Roll No: ----------

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

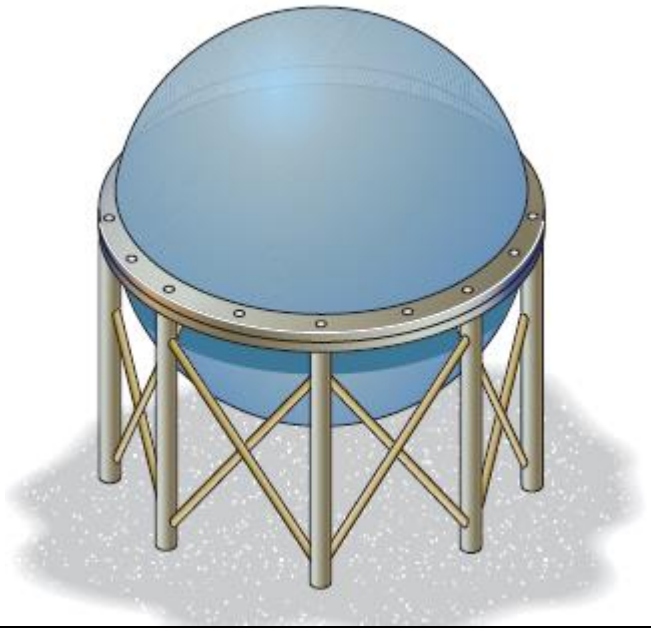
End Semester Examination, December 2017

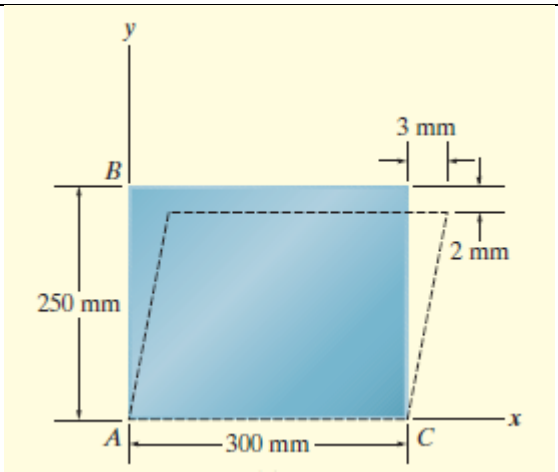
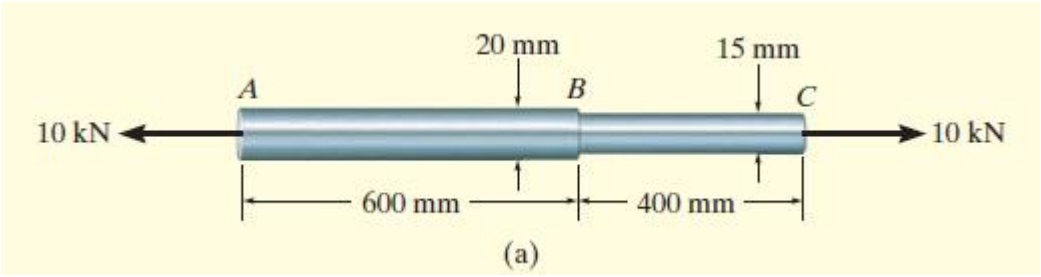
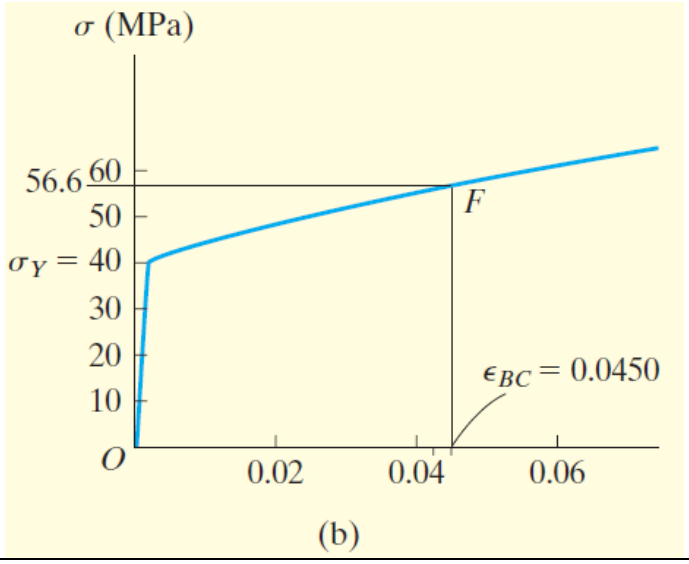
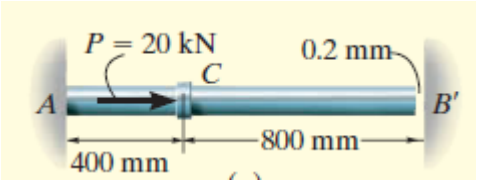
Program: BTECH IN CIVIL ENGINEERING | **Semester – III**
Subject (Course): MECHANICS OF SOLIDS | **Max. Marks : 100**
Course Code : CEEG201 | **Duration : 3 Hrs**
No. of page/s: 5

