INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

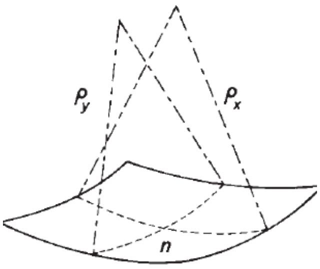
TUTORIAL QUESTION BANK

Course Name	:	**AIRCRAFT VEHICLES STRUCTURES II**
Course Code	:	**A52109**
Class	:	III B. Tech I Semester
Branch	:	AERO
Year	:	2017 – 2018
Course Coordinator	:	Dr. Y B Sudhir Shastry, Professor
Course Faculty	:	Dr. Y B Sudhir Shastry, Professor

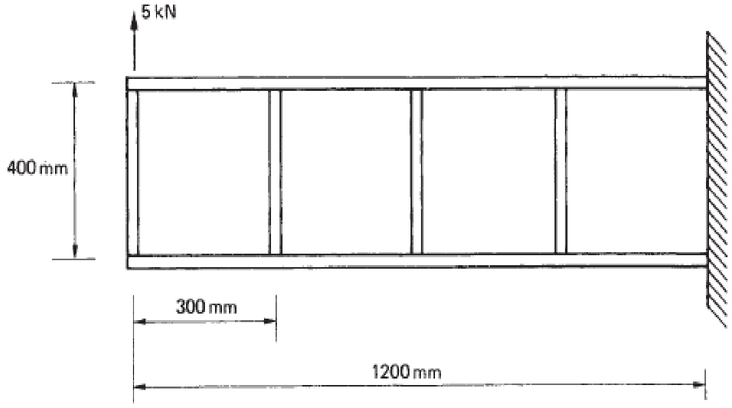
OBJECTIVES

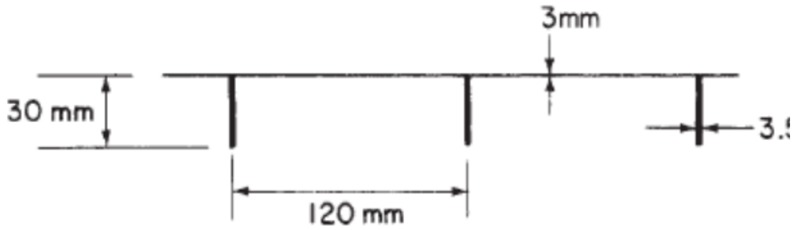
To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure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

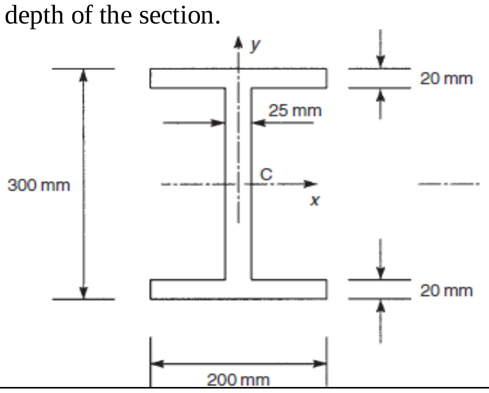
In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught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

S No	Question	Blooms taxonomy level	Course Outcomes
	UNIT - I **BENDING OF THIN PLATES**		
	Part - A (Short Answer Questions)		
1	A thin plate as a sheet of material whose **thickness** is small compared with its other dimensions but which is capable of resisting **bending** in addition to membrane forces.	Remember	1
2	What is $\rho_x \, and \, \rho_y$ from below diagram **radius of curvatures?** 	Understand	1
3	Flexural rigidity denoted by D=$\frac{Et^3}{12(1-\vartheta^2)}$	Understand	1
4	"W" is denoted by $w = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} A_{mn} \sin\frac{m\pi x}{a} \sin\frac{n\pi y}{b}$	Understand	3

5	"U" is **total strain energy** in $U=\frac{D}{2}\int_0^a\int_0^b\left[\left(\frac{\partial^2 w}{\partial x^2}\right)^2+\left(\frac{\partial^2 w}{\partial y^2}\right)^2+2v\frac{\partial^2 w}{\partial x^2}\right]$	Understand	2
6	**Synclastic** material means which has curvatures of the same sign.	Remember	1
7	Built-in edge condition for $(w)_{x=0}, \left(\frac{\partial w}{\partial x}\right)_{x=0}$?	Remember	2
8	"N_x" is **direct force per unit length** in this equation $\frac{\partial^4 w}{\partial x^4}+\frac{\partial^4 w}{\partial x^2 \partial y^2}+\frac{\partial^4 w}{\partial y^4}=\frac{1}{D}\left(q+N_x\frac{\partial^2 w}{\partial x^2}+N_y\frac{\partial^2 w}{\partial y^2}+N_{xy}\frac{\partial^2 w}{\partial x \partial y}\right)$	Remember	2
9	Transverse loading **perpendicular** to longitudinal axis.	Remember	2
10	The application of transverse and in-plane loads will cause the plate to deflect a further amount w1 so that the total deflection is then **w=w0 +w1**.	Remember	2
11	Critical load is also called as **crippling load**.	Understand	2
12	Stiffeners are used for **stiffening**.	Remember	2
Part - B (Long Answer Questions)			
1	**Explain** the basic theory of thin plates?	Remember	1
2	**Derive** the expression for direct/bending stress of a pure bending of thin plates?	Analyze	1
3	**What** is the term flexural rigidity called in bending of thin plates and explain?	Evaluate	2
4	Clearly **explain** the difference between synclastic and anticlastic surface of thin plates?	Remember	2
5	**Clearly** draw the figure for plate element subjected to bending, twisting and transverse loads?	Understand	2
6	**Write** the conditions for a plate which simply supported all edges? And write the assumed deflected form of the plate which satisfies the boundary conditions for this plate?	Remember	2
7	**Write** the conditions for a plate which clamped at all edges? And write the assumed deflected form of the plate which satisfies the boundary conditions for this plate?	Understand	2
8	**Write** the conditions for a plate which simply supported all two edges and the other two edges are free? And write the assumed deflected form of the plate which satisfies the boundary conditions for this plate?	Understand	1
9	**Write** the conditions for free	Understand	1
10	**Describe** an experiment to determine the critical load of buckling for a flat panel.	Remember	1
11	**Explain** Instability of Stiffened panels.	Understand	1
12	A plate 10mmthick is subjected to bending moments Mx equal to 10 Nm/mm and My equal to 5 Nm/mm. **Calculate** the maximum direct stresses in the plate.	Analyze	2
13	**Derive** the equation to find out Failure stress in plates and stiffened panels.	Analyze	2
14	In complete tension field beam, which part of beam resists informal bending moment and **why** this assumption is necessary?	Understand	2
15	**What** are the factors that determine the angle of diagonal tension? If the flanges and stiffness are rigid what will be the angle of diagonal tension?	Remember	2
Part - C (Problem Solving and Critical Thinking Questions)			
1	**Derive** the equation (1/ρ) =M / [D (1+ υ)] of thin plate subjected to pure bending.	Analyze	2
2	**Derive** the equation $M_{xy} = D(1-\upsilon)\,\partial^2 w/\partial x \partial y$ for a thin plate subjected to	Evaluate	2

