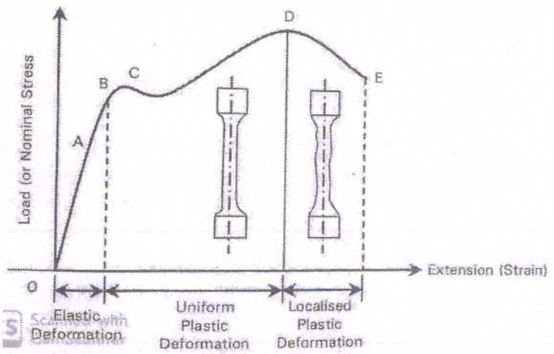
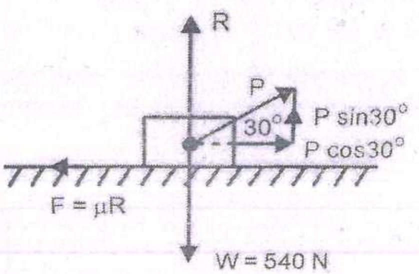
SCHEME OF EVALUATION

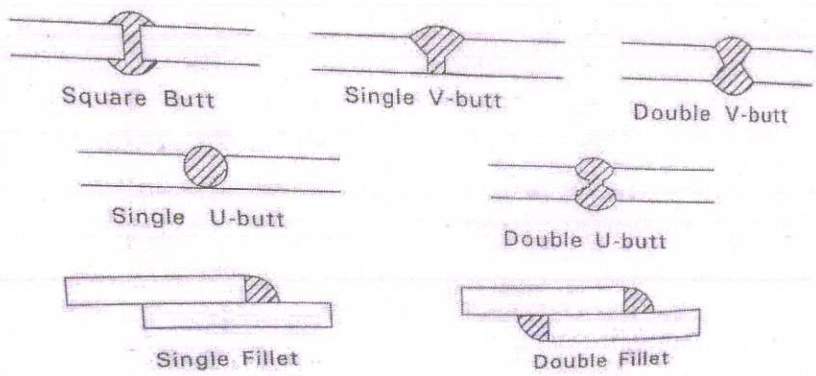
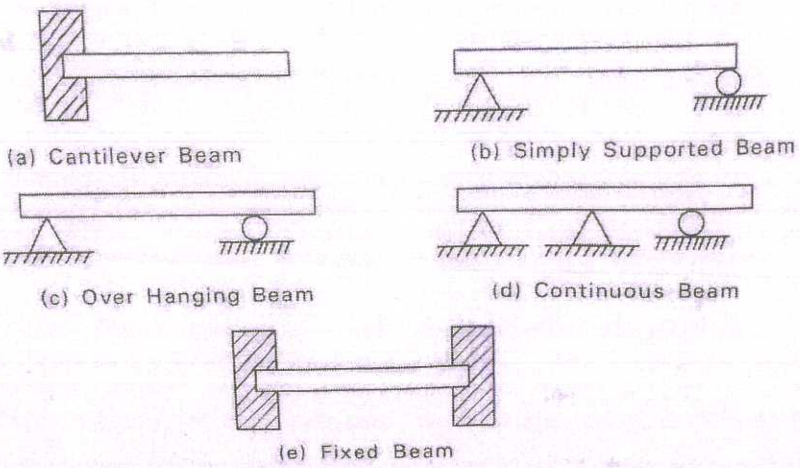
(Scoring Indicators)