NOTE : - ALL THE QUESTIONS ARE COMPULSORY

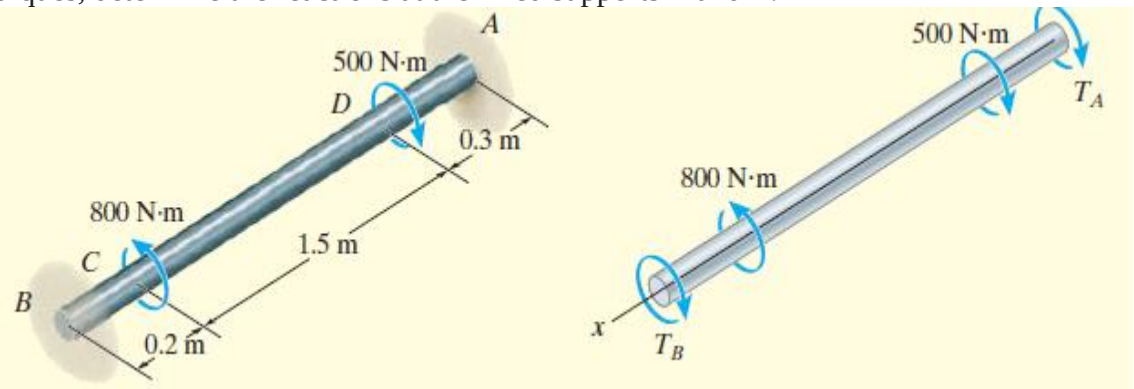
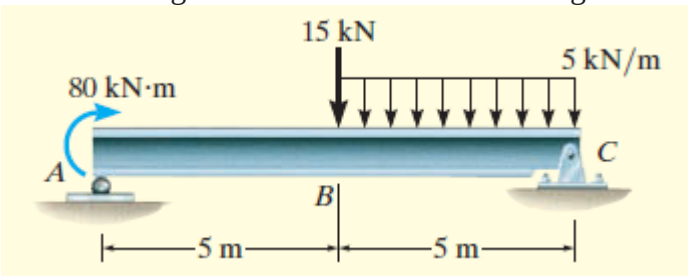
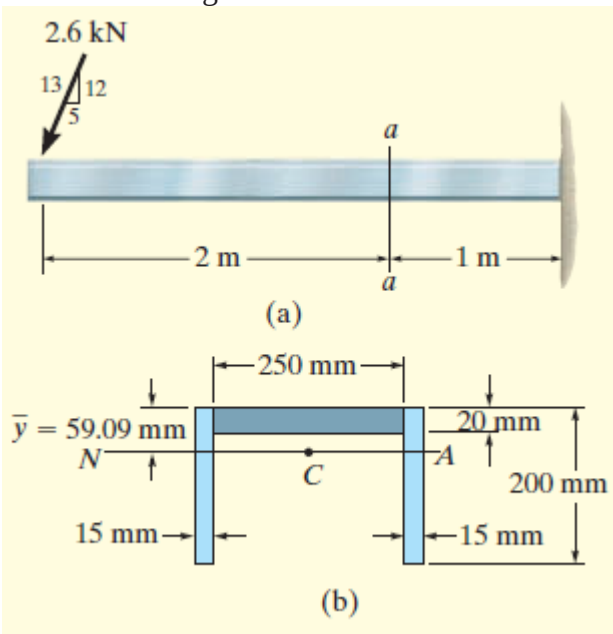
SECTION- A

