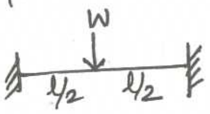
SCHEME OF VALUATION

(Scoring Indicators)

Revision: 2015 **Course Code:** 4014

Course Title: Theory of structures II

Qs No	Scoring Indicators	Split up score	Sub Total	Total
I 1.	The ratio of the actual length of a column to the least radius of gyration of the column. Slenderness ratio $= \frac{l}{K}$	1 1	2	2
2.	1. Both ends hinged 2. One end is fixed and other is free 3. Both ends fixed 4. One end fixed and other is hinged	½ ½ ½ ½	2	2
3.	It is defined as the maximum inclination of plane at which a body remains in equilibrium over the inclined plane by the assistance of friction only. The earth particles lack in cohesion and have a definite angle of repose	2	2	2
4.	 $y_c = \frac{Wl^3}{192EI}$ $EI\frac{dy}{dx} = \frac{Wx^2}{4} - \frac{WLx}{8}$	1 1	2	2
5.	The ratio of moment produced at a joint to the moment applied at the other joint without displacing is called carry over factor.	2	2	2

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	PART B			
II 1.	1) The column is initially perfectly straight and the load is applied axially.	1		
	2) The cross-section of the column is uniform throughout its length.	1		
	3) The column material is perfectly elastic, homogeneous and isotropic and obeys Hooke's law.	1		
	4) The length of the column is very large as compared to its lateral dimensions.	1		
	5) The direct stress is very small as compared to the bending stress.	1		
	6) the self weight of the column is negligible	1		
	7) the column will fail by buckling alone		6	6
2.	$b = 200mm \quad d = 150mm$	1		
	$A = b \times d = 200 \times 150 = 30000 mm^2$	1		
	$P = 240kN = 240 \times 10^3 N$			
	$e = 10mm$			
	$\sigma_{max} = \frac{P}{A}\left(1 + \frac{6e}{b}\right) = \frac{240 \times 10^3}{30000}\left(1 + \frac{6 \times 10}{200}\right)$	2		
	$= 8(1 + \cdot 3) = 10 \cdot 4 \; N/m^2$			
	$\sigma_{min} = \frac{P}{A}\left(1 - \frac{6e}{b}\right) = \frac{240 \times 10^3}{30000}\left(1 - \frac{6 \times 10}{200}\right)$	2	6	6
	$= 8(1 - \cdot 3) = 5 \cdot 6 \; N/mm^2$			

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
3.	A dam should be stable under all conditions. But the dam may fail : i) by sliding on the soil on which it rests ii) by overturning iii) due to tensile stresses developed iv) due to excessive compressive stresses.	2		
	* Condition to prevent the sliding of the dam If the force of friction is more than the force due to water pressure, the dam will be safe against sliding	1		
	* condition to prevent the overturning There will be no overturning about point B, if restoring moment about B is more than the overturning moment.	1		
	* condition to avoid tension. Resultant must lie within the middle third of the base width in order to avoid tension	1		
	* condition to avoid the excessive compressive stresses. maximum stress in the masonry should be less than the permissible stresses in the masonry.	1	6	6

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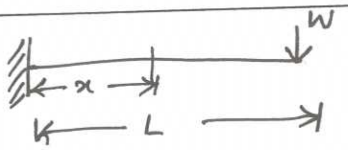
Qs No	Scoring Indicators	Split up score	Sub Total	Total
4.				
	$M_x = -W(L-x)$	1		
	$M = EI \frac{d^2y}{dx^2}$			
	$EI \frac{d^2y}{dx^2} = -W(L-x) = -WL + Wx$	1		
	Integrating,			
	$EI \frac{dy}{dx} = -WLx + \frac{Wx^2}{2} + C_1$ — ①	1		
	Integrating again,			
	$EIy = -WL\frac{x^2}{2} + \frac{W}{2}\frac{x^3}{3} + C_1x + C_2$ — ②	1		
	at $x=0$, $y=0$			
	$C_2 = 0$			
	at $x=0$, $\frac{dy}{dx} = 0$			
	$C_1 = 0$			
	Sub C_1 in eqn ①			
	$EI\frac{dy}{dx} = -WLx + \frac{Wx^2}{2}$			
	$= -W\left[Lx - \frac{x^2}{2}\right]$			
	Sub C_1 & C_2 in eqn ②			
	$EIy = -WL\frac{x^2}{2} + \frac{Wx^3}{6}$			