	bending and twisting		
3	A plate 10mmthick is subjected to bending moments Mx equal to 10 Nm/mm and My equal to 5 Nm/mm. **find** the maximum twisting moment per unit length in the plate and the direction of the planes on which this occurs.	Evaluate	2
4	A thin rectangular plate a×b is simply supported along its edges and carries a uniformly distributed load of intensity q0. **Determine** the deflected form of the plate and the distribution of bending moment.	Evaluate	2
5	A rectangular plate *a*×*b*, is simply supported along each edge and carries a uniformly distributed load of intensity q0. Assuming a deflected shape given by $w = A_{11} \sin\frac{\pi x}{a} \sin\frac{\pi y}{b}$. **Determine** using the energy method, the value of the coefficient *A*11 and hence find the maximum value of deflection.	Remember	2
6	A thin rectangular plate *a*×*b* is simply supported along its edges and carries a uniformly distributed load of intensity *q*0 and supports an in-plane tensile force *Nx* per unit length..**Determine** the deflected form of the plate.	Evaluate	2
7	A rectangular plate *a*×*b*, simply supported along each edge, possesses a small initial curvature in its unloaded state given by $w = A_{11} \sin\frac{\pi x}{a} \sin\frac{\pi y}{b}$ **Determine**, using the energy method, its final deflected shape when it is subjected to a compressive load *Nx* per unit length along the edges *x* =0, *x* =*a*.	Remember	2
8	**Explain** Instability of Stiffened panels.	Evaluate	2
9	The beam shown in is assumed to have a complete tension field web. If the cross-sectional areas of the flanges and stiffeners are, respectively, 350mm2 and 300mm2 and the elastic section modulus of each flange is 750mm3, **determine** the maximum stress in a flange and also whether or not the stiffeners will buckle. The thickness of the web is 2mm and the second moment of area of a stiffener about an axis in the plane of the web is 2000mm4; *E* =70 000 N/mm2.  	Evaluate	2
10	**Derive** the equation for critical stress (σCR) = [kπ2E /12(1 – υ2)] (t/b)2 for plate subjected to the compressive load.	Analyze	2
11	Part of a compression panel of internal construction is shown in Figure. The equivalent pin-centre length of the panel is 500 mm. The material has a Young's modulus of 70 000 N/mm2 and its elasticity may be taken as falling catastrophically when a compressive stress of 300 N/mm2 is reached. Taking coefficients of 3.62 for buckling of a plate with simply supported sides and of 0.385 with one side simply supported and one free, **determine** (a) the load per mm width of panel when initial buckling may be expected and (b) the load per mm for ultimate failure. Treat the material as thin for calculating section constants and assume that after initial buckling the stress in the plate	Apply	2

	increases parabolically from its critical value in the centre of sections. 		
12	A simply supported beam has a span of 2.4m and carries a central concentrated load of 10 kN. The flanges of the beam each have a cross-sectional area of 300mm2 while that of the vertical web stiffeners is 280mm2. If the depth of the beam, measured between the centroid of area of the flanges, is 350mm and the stiffeners are symmetrically arranged about the web and spaced at 300mm intervals, **determine** the maximum axial load in a flange and the compressive load in a stiffener. It may be assumed that the beam web, of thickness 1.5 mm, is capable of resisting diagonal tension only.	Apply	2
UNIT - II **BENDING AND SHEAR AND TORSION OF THIN WALLED BEAMS:**			
Part – A (Short Answer Questions)			
1	What is symmetrical bending and clearly explain with figure?	Remember	4
2	What is neutral axis?	Remember	3
3	What is the difference between centroid and centre of gravity?	Understand	3
4	What is the general equation for determining bending stress for an unsymmetrical section?	Remember	3
5	What is the relation between bending moment and shear force?	Remember	3
6	What is the relation between load intensity and shear force?	Remember	3
7	What is shear flow?	Apply	3
8	Explain bredth-batho equation?	Analyze	3
9	What is the general equation for determining Shear flow for an unsymmetrical section?	Remember	3
10	Define Shear centre?	Remember	3
11	Locate position of shear centre for different section?	Remember	3
12	What are the properties of shear centre?	Create	4
13	What is warping?	Evaluate	4
14	What is the general equation for determining Shear flow for an symmetrical section?	Remember	4
15	If thickness is 5mm, shear flow is 100Nmm then shear stress?	Remember	4
16	If beam has cross section of 10mmx5mm and torque is 100Nmm then shear flow?	Remember	4
Part - B (Long Answer Questions)			
1	**Write** short notes on the following: Symmetrical bending Unsymmetrical bending	Understand	3
2	**Explain** the following terms. Shear center Shear flow	Analyze	4