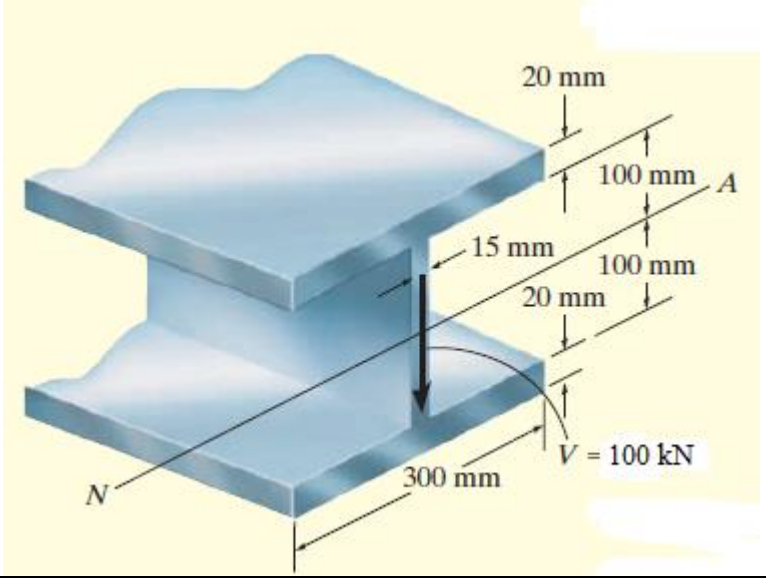
(EACH QUESTION IN THIS SECTION CARRIES 5 MARKS)

Q1.	The spherical gas tank is fabricated by bolting together two hemispherical thin shells. If the 8-m inner diameter tank is to be designed to withstand a gauge pressure of 2 MPa, determine the minimum wall thickness of the tank and the minimum number of 25-mm diameter bolts that must be used to seal it. The tank and the bolts are made from material having an allowable normal stress of 150 MPa and 250 MPa, respectively. 	**5 Marks**	**CO 4**
Q2.	Due to a loading, the plate is deformed into the dashed shape shown in figure. Determine (a) the average normal strain along the side *AB,* and (b) the average shear strain in the plate at *A* relative to the *x* and *y* axes.	**5 Marks**	**CO 2**

			
Q3.	An aluminum rod shown in figure (a) has a circular cross section and is subjected to an axial load of 10 kN. If a portion of the stress–strain diagram is shown in figure (b), determine the approximate elongation of the rod when the load is applied.Take Eal = 70 GPa.  (a)  (b)	**5 Marks**	**CO 1**
Q4.	The A-36 steel rod shown in figure has a diameter of 10 mm. It is fixed to the wall at *A*, and before it is loaded there is a gap between the wall at *B'* and the rod of 0.2 mm. Determine the reactions at *A* and *B'*. Neglect the size of the collar at *C*. Take Est = 200 GPa. 	**5 Marks**	**CO 1**