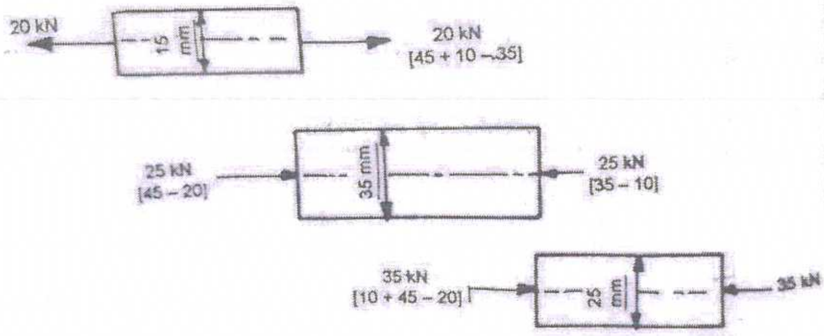
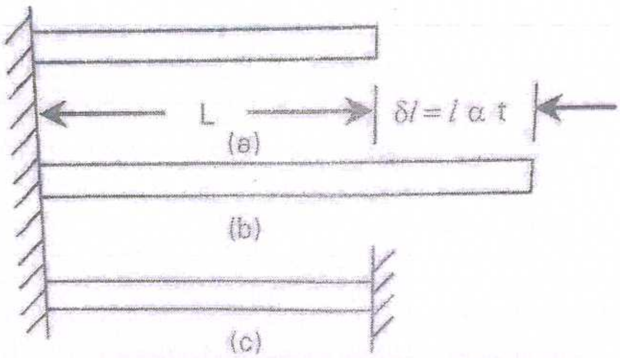
Revision: 2015 Course Code: 4021

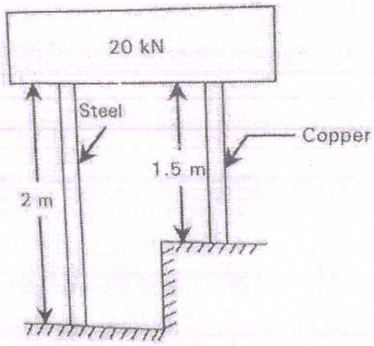
Course Title: APPLIED MECHANICS AND STRENGTH OF MATERIALS

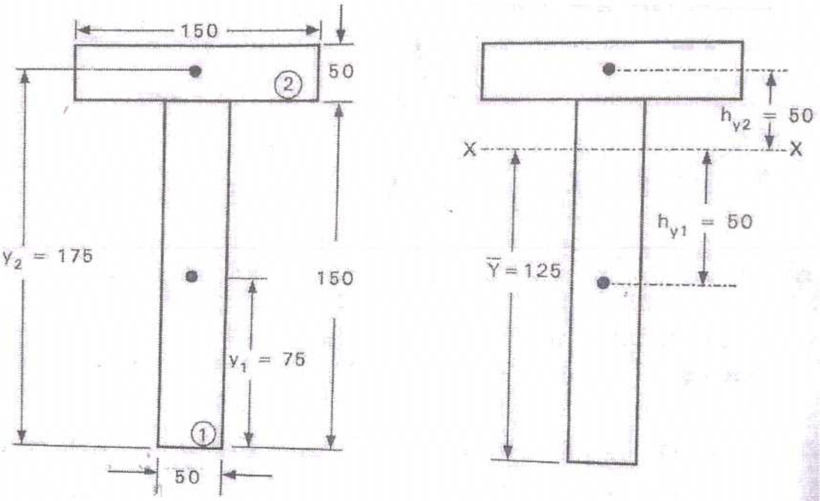
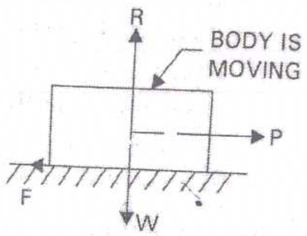
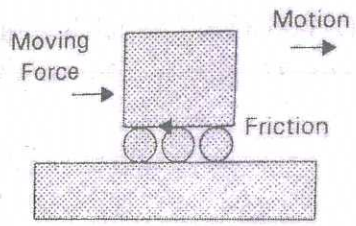
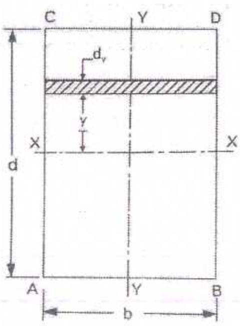
Q. No.	Scoring Indicators	Split up score	Sub Total	Total
	PART - A			
I 1.	It is the ratio change in dimension to the original dimension in the direction perpendicular to the force	2	2	
2.	The angle between resultant reaction and normal reaction	2	2	
3.	Single riveted lap joint, Double riveted lap joint, single strap butt joint, double strap butt joint etc… (Any 4)	½ x 4	2	10
4.	Column with slenderness ratio more than 120 is long column and column with slenderness ratio less than 32 is short column.	1 + 1	2	
5.	It is the ratio of mean coil diameter to the diameter of spring wire.	2	2	