	Centre of twist		
3	**Derive** the equations to find out the primary and secondary warping of an open cross section subjected to torsion.	Analyze	4
4	**Derive** the Bredt-Batho formula for thin walled closed section beams with the help of neat sketch.	Understand	4
5	**Explain** the condition for Zero warping at a section, and derive the warping of cross section.	Understand	3
6	**What** do mean by shear centre? Explain with the help of figure.	Understand	3
7	In order to understand open sections, one has to be clear about centroid, neutral point and shear centre. **Explain** them with mathematical expression.	Analyze	4
8	**Derive** the expression for the ripple factor of π-Section filter when used with a Full-wave-rectifier. Make necessary approximations?	Analyze	4
9	**Explain** the i) shear flow, ii) shear centre, iii) centre of twist.	Evaluate	4
10	**Determine** the warping distribution in the doubly symmetrical rectangular, closed section beam, shown in Fig, when subjected to an anticlockwise torque *T*.	Remember	6
	Part – C (Problem Solving and Critical Thinking)		
1	**Derive** $(\sigma_z) = [(M_y I_{xx} - M_x I_{xy}) / (I_{xx} I_{yy} - I_{xy}^2)]\ x + [(M_x I_{yy} - M_y I_{xy}) / (I_{xx} I_{yy} - I_{xy}^2)]\ y$		
	Figure in pg 495 problem P.16.1of Megson shows the section of an angle purlin. A bending moment of 3000 Nm is applied to the purlin in a plane at an angle of 30^o to the vertical *y* axis. If the sense of the bending moment is such that its components *Mx* and *My* both produce tension in the positive *xy* quadrant, **calculate** the maximum direct stress in the purlin, stating clearly the point at which it acts.	Evaluate	4
2	**Derive** $(\sigma_z) = [(M_y I_{xx} - M_x I_{xy}) / (I_{xx} I_{yy} - I_{xy}^2)]\ x + [(M_x I_{yy} - M_y I_{xy}) / (I_{xx} I_{yy} - I_{xy}^2)]\ y$	Evaluate	4
3	**Write** short notes on the following: Symmetrical bending Unsymmetrical bending Anticlastic bending	Evaluate	4
4	The cross-section of a beam has the dimensions shown in figure. If the beam is subjected to a negative bending moment of 100 kNm applied in a vertical plane, **determine** the distribution of direct stress through the depth of the section. 	Evaluate	4
5	**Derive** the equation to find out the shear center of figure shown.	Evaluate	4

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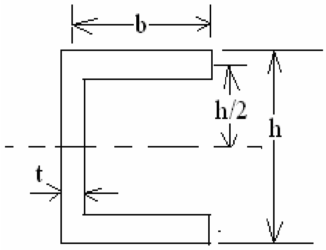
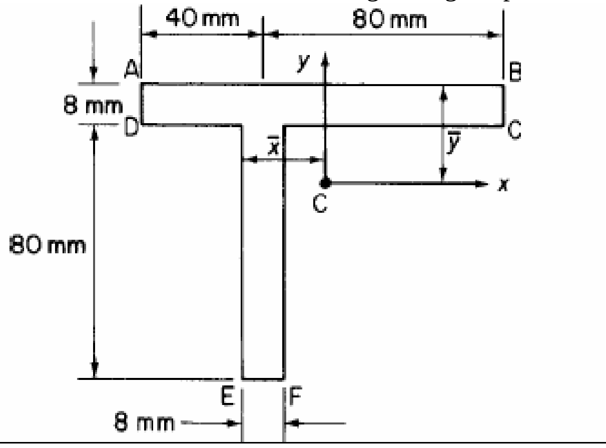
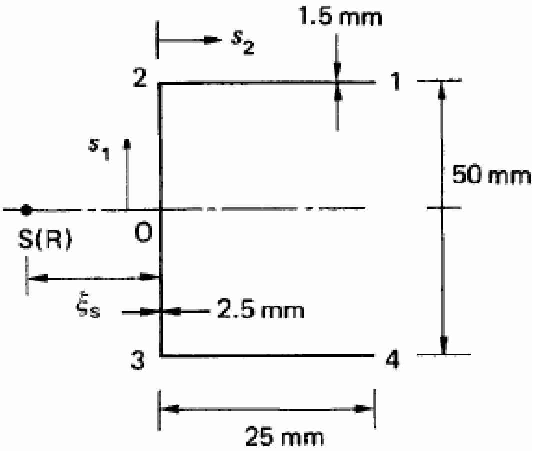
<tr><td></td><td>
</td><td></td><td></td></tr>
<tr><td>6</td><td>The beam section of problem 1 above, is subjected to a bending moment of 100 kNm applied in a plane parallel to the longitudinal axis of the beam but inclined at 30◦ to the left of vertical. The sense of the bending moment is clockwise when viewed from the left-hand edge of the beam section. Determine the distribution of direct stress.</td><td>Remember</td><td>4</td></tr>
<tr><td>7</td><td>A beam having the cross section shown in Figure is subjected to a bending moment of 1500 Nm in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it acts.