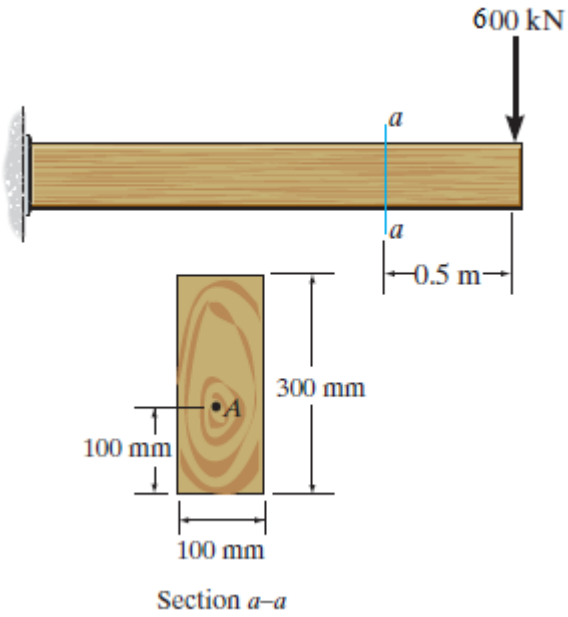
SECTION- B
(EACH QUESTION CARRIES 10 MARKS)

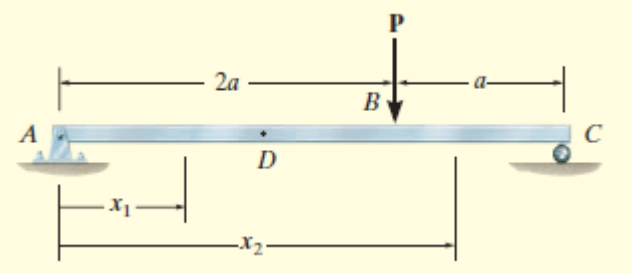
Q5.	The solid steel shaft shown in figure has a diameter of 20 mm. If it is subjected to the two torques, determine the reactions at the fixed supports *A* and *B*. 	**10 Marks**	**CO 4**
Q6.	Draw the shear and moment diagrams for the beam shown in figure. 	**10 Marks**	**CO 3**
Q7.	The beam shown in figure (a) has a cross-sectional area in the shape of a channel, figure (b). Determine the maximum bending stress that occurs in the beam at section *a–a*. 	**10 Marks**	**CO 3**
Q8.	A steel wide-flange beam has the dimensions shown in figure. If it is subjected to a shear of V = 100 kN, plot the shear-stress distribution acting over the beam's cross-sectional area.	**10 Marks**	**CO 3**

SECTION C

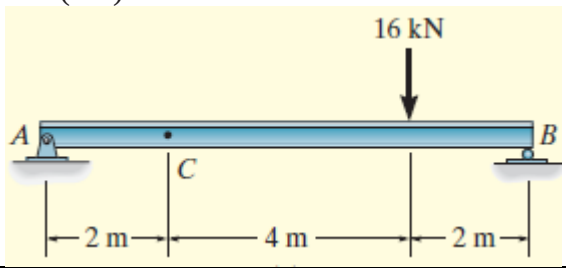
(EACH QUESTION CARRIES 20 MARKS)

Q9.	Determine the state of stress at point *A* on the cross section of the beam at section *a–a*. Also, determine the principle stresses, their orientation by either analytical method or by Mohr's circle method, maximum in plane shear stress and absolute maximum shear stress. 	**20 Marks**	**CO 2**
Q10.	The simply supported beam shown in figure is subjected to the concentrated force **P**. Determine the maximum deflection of the beam by Double Integration Method. *EI* is constant.	**20 Marks**	**CO 5**



OR

Determine the slope at point *C* for the steel beam in figure by Moment Area Method. Take Est = 200 GPa, I = 17(10^6) mm^4.