		PART - B (Any 5)			
II	1	a) The maximum stress that a material can withstand without fracture is called Ultimate stress b) To prevent failure, maximum stress induced during working must be below the elastic limit. That design stress is called working stress. c) Factor of safety is the ratio of Ultimate stress to the working stress	2 2 2	6	
	2		3		
		During gradual loading of specimen, stress and strain are plotted as shown in figure. Salient points are 1.Proportional limit (Stress and strain are in linear proportion) 2. Elastic Limit (Elastic property of material disappears beyond this point. 3.Yield point (Plastic deformation starts) 4. Ultimate point (Maximum stress before fracture) 5. Breaking point (Specimen breaks)	3	6	
	3.	**Parallel axis theorem:-** Moment of inertia of an area about an axis is equal to the moment of inertia about a parallel axis passing through the centroid plus the area multiplied by the square of distance between the axex. $I_{AB} = I_G + Ah^2$	3		
		Perpendicular axis theorem:- If I_{xx} and I_{YY} be the moment of inertia of an area about mutually perpendicular axes X X and YY , then the moment of inertia about an axis ZZ , normal to the lamina passing through the intersection of XX and YY is given by $I_{ZZ} = I_{XX} + I_{YY}$	3	6	
	4.	Wt. of body (W) = 540 N, Angle of pull = 30^0, Pull Applied (P) = 180 N 	2		

	Resolving perpendicular to the plane : R + 180 x sin 30 = 540 then R = 450 N Resolving parallel to the plane : μ x 450 = 180 x cos 30 Then μ = 0.346 ..... (Ans)	2 2	6	
5.		Any 6 x 1	6	
6	Dia. Of shell = 3m = 3000 mm……….Thichness t = 30 mm Pressure = 1 N/mm^2 Hoop stress (σh) = pd/2t = 1 x 3000 / 2x30 = 50 N/mm^2 **(Ans)** Longitudinal stress (σt) = pd / 4t = 1 x 3000 / 4 x 30 = 25 N/mm2 **(Ans)**	3 + 3	6	Any 5 x 6
7		Any 4 x 1 1/2	6	30

	PART – C **UNIT – 1**			
III a)		4		
	Consider 15 mm section:- D1 = 15 mm ; A1 = $\pi/4 \times 15^2 = 176.6$ mm^2 Stress $\sigma1 = P1/A1 = (20 \times 10^3) / 176.6 = 113.18$ N/mm^2 (Tensile) **Ans…**	2		
	Consider 35 mm section:- D2 = 35 mm ; A2 = $\pi/4 \times 35^2 = 962.11$ mm^2 Stress $\sigma2 = P2/A2 = (25 \times 10^3) / 962.11 = 25.98$ N/mm^2 (Comp) **Ans…**	2		
	Consider 25 mm section:- D3 = 25 mm ; A3 = $\pi/4 \times 25^2 = 490.87$ mm^2 Stress $\sigma3 = P3/A3 = (35 \times 10^3) / 490.87 = 71.3$ N/mm^2 (Comp) **Ans…**	2	10	
b)		3		
	Compressive strain = $\delta l / l = l\alpha t / l = \alpha t$ By Hooks law Stress = E x strain = $E\alpha t$	2	5	15

