1.5^0 over the entire length. The maximum shear stress is limited to 55 N/mm^2. Take G = $8x10^4$ N/mm^2	understanding	1
9	The internal diameter of a hollow shaft is $2/3^{rd}$ of its external diameter. Compare its resistance to torsion with that of solid shaft of the same weight and material.	Apply	2
10	In a open coil helical spring having 10 coils, the stresses due to bending and twisting are 98MPa and 105MPa respectively, and the spring is axially loaded. Assuming the mean diameter of the coils to be 8 times the diameter of wire, find the maximum permissible load and the diameter of wire for a maximum extension of 2cm. E=210GPa and G=82GPa.	Analyze	1
	UNIT-II		
1	Derive the equivalent length of a column for which both ends are fixed using	Analyze	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
	Euler's theory.		
2	Derive the equivalent length of a column for which one end is fixed and other end is free using Euler's theory.	Understand	4
3	Derive Rankine's formula	Apply	5
4	Derive the maximum and minimum stresses developed in eccentrically loaded long columns	analyze	3
5	Derive the equation for maximum deflection and stresses for a uniformly loaded lateral strut.	analyze	4
6	A hollow circular steel strut with its ends position – fixed, has a length of 3m, external diameter of 0.4m and internal diameter 10cm. Before loading, the strut is bent with a maximum deviation of 0.4cm. Assuming the central line to be sinusoidal, determine (a) the maximum stress due to a central compressive end load of 8kN. (B) If the load has an eccentricity of 1.5cm, then find the maximum stress induced. Take E = 200GPa	understanding	3
7	A steel strut of circular cross-section 1.25m long is hinged at both ends. Find the necessary diameter in order that if a thrust of 50kN deviates at the end by $1/10^{th}$ of the diameter from the axis of the strut, the greatest compressive stress shall not exceed 35MPa. If the yield stress of steel 300MPa, find the crippling load. E = 200GPa	remembering	3
8	Determine the safe axial load a timber column of cross-sectional area 150mm X 150mm and of 4m length can carry using a factor of safety, 8. Take E = $10kN/mm^2$ and for (a)hinged ends (b) fixed ends (c)one end free and other end fixed (d)one end hinged and other end fixed.	remembering	3
9	A steel column consists of two channels ISMC 300 X 35.8 kg/m placed back to back at a clear distance of 15cm and two plates of 350mm X 20mm are connected to the flanges. Find the crippling load for the column if the distance between the hinged ends is 8m. Take E = $210kN/mm^2$. Properties of channel sections: Area of cross-section of each channel = $45.64cm^2$ $I_{xx} = 6362.6\ cm^4$ $I_{yy} = 310.8\ cm^4$ $C_{yy} = 2.36$ cm Thickness of web = 7.6mm Thickness of flange = 13.6mm	remembering	4
10	A steel strut of circular section is 2m long and hinged at both ends. Find the necessary diameter such that under a thrust of 100kN at an eccentricity of 0.1 of the diameter from the axis of the strut, the maximum compressive stress does not exceed $90kN/mm^2$. If the yield tress in compression for steel is $400N/mm^2$, find the crippling load of the strut.	apply	4
	UNIT-III		
1	Derive the equation for maximum stress of a strut subjected to compressive axial load and a transverse point load at centre and whose both ends are pinned.	Evaluate	5
2	Derive the equation for maximum bending moment of a strut subjected to compressive axial load and a transverse point load at centre and whose both ends are fixed.	Analyze	5
3	Derive the equation for maximum deflection of a strut subjected to compressive axial load and a transverse point load at centre and whose both ends are fixed.	Evaluate	5
4	Derive the resultant stress when a column of rectangular cross-section is subjected to a load which is eccentric to both axes.	Remembering &Evaluate	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
5	Explain middle - third rule for rectangular sections	Understanding	6
6	A propeller shaft of 20cm external diameter and 15cm internal diameter has to transmit 1103.25kW at 100rpm. It is additionally subjected to a bending moment of 10kNm and an end thrust of 200kN. Find i) principal stresses and their planes and ii) maximum shear stress and it plane.	Evaluate	10
7	A brick chimney weighs 1600kN and has internal and external diameters at the base are 2m and 3m respectively. The chimney leans by 5^o with the vertical. Calculate the maximum stresses in the base. Assume that there is no wind pressure and C.G of chimney is 15m above the base.	Remembering & evaluate	10,13
8	Determine the maximum stress induced in a horizontal strut of length 2.5m and of rectangular cross section 40mm wide and 80mm deep when it carries an axial thrust of 100kN and a vertical load of 6kN/m length. The strut is having pin joints at its ends. E=208GPa.	Remembering & evaluate	5
9	A masonry dam of rectangular section, 20m high and 10m wide, as water up to a height of 16m on its one side. Find a) Pressure force due to water and 1m length of dam b) Position of centre of pressure and the point at which the resultant cuts the base. Take weight density of masonry=19.62kN/ m^3 and of water =9.81kN/ m^3. Calculate the maximum and minimum stress intensities at base of dam.	Understanding	6
10.	A masonry retaining wall of trapezoidal section is 12m high and retains earth which is level up to the top. The width at the top is 3m and at the bottom is 6m and exposed face is vertical. Find the maximum and minimum intensities of normal stress at the base. Take density of earth=1600kg/m^3 and density of masonry=2300kg/ m^3 and angle of repose of earth=30^0	Evaluate	6
UNIT-1V			
1	Derive the equation for shear centre of channel section.	Understanding	7
2	Derive the resultant shear force, F_R for equal leg angle section.	Evaluate	7
3	Derive the shear centre for channel section	Apply	7
4	Derive shear centre for unequal I-section	Understanding	7
5	Derive transformation laws for moment and product of inertia.	Analyze	7
6	A simply supported beam T-section, 2.5m long carries a central concentrated load inclined at 30^o to the Y-axis. If the maximum compressive and tensile stresses are not to exceed 75MPa respectively find the maximum load the beam can carry.	Apply	7
7	A standard I-beam is bent by equal and opposite couples M acting at the ends of the beam in the plane m-m. Find the maximum stress and the maximum deflection. I=2400mm^4, Iv=150cm^4, M=5kNm, l=3m, $\varphi=30^0$, E= 200GPa	Apply	7
8	A cantilever beam of I-section is used to support the loads inclined to the V-axis as shown in figure. Calculate the stresses at the corners A, B, C and D. Also locate the neutral axis.	Analyze	5,2