CONFIDENTIAL

Name of Examination (Please tick, symbol is given)	**:**	**MID**		**END**	□	**SUPPLE**	
Name of the College (Please tick, symbol is given)	**:**	**COES**	□	**CMES**		**COLS**	
Program	**:**	**BTECH IN CIVIL ENGINEERING WITH SPECIALISATION IN INFRASTRUCTURE**					
Semester	**:**	**III**					
Name of the Subject (Course)	**:**	**MECHANICS OF SOLIDS**					
Course Code	**:**	**CEEG 201**					
Name of Question Paper Setter	**:**	**ASHISH YADAV**					
Employee Code	**:**	**40001301**					
Mobile & Extension	**:**	**7060044188, 1398**					
GRAPH SHEET – ONE FOR EACH STUDENT							

FOR SRE DEPARTMENT

Date of Examination	**:**	
Time of Examination	**:**	
No. of Copies (for Print)	**:**	

Note: - Pl. start your question paper from next page

Roll No: ----------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

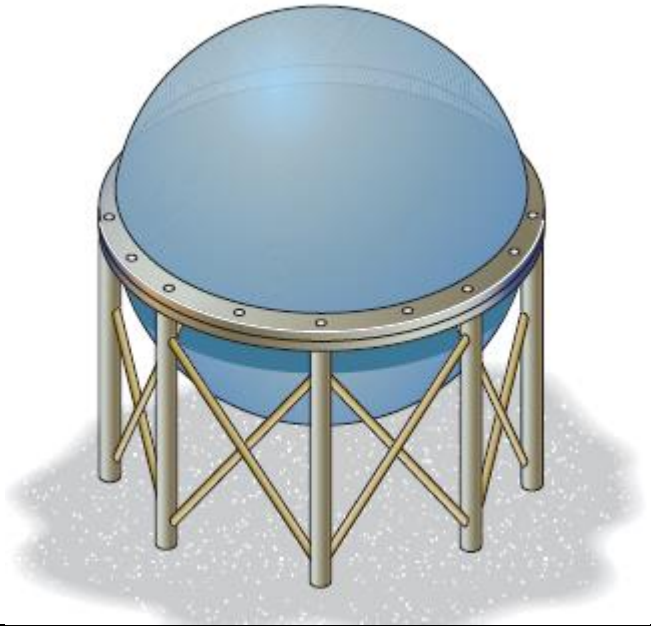
End Semester Examination, December 2017

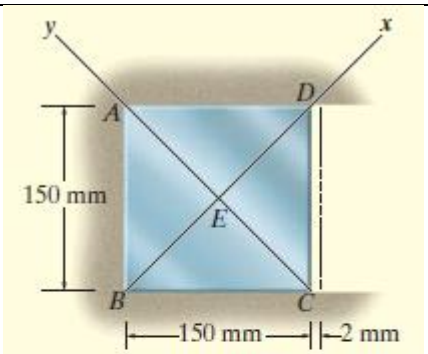
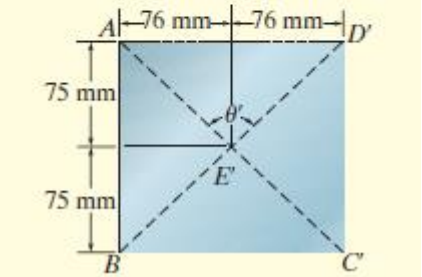
Program: BTECH IN CIVIL ENGINEERING | **Semester – III**
Subject (Course): MECHANICS OF SOLIDS | **Max. Marks : 100**
Course Code : CEEG201 | **Duration : 3 Hrs**
No. of page/s: 6

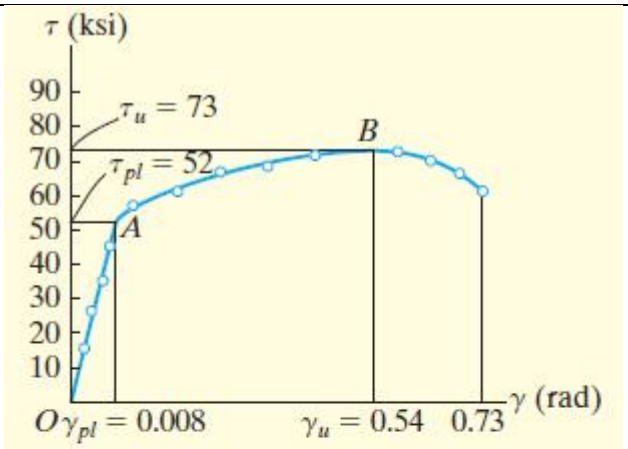
NOTE : - ALL THE QUESTIONS ARE COMPULSORY