</td><td>Evaluate</td><td>4</td></tr>
<tr><td>8</td><td>Determine the maximum shear stress and the warping distribution in the channel section shown in Figure when it is subjected to an anticlockwise torque of 10 Nm. G=25000 N/mm^2.</td><td>Evaluate</td><td>4</td></tr>
<tr><td>9</td><td>
</td><td>Evaluate</td><td>4</td></tr>
<tr><td>10</td><td>A single cell, thin-walled beam with the double trapezoidal cross-section shown in Fig is subjected to a constant torque T =90 500Nmand is constrained to twist about an axis through the point R. Assuming that the shear stresses are distributed according to the Bredt–Batho theory of torsion, calculate the distribution of warping around the cross-section. Illustrate your answer clearly by means of a sketch and insert the principal values of the warping displacements. The shear modulus G=27 500N/mm2 and is constant throughout.</td><td>Remember</td><td>6</td></tr>
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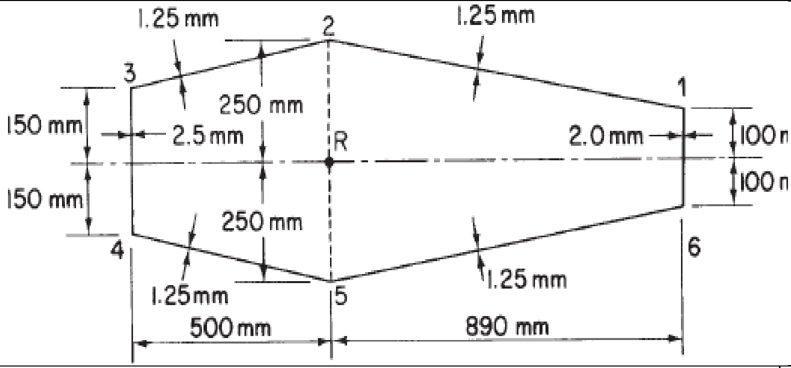
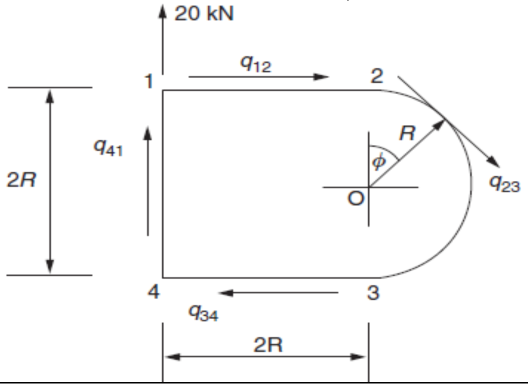
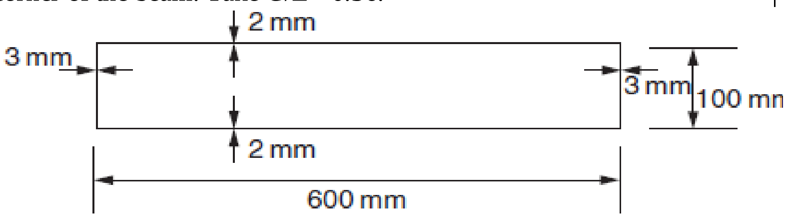
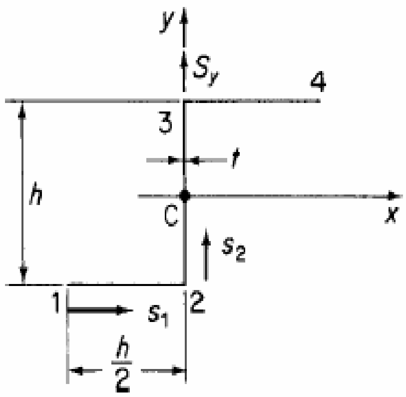
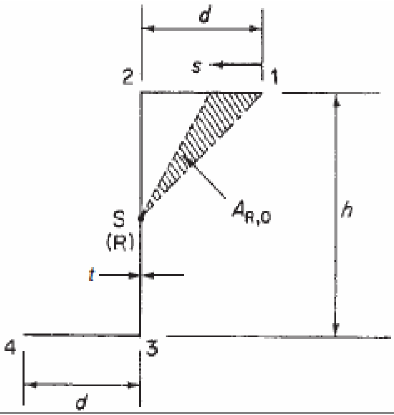
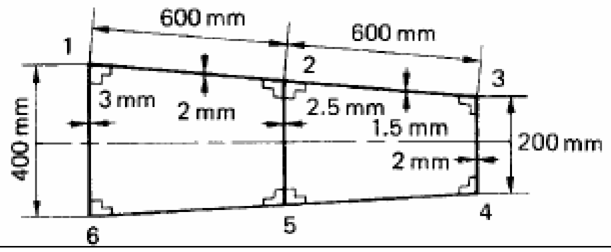
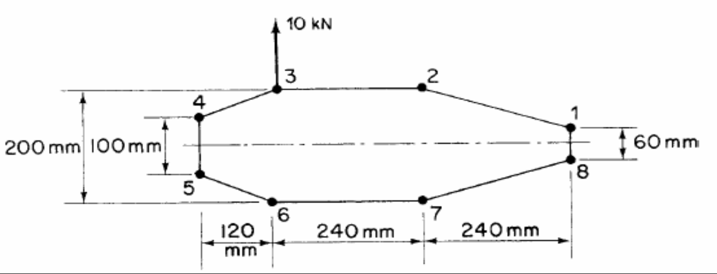
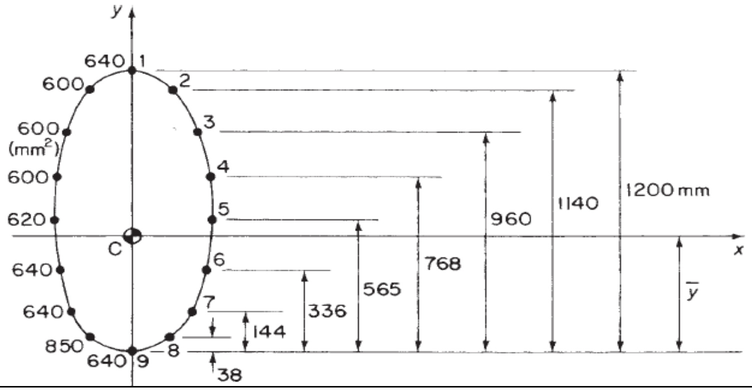
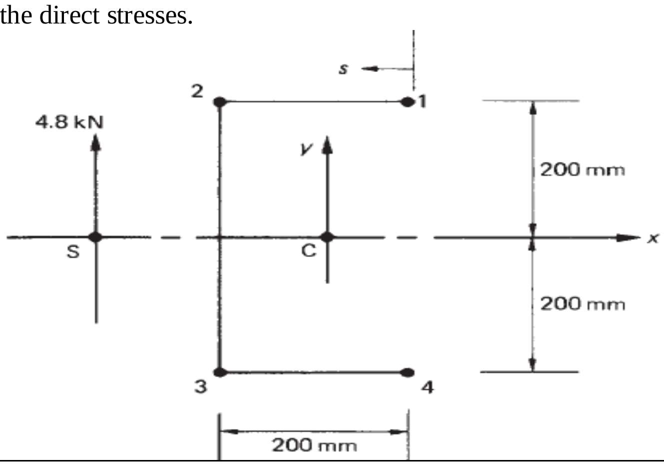
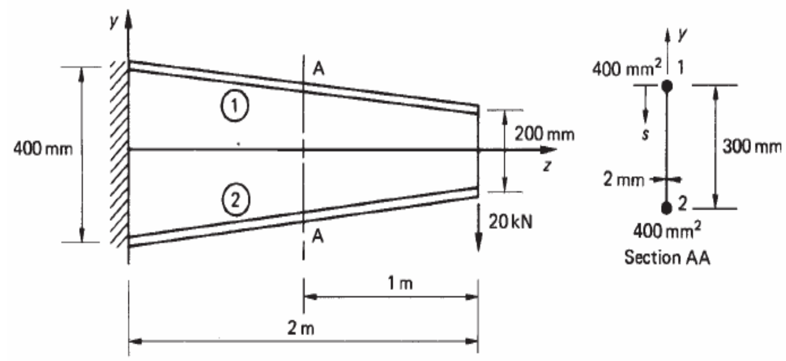
			