	OR			
IV a)				
	D = 20 mm, Area of each rod (A) = $\pi/4 \times 20^2 = 314.1592\ mm^2$ Es = $2.05 \times 10^5\ N/mm^2$ … Ec = $1.1 \times 10^5\ N/mm^2$ Elongation for both rods are equal… $\delta ls = \delta lc$ $\sigma s\ ls/Es = \sigma c\ lc/Ec$ ………	3		
	$\sigma s \times 2000 / 2.05 \times 10^5 = \sigma c \times 1500 / 1.1 \times 10^5$ $\sigma s = 1.3977\ \sigma c$ ……Also $P = \sigma s \times As = \sigma c \times Ac$ $20 \times 10^3 = 1.3977\ \sigma c \times 314.1592 = 314.1592\ \sigma c$	3		
	σc = 26. 56 N/mm^2 **(Ans..)** Substitituting σc = 26. 56 in $\sigma s = 1.3977\ \sigma c$;	2		
	$\sigma s = 37.12\ N/mm^2$ (Ans…)	2	10	
b)	**Modulus of rigidity**: It is the ratio of shear stress to shear strain. Modulus of rigidity = Shear stress (τ) / shear strain (e)	2 ½		
	Poisson's ratio: It is the ratio of lateral strain to the linear strain poisson's ratio = $\varepsilon_1 / \varepsilon$ where $\varepsilon_1 = \delta t / t$ ..Lateral strain $\varepsilon = \delta l / i$……linear strain	2 ½	5	15
	UNIT – 2			
V a)	Area (A1) = 150 x 50 = 7500 mm^2 and Y1 = 150/2 = 75 mm Area (A2) = 150 x 50 = 7500 mm^2 and Y2 = 50/2 + 150 = 175 Position of centroid from bottom = (A1 Y1 + A2 Y2) / (A1 = A2) = (7500 x 75 + 7500 x 175) / (7500 + 7500) = 125 mm	2		
	Consider section 1, $I_{xx1} = I_G + A h^2 = bd^3/12 + A h^2$ $(50 \times 150^3 / 12) + (7500 \times 50^2) = 328.125 \times 10^5\ mm^4$	2		
	Consider section 2, $I_{xx2} = I_G + A h^2 = bd^3/12 + A h^2$ $(150 \times 50^3 / 12) + (7500 \times 50^2) = 203.125 \times 10^5\ mm^4$	2		

		3		
	$I_{xx} = I_{xx1} + I_{xx2} = 328.125 \times 10^5 + 203.125 \times 10^5$ $= \mathbf{531.125 \times 10^5\ mm^4}$ **(Ans..)**	1	10	
b)	**i) Sliding Friction** **ii) Rolling Friction**  In sliding friction one body slide moves over the surface of other body. But in Rolling friction, the relative motion between the surfaces is rolling motion.	2 ½ + 2 ½	5	15
	OR			
VI a)		3 2		

<table>
<tr><td></td><td>Consider an elementary strip of depth dy at a distance at 'y' from XX axis…… Area of strip = b x dy
Moment of Inertia of elementary strip about XX = (b x dy) x y^2

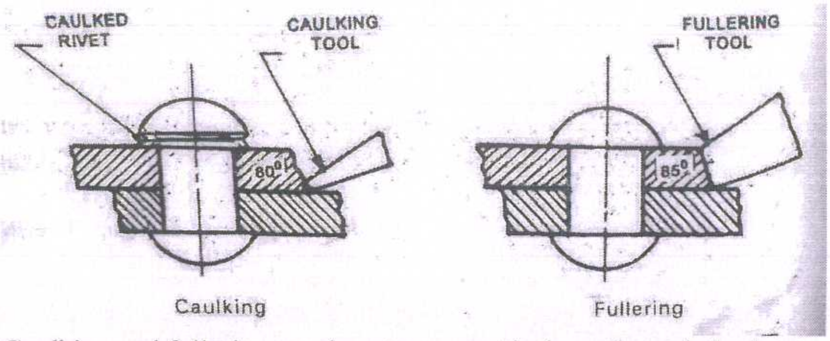
$= by^2\,dy$
Total Moment of Inertia about XX = $2 \times \int_0^{d/2} by^2\,dy$
$= 2b\left[\frac{y^3}{3}\right]_0^{d/2} = 2b\left[\frac{(\frac{d}{2})^3}{3}\right] = 2\,db^3/24 =$
$I_{yy} = db^3/12$.(.Ans)
similarly , Ixx $bd^3/12$ (Ans ..)</td><td>3