SECTION- A

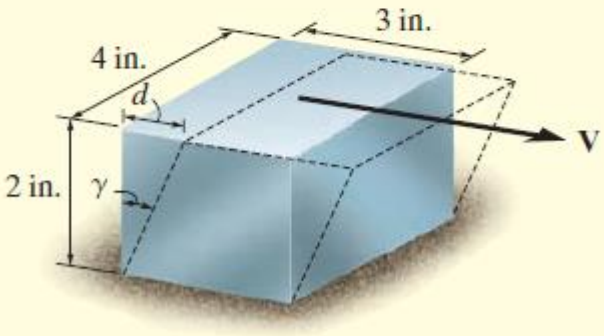
(EACH QUESTION IN THIS SECTION CARRIES 5 MARKS)

Q1.	The spherical gas tank is fabricated by bolting together two hemispherical thin shells of thickness 30 mm. If the gas contained in the tank is under a gauge pressure of 2 MPa, determine the normal stress developed in the wall of the tank and in each of the bolts. The tank has an inner diameter of 8m and is sealed with 900 bolts each 25 mm in diameter. 	**5 Marks**	**CO 4**
Q2.	The plate shown in figure is fixed connected along *AB* and held in the horizontal guides at its top and bottom, *AD* and *BC*. If its right side *CD* is given a uniform horizontal displacement of 2 mm, determine (a) the average normal strain along the diagonal *AC*, and (b) the shear strain at *E* relative to the *x*, *y* axes.	**5 Marks**	**CO 2**

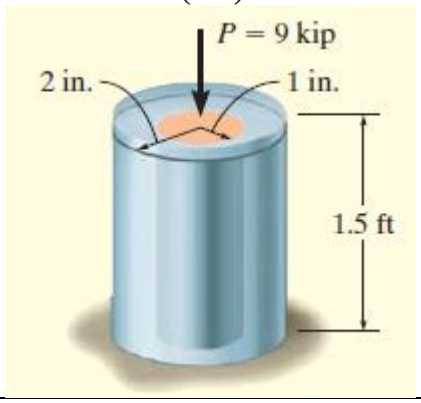
	 (a)  (b)		
Q3.	A specimen of titanium alloy is tested in torsion and the shear stress– strain diagram is shown in figure (a). Determine the shear modulus *G*, the proportional limit, and the ultimate shear stress. Also, determine the maximum distance *d* that the top of a block of this material, shown in figure (b), could be displaced horizontally if the material behaves elastically when acted upon by a shear force **V**.	**5 Marks**	**CO 1**



(a)