11	**Determine** the shear flow distribution at the built-in end of a beam whose cross-section is shown in Fig. below. All walls have the same thickness *t* and shear modulus *G*; *R*=200 mm. 	Understand	6
12	A shallow box section beam whose cross-section is shown in Fig. 26.20 is simply supported over a span of 2m and carries a vertically downward load of 20 kN at mid span. Idealise the section into one suitable for shear lag analysis, comprising eight booms, and hence **determine** the distribution of direct stress along the top right-hand corner of the beam. Take *G/E* =0.36. 	Understand	6
13	**Determine** the shear flow distribution in the thin-walled Z-section shown in Figure due to a shear load *Sy* applied through the shear center of the section. 	Understand	6
14	An open section beam of length L has the section shown in Figure. The beam is firmly built-in at one end and carries a pure torque T. **Derive** expressions for the direct stress and shear flow distributions produced	Analyze	6

	by the axial constraint (the σ_Γ and q_Γ systems) and the rate of twist of the beam. 		
UNIT-III **Structural Idealization of Thin Walled Beams**			
Part - A (Short Answer Questions)			
1	**Define** structural idealization.	Remember	5
2	**Derive** the equation to find out boom areas with neat sketches.	Understand	5
3	**Explain** how to idealization the panel	Understand	5
4	**Derive** the equation $q_s = -\left(\frac{S_x I_{xx} - S_y I_{xy}}{I_{xx} I_{yy} - I_{xy}{}^2}\right)\left(\int_0^s t_D x ds + \sum_{r=1}^{n} B_r x_r\right) - \left(\frac{S_y I_{yy} - S_x I_{xy}}{I_{xx} I_{yy} - I_{xy}{}^2}\right)\left(\int_0^s t_D y ds + \sum_{r=1}^{n} B_r y_r\right)$	Understand	5
5	**Explain** what are structural Idealization and its principle.	Understand	5
6	**What** is the boom area?	Understand	5
7	**Write** short notes on the following: (a) Booms in structures (b) Structural idealization.	Remember	5
8	**Explain** about air loads.	Remember	5
9	**Why** moment of inertia of boom section is zero?		
10	**What** type of loads carried by booms, skin, web and flange?		
Part – C (Problem Solving and Critical Thinking)			
1	Part of a wing section is in the form of the two-cell box shown in Figure in which the vertical spars are connected to the wing skin through angle sections, all having a cross-sectional area of 300 mm^2. **Idealize** the section into an arrangement of direct stress-carrying booms and shear-stress-only-carrying panels suitable for resisting bending moments in a vertical plane. Position the booms at the spar/skin junctions. 	Evaluate	6
2	The thin-walled single cell beam shown in Figure has been idealized into a combination of direct stress-carrying booms and shear-stress-	Evaluate	6

	only-carrying walls. If the section supports a vertical shear load of 10 kN acting in a vertical plane through booms 3 and 6, **calculate** the distribution of shear flow around the section. Boom areas: $B_1=B_8=200$ mm^2, $B_2=B_7=250$ mm^2 $B_3=B_6=400$ mm^2, $B_4=B_5=100$ mm^2. 		
3	The fuselage section shown in Fig. 20.5 is subjected to a bending moment of 100 kNm applied in the vertical plane of symmetry. If the section has been completely idealized into a combination of direct stress carrying booms and shear stress only carrying panels, **determine** the direct stress in each boom. 	Evaluate	6
4	**Calculate** the shear flow distribution in the channel section shown in Fig. 20.7 produced by a vertical shear load of 4.8 kN acting through its shear centre. Assume that the walls of the section are only effective in resisting shear stresses while the booms, each of area 300mm2, carry all the direct stresses. 	Evaluate	6
UNIT-IV STRUCTURAL AND LOADING DISCONTINUITIES IN THIN WALLED BEAMS			
Part – A (Short Answer Questions)			
1	If all direct stresses are carried by booms, while the skin is effective only in ?	Remember	7
2	How the warping will arise in open section beams?	Remember	7
3	Write down the formula for Ixx, Iyy?	Remember	7