2</td><td>10</td><td></td></tr>
<tr><td>b)</td><td>1) Frictional force is directly proportional to normal reaction.
2) Frictional force depends up on the material of contacting surfaces and roughness.
3) Frictional force is independent of area of contact.
4) Frictional force is independent of velocity of sliding</td><td>1 1/4
x 4</td><td>5</td><td>15</td></tr>
<tr><td></td><td>UNIT – 3</td><td></td><td></td><td></td></tr>
<tr><td>VII
a)</td><td>Power (P) = 200 x 10^3 Watts RPM (N) = 300 $\tau = 100$ N/mm^2

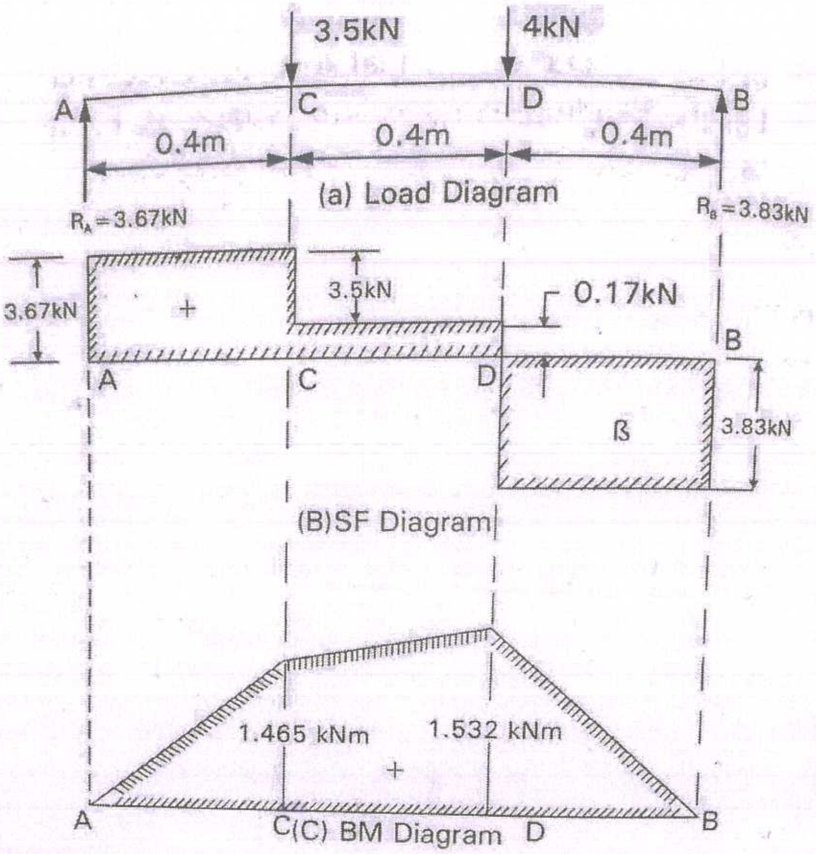
P= 2πNT /60 ; 200 x 10^3 = 2π x 300T /60 ; T = 6369.4 N -m