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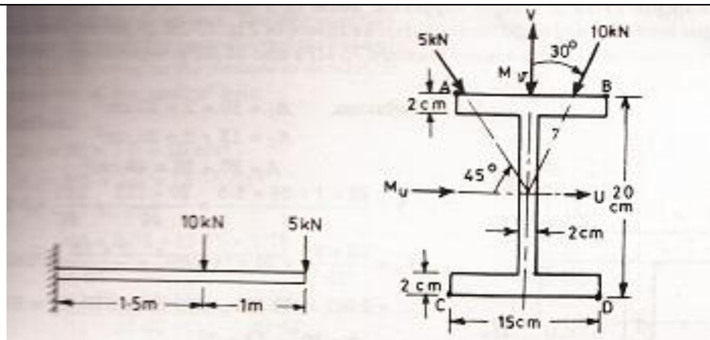
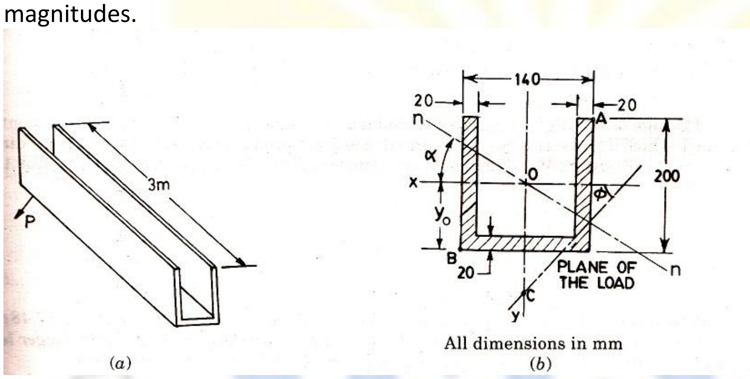
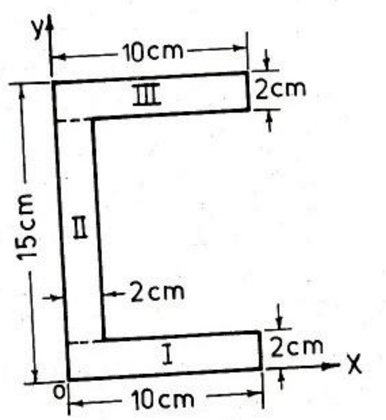
			
9	A cantilever beam has a channel section as shown in the figure. A concentrated load 15kN lies in the plane of the loads making an angle of 60^0 with the X-axis. Load lies in the plane of the cross section of the free end of the beam and passes through shear centre C. Locate points of maximum tensile and compressive stresses in the beam and determine their magnitudes. 	Understand	6
10	A channel section is loaded as shown in the figure. Determine (a) the product of inertia with respect to x and y axes; (b) Shear centre. 	Remember	2
	UNIT-V		
1	Derive expression for longitudinal stress and maximum shear stress developed in thin cylindrical vessel due to internal pressure.	Evaluate	8
2	Derive circumferential strain and longitudinal strain for a thin cylindrical shell	Evaluate	8

S. No	Question	Blooms Taxonomy Level	Course Outcome
	subjected to internal pressure		
3	Derive the stresses developed in thick cylindrical vessel subjected to internal fluid pressure.	Analyze	8
4	What do you mean by thick compound cylinders? How will you determine the hoop stresses in a thick compound cylinder?	Apply	8
5	Derive an expression for the radial pressure and hoop stress for thick spherical shell.	Apply	8
6	A thick cylindrical pipe of outside diameter 300mm and thickness of metal 60mm is subjected to an internal fluid pressure of 40N/mm^2 and an external pressure of 4N/mm^2. Calculate the maximum and minimum intensities of circumferential and radial stresses in the pipe section.	remembering	8
7	A compressed air cylinder for laboratory use ordinarily carries approximately 15 N/mm^2 pressure at the time of delivery. The outside diameter of such a cylinder is 250mm. If the steel has a yield point of 225N/mm^2 and a safety factor of 25. Calculate the required wall thickness.	apply	8
8	A cast iron pipe having an internal diameter of 30cm has wall 6mm thick and is closely wound with a single layer of steel wire 3mm diameter under a stress of 8MN/m^2.Calculate the stresses in pipe and the wire when the internal pressure in the pipe is 1MPa.	remembering	8
9	A cylindrical steel vessel with hemispherical ends is 60cm long over all, the outside diameter is 10cm and the thickness 5mm throughout. Calculate the change in internal volume of the vessel when it is subjected to an internal pressure of 15MPa. E=200GPa and υ = 0.28	Apply	8
10	A copper tube of inside diameter 6cm and outside diameter 6.5cm is closely wound with steel wire of diameter 1mm. Find the tension at which the wire must be wound on the tube if a pressure of 1.5MPa is required before the copper is subjected to tensile stresses, the tube being free to expand or contract axially. For copper, E_c=10GPa, υ=0.3, and for steel, E_s=200GPa	evaluate	8

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