4	Write down the bending equation for symmetrical bending theory?	Remember	7
5	What is centroid for boom section?	Evaluate	7
6	For a beam having either Cx or Cy as an axis of symmetry, Ixy =0. U’’?	Remember	7
7	What are idealized section properties?	Apply	7
8	Write down formula for shear of a boom un symmetrical section?	Remember	7
9	Write down formula for bending of a boom section?	Evaluate	8
10	How we can calculate deflection of a boom?	Understand	7
	Part – B (Long Answer Questions)		
1	**Derive** Torsion-Bending constant for an arbitrary section beam subjected to Torsion.	Remember	7
2	**Derive** total Torque equation of an arbitrary section beam subjected to torsion.	Understand	8
3	**Explain** shear lag that poses problems in the analysis of wide, shallow, thin walled beams.	Remember	7
4	**Discuss** shear stress distributions of a closed section beam built in one end and subjected to bending.	Understand	8
5	**Draw** and explain construction and different parts of wing.	Remember	9
	Part – C (Problem Solving and Critical Thinking)		
1	**Determine** the shear flow distribution in the web of the tapered beam shown in Figure at a section midway along its length. The web of the beam has a thickness of 2 mm and is fully effective in resisting direct stress. The beam tapers symmetrically about its horizontal centroidal axis and the cross-sectional area of each flange is 400 mm^2.	Create	9
2			10
3	The cantilever beam shown in Figure is uniformly tapered along its length in both *x* and *y* directions and carries a load of 100 kN at its free end. **Calculate** the forces in the booms and the shear flow distribution in the walls at a section 2 m from the built-in end if the booms resist all the direct stresses while the walls are effective only in shear. Each corner boom has a cross-sectional area of 900 mm^2 while both central booms have cross-sectional areas of 1200 mm^2.	Remember	10

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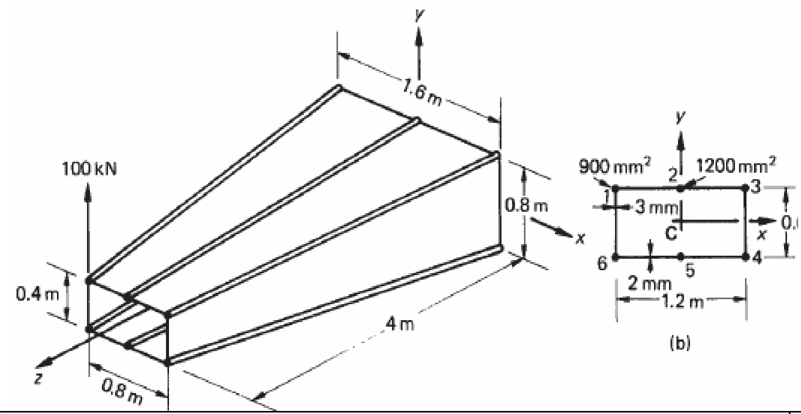
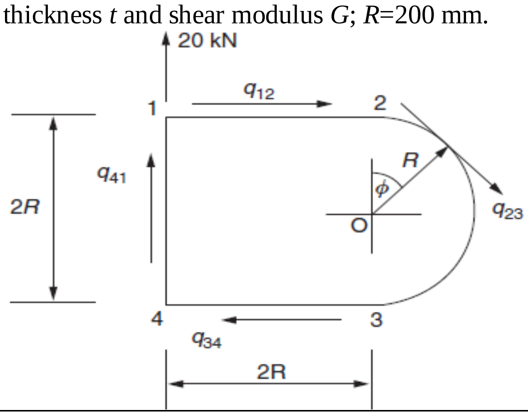
<tr><td>4</td><td>
</td><td>Create</td><td>9</td></tr>
<tr><td>5</td><td>Determine the shear flow distribution at the built-in end of a beam whose cross-section is shown in Fig. below. All walls have the same thickness t and shear modulus G; R=200 mm.

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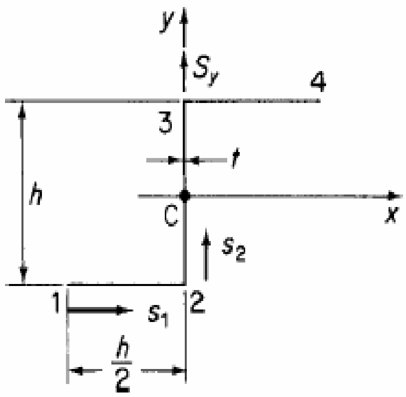
<tr><td>6</td><td>Determine the shear flow distribution in the thin-walled Z-section shown in Figure due to a shear load Sy applied through the shear center of the section.

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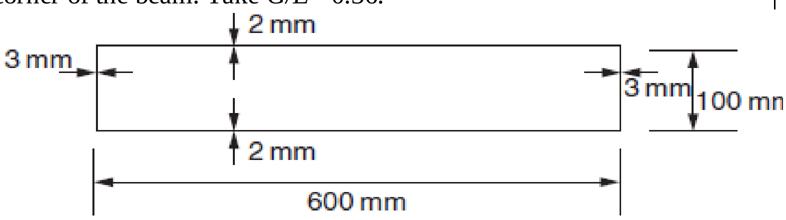
<tr><td>7</td><td>A shallow box section beam whose cross-section is shown in Fig. 26.20 is simply supported over a span of 2m and carries a vertically downward load of 20 kN at mid span. Idealise the section into one suitable for shear lag analysis, comprising eight booms, and hence determine the distribution of direct stress along the top right-hand corner of the beam. Take G/E =0.36.