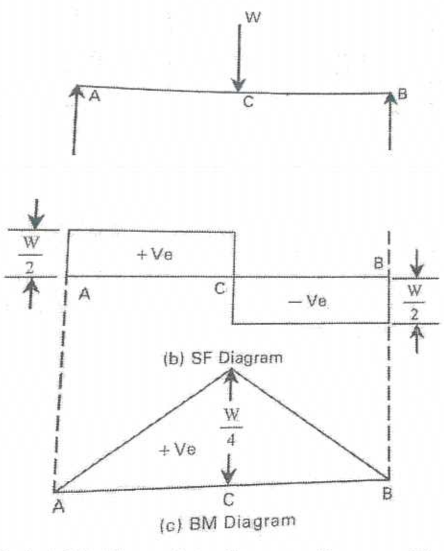
T = 6369.4 x 10^3 N mm
T = $(\pi/16)\,d^3\,\tau$; 6369.4 x 10^3 = $(\pi/16)\,d^3$ x 100
d = 68.7 mm (Ans…)</td><td>5

5</td><td>10</td><td></td></tr>
<tr><td>b)</td><td>



Caulking and fullering are done to prevent leakage through the joint.</td><td>2 1/2
+
2 1/2</td><td>5</td><td>15</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>VIII
a)</td><td>Power (P) = 200 x 10^3 Watts RPM (N) = 80 $\tau = 60$ N/mm^2
P= 2πNT /60 ; 200 x 10^3 = 2π x 80T /60 ; T = 23873.24 N -m</td><td></td><td></td><td></td></tr>
</table>

	$T = 23873.24 \times 10^3$ N–mm	5		
	$T = (\pi/16)\, D^3 \tau\, (1 - K)^4$ where $K = 0.6$ $23873.24 \times 10^3 = (\pi/16)\, D^3 \times 60\, (1 - 0.6)^4$ **D= 132.5 mm and d = 79.5 mm**	5	10	
b)	**(Ans..)** **1. Shearing of Rivet:-**The rivet may be sheared of at one or more sections if diameter is not enough. **2.crushing of rivet or plate :** Due to compressive force (not Uniform) rivet or plate may be crush off. **3 Tearing of the plate:-** Due the presence of rivet holes decrease the strength of plate and leads to tearing. **4. Tearing of plate edge:-** Due to the lack of required margin	5	5	15
IX a)	**UNIT – 4**  **<u>SF Diagram</u>** SF at B = -3.89 KN , and it remains constant up to point D SF at D = -3.83 + 4 = 0.17 KN and it is constant up to point C SF at C = 0.17 + 3.5 = 3.67 KN and it is constant up to A	4 4		

<table>
<tr><td></td><td><u>BM Diagram</u>
BM at B = 0
BM at D = +3.83 x 0.4 = + 1.532 kN m
BM at C = + 3.83 x 0.8 – 4 x 0.4 = + 1.464 kN m
BM at A = 0</td><td>2</td><td>10</td><td></td></tr>
<tr><td>b)</td><td><table><tr><td>In close coiled spring, the spring wires are coiled very closely , each turn is nearly at right angles to the axis of helix. But in open coiled spring</td><td>In open coiled spring, the wires are coiled such that there is a gap between two consecutive turns</td></tr><tr><td>In close coiled springs, Helix angle is less than 100</td><td>In open coiled springs, Helix angle is large and more than 100</td></tr></table></td><td>$2^{1/2}$
+
$2^{1/2}$</td><td>5</td><td>15</td></tr>
<tr><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>X
a)</td><td>Length (l) = 1.75 m = 1750 mm
Width (b) = 120 mm Depth (d) = 100 mm E= 2×10^5 N/mm^2
For Column fixed at one and hinged at other end,
Effective length L = $l/\sqrt{2}$ = 1750 / $\sqrt{2}$ = 1237 mm
Moment of Inertia (I) = $bd^3/12 = 120 \times 100^3/12 = 10^7$ mm^4
Buckling Load, $P = \pi^2 E I / l^2 = (\pi^2 \times 2 \times 10^5 \times 10^7) / 1237^2$
12.9×10^6 Ans…</td><td>2
3
5</td><td>10</td><td></td></tr>
<tr><td>b)</td><td>

Point C is the point of contra flexure. The shear force change sign and Bending moment becomes maximum at that point.</td><td>3
2</td><td>5</td><td>15</td></tr>
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