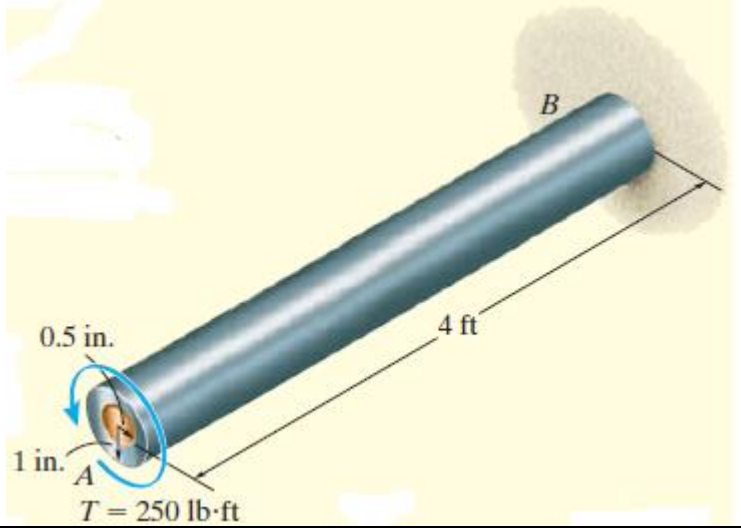
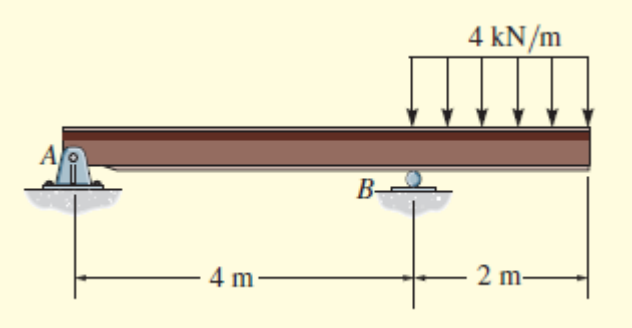
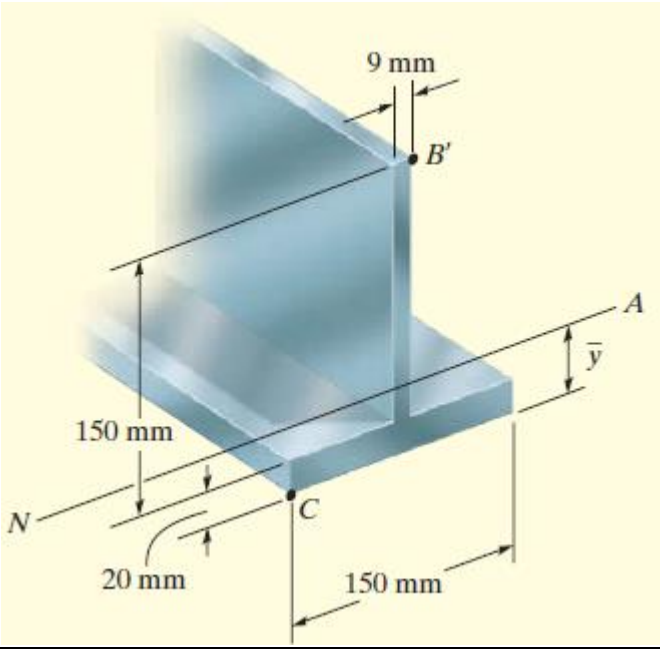


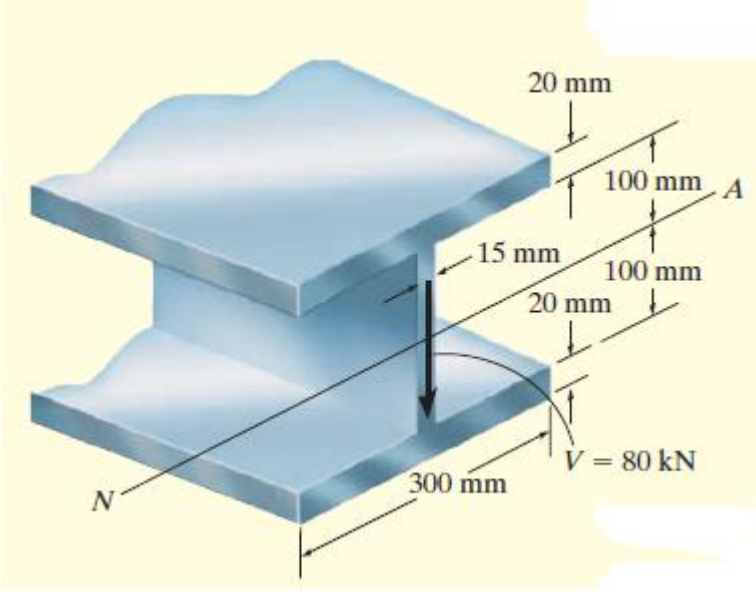
(b)