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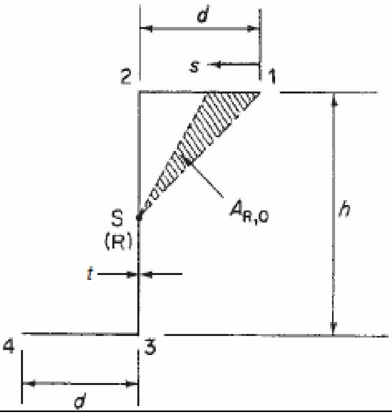
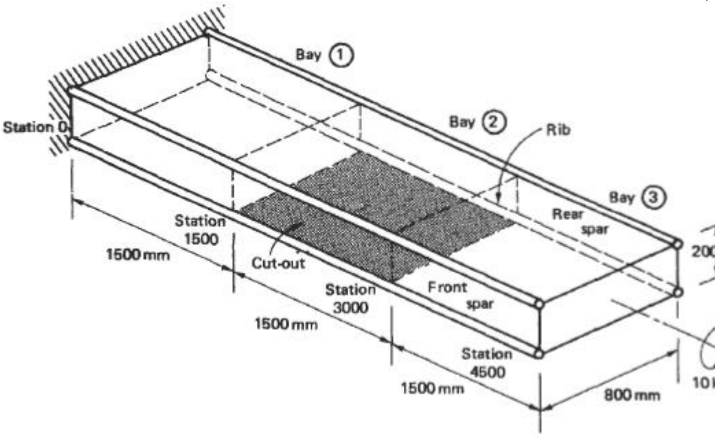
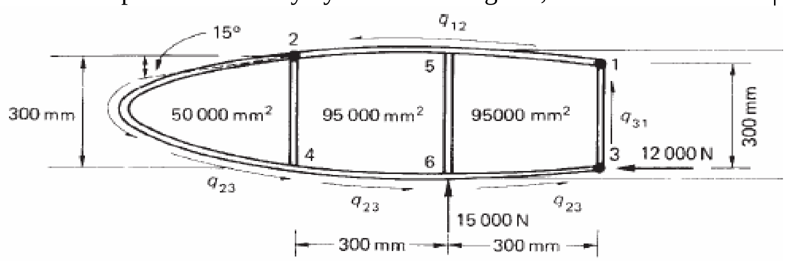
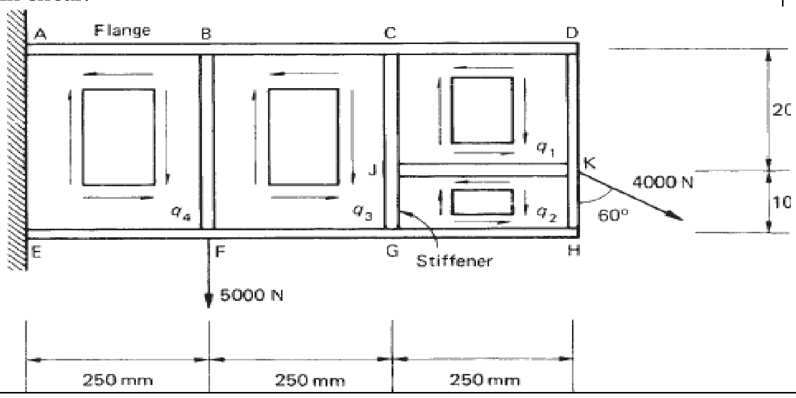
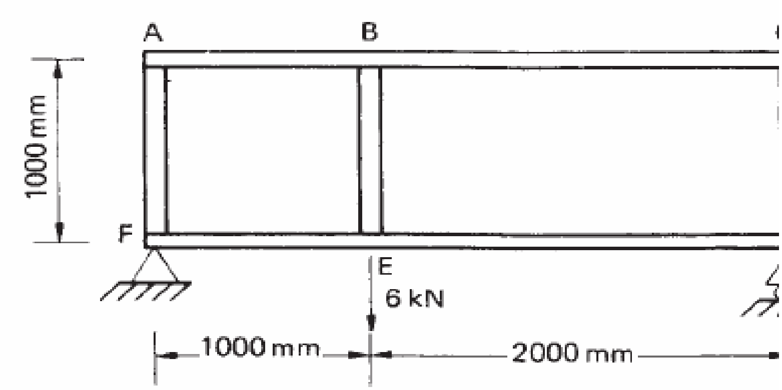
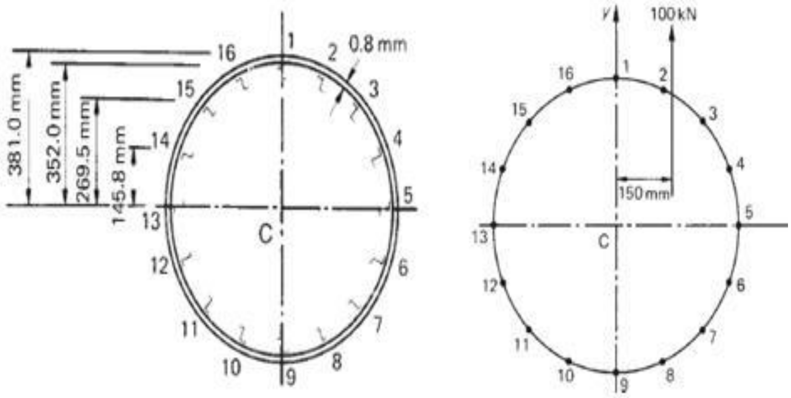
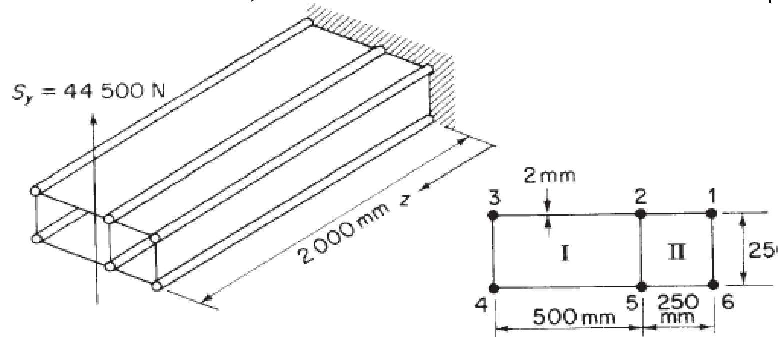
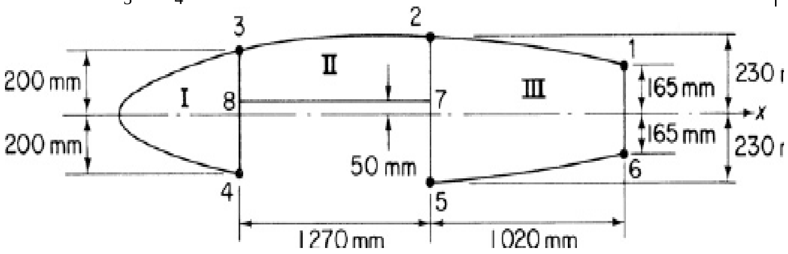
<tr><td>8</td><td>An open section beam of length L has the section shown in Figure. The beam is firmly built-in at one end and carries a pure torque T. Derive</td><td>Analyze</td><td>1</td></tr>
</table>