Q4.	The aluminum post shown in figure is reinforced with a brass core. If this assembly supports an axial compressive load of P= 9 kip, applied to the rigid cap, determine the average normal stress in the aluminum and the brass. Take Eal = $10(10^3)$ ksi and Ebr = $15(10^3)$ ksi. 	**5 Marks**	**CO 1**

SECTION- B
(EACH QUESTION CARRIES 10 MARKS)

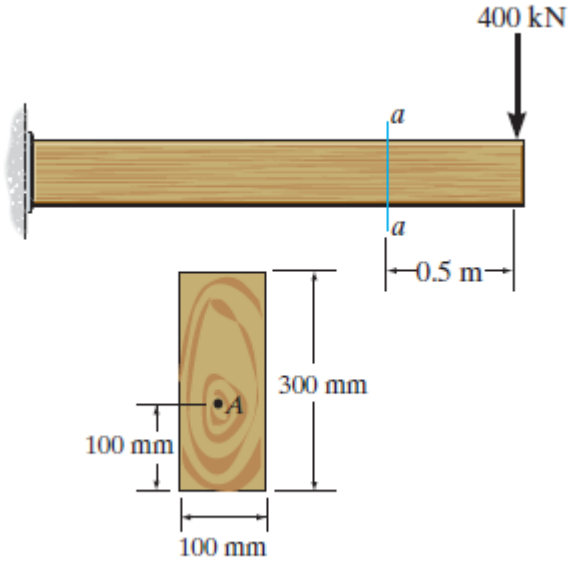
Q5.	The shaft shown in figure is made from a steel tube, which is bonded to a brass core. If a torque of T = 250 lb.ft is applied at its end, plot the shear-stress distribution along a radial line of its cross-sectional area. Take Gst = $11.4(10^3)$ ksi, Gbr = $5.20(10^3)$ ksi.	**10 Marks**	**CO 4**

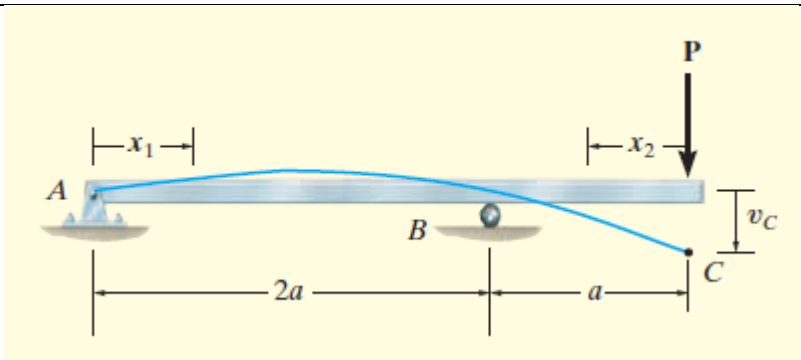
			
Q6.	Draw the shear and moment diagrams for the beam shown in figure. 	**10 Marks**	**CO 3**
Q7.	A composite beam is steel in the inverted T shape with its flange located on its bottom side. It has the cross-sectional area shown in figure. If the beam is subjected to a bending moment of M = 2 kNm, determine the normal stress at points *B* and *C*. Take Est = 200 GPa. 	**10 Marks**	**CO 3**
Q8.	A steel wide-flange beam has the dimensions shown in figure. If it is subjected to a shear of V = 80 kN, plot the shear-stress distribution acting over the beam's cross-sectional area.	**10 Marks**	**CO 3**

SECTION C

(EACH QUESTION CARRIES 20 MARKS)

Q9.	Determine the state of stress at point *A* on the cross section of the beam at section *a–a*. Also, determine the principle stresses, their orientation by either analytical method or by Mohr's circle method, maximum in plane shear stress and absolute maximum shear stress. 	**20 Marks**	**CO 2**
Q10.	The beam in figure is subjected to a load **P** at its end. Determine the displacement at *C* by Double Integration Method. *EI* is constant.	**20 Marks**	**CO 5**



OR

Determine the equation of the elastic curve and deflection at point B for the cantilevered beam shown in figure by Macaulay Method. *EI* is constant.