	expressions for the direct stress and shear flow distributions produced by the axial constraint (the σ_{Γ} and q_{Γ} systems) and the rate of twist of the beam. 		
	UNIT-V **STRESS ANALYSIS OF AIRCRAFT COMPONENTS- WING, FUSELAGE**		
	Part - A (Short Answer Questions)		
1	The fuselage shell section has been idealized such that the fuselage skin is effective only in?	Evaluate	11
2	Why wings and fuselages are usually tapered along their lengths for greater?	Remember	11
3	What are functions of wing ribs?	Remember	11
4	How a thin rectangular strip suffers warping across its thickness when subjected to torsion?	Remember	11
5	Explain the theory of the torsion of closed section beams?	Remember	11
6	A section does not remain rectangular but distorts; the effect is known as ?	Understand	11
7	If the sheer force is 400 N over the length of the 200 mm stiffener, the shear flow is?	Remember	11
8	A bending moment M applied in any longitudinal plane parallel to the z-axis may be resolved into components?	Remember	11
9	For a symmetric section about both axes, then shear centre lies at?	Understand	12
10	Define Warping?	Remember	12
	Part - B (Long Answer Questions)		
1	**Write** a detailed note on the following Fuselage frames Wing ribs	Understand	11
2	The beam shown in Figure is simply supported at each end and carries a load of 6000N. if all direct stresses are resisted by the flanges and stiffeners and the web panels are effective only in shear, **calculate** the distribution of axial load in the flanges ABC and the stiffeners BE and the Shear flows in the panels.	Understand	12
3	**Derive** the equation to find out shear flow in a tapered wing.	Apply	12
4	A wing spar has the dimensions shown in Fig. P.21.1 and carries uniformly distributed loads of 15 kN/m along its complete length. Each flange has a cross-sectional area of 500mm2 with the top flange being horizontal. If the flanges are assumed to resist all direct loads while the spar web is effective only in shear, **determine** the flange loads and the shear flows in the web at sections 1 and 2m from the free end.	Remember	11

<table>
<tr><td>5</td><td>Calculate the shear flows in the web panels and direct load in the flanges and stiffeners of the beam shown in Figure if the web panels resist shear stresses only.</td><td>Remember</td><td>10</td></tr>
<tr><td>6</td><td>The structural portion of a wing consists of a three-bay rectangular section box which may be assumed to be h l y attached at all points around its periphery to the aircraft fuselage at its inboard end. The skin on the undersurface of the central bay has been removed and the wing is subjected to a torque of lOkNm at its tip (Fig.).
Calculate the shear flows in the skin panels and spar webs, the loads in the corner g e s and the forces in the ribs on each side of the cut-out assuming that the spar
h g e s carry all the-direct loads while the skin panels and spar webs are effective
only in shear

</td><td>Evaluate</td><td>10</td></tr>
<tr><td colspan="4">Part – C (Problem Solving and Critical Thinking)</td></tr>
<tr><td>1</td><td>Calculate the shear flows in the web panels and the axial loads in the flanges of the wing rib shown in Figure. Assume that the web of the rib is effective only in shear while the resistance of the wing to bending moments is provided entirely by the three flanges 1, 2 and 3.

</td><td>Evaluate</td><td>12</td></tr>
<tr><td>2</td><td>A cantilever beam shown in Figure carries concentrated loads as shown. Calculate the distribution of stiffener loads and the shear flow distribution in the web panels assuming that the latter are effective only in shear.

</td><td>Evaluate</td><td>10</td></tr>
</table>

<table>
<tr><td>3</td><td>The beam shown in Figure is simply supported at each end and carries a load of 6000 N. If all direct stresses are resisted by the flanges and stiffeners and the web panels are effective only in shear, calculate the distribution of axial load in the flange ABC and the stiffener BE and the shear flows in the panels.

</td><td>Evaluate</td><td>11</td></tr>
<tr><td>4</td><td>The fuselage shown in Fig. a) below is subjected to a vertical shear load of 100 kN applied at a distance of 150mm from the vertical axis of symmetry as shown, for the idealized section, in Fig. b). Calculate the distribution of shear flow in the section.

</td><td>Evaluate</td><td>11</td></tr>
<tr><td>5</td><td>Calculate the shear flows in the web panels and direct load in the flanges and stiffeners of the beam shown in Figure if the web panels resist shear stresses only.</td><td>Apply</td><td>3</td></tr>
<tr><td></td><td>Calculate the deflection at the free end of the two cell beam shown in figure below. Allowing for both bending and shear effects. The boom carries all constant thickness throughout, are effective only in shear. Take E =69000 N/mm² and G =25900 N/mm². Boom areas: B1 =B3 =B4 =B5 =B6 =650mm²; B2 =B5 =1300mm².

</td><td>Analyze</td><td>2</td></tr>
<tr><td>6</td><td>The wing section shown in Figure has been idealized such that the booms carry all the direct stresses. If the wing section is subjected to a bending moment of 300 kN m applied in a vertical plane, calculate the direct stresses in the booms. Boom areas: $B_1 = B_6 = 2580\ mm^2$ $B_2 = B_5 =$</td><td>Analyze</td><td>2</td></tr>
</table>

	3880 mm^2 $B_3 = B_4 = 3230$ mm^2 		

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HOD, AE