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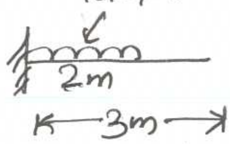
Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$= -W\left(\frac{Lx^2}{2} - \frac{x^3}{6}\right)$ Sub θ_B for $\frac{dy}{dx}$ & $x = L$ $EI\,\theta_B = -W\left(L \cdot L - \frac{L^2}{2}\right)$ $\boxed{\theta_B = -\frac{WL^2}{2EI}}$	1		
	Sub y_B for y and $x = L$ $\boxed{y_B = \frac{-WL^3}{3EI}}$	1	6	6
5.	$L = 3m$ $w = 10kN/m = 12\,N/mm$ $I = 10^8 mm^4$ $E = 2 \times 10^5\, N/mm^2$  	1		
	$\theta_B = \frac{wa^3}{6EI} = \frac{10 \times 2000^3}{6 \times 2 \times 10^5 \times 10^8} = 0.00066$	2		
	$y_B = \frac{wa^4}{8EI} + \frac{wa^3}{6EI}(L-a)$ $= \frac{10 \times 2000^4}{8 \times 2 \times 10^5 \times 10^8} + \frac{10 \times 2000^3}{6 \times 2 \times 10^5 \times 10^8}(3000 - 2000)$	2		

$= 1 + .67 = \underline{1.67mm}$ 1 6 6

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
6.	Stiffness factor:- It is the moment required to rotate the end while acting on it, through a unit angle, without translation of the far end.	2		
	Distribution factor: The distribution factor for a member at a joint is the ratio of the stiffness factor of the member to the total stiffness factor of all the members meeting at the joint.	2		
	Carry over moment: The moment induced at the far end due to distributed moment at the nearest end, the far end being fixed is known as carryover moment.	2	6	6
7.	i) Assume all the joints to be fixed against rotation initially and work out the fixed end moments for all members. ii) calculate stiffness factors for all members iii) At the joints calculate the distribution factors for all the members. iv) The ends of the member which are actually hinged but taken as fixed initially in step (i) have to be released by applying equal and opposite moment at the end.			

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	Half of this released moment has to be carried over to the other end of the member v) Obtain the net fixed end moments from step (iv) vi) Balance the moments at each joint by releasing the imaginary restraints and distributing the unbalanced moment to the members meeting at the joint in the ratio of their distribution factors. vii) Carry over half the distributed moments to the other end of the member with the same sign. No moment is carried over to the s.supported end. viii) Repeat the process until the carry over moments become very small. ix) Sum up all the moments so obtained at any end of the member. This gives final moment at this ends.	6	6	6
	PART C			
III (a)	$\frac{1}{P} = \frac{1}{P_C} + \frac{1}{P_E}$ $P = \sigma_C \times A$ $P_E = \frac{\pi^2 EI}{L^2}$	1		

When the column is very long,

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	P_E is very small and $\frac{1}{P_E}$ is very large and $\frac{1}{P_C}$ is negligible			
	$\therefore \frac{1}{P} = \frac{1}{P_E}$	1		
	when the column is very short, P_E is very large $\frac{1}{P_E}$ is very small compared $\frac{1}{P_C}$ and is negligible	1		
	$\frac{1}{P} = \frac{1}{P_C}$			
	$\frac{1}{P} = \frac{1}{P_C} + \frac{1}{P_E} = \frac{P_E + P_C}{P_C \cdot P_E}$	1		
	$P = \frac{P_C \cdot P_E}{P_E + P_C} = \frac{P_C}{1 + \frac{P_C}{P_E}}$	1		
	$P = \frac{\sigma_C \times A}{1 + \frac{\sigma_C \times A L^2}{\pi^2 E I}} = \frac{\sigma_C A}{1 + \frac{\sigma_C}{\pi^2 E} \times \frac{A L^2}{A K^2}}$	1		
	$= \frac{\sigma_C \times A}{1 + a\left(\frac{L}{K}\right)^2}$	2	8	

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(Scoring Indicators)

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
(b)	(i) $P = \frac{\pi^2 E I}{Le^2}$			
	$Le = \frac{l}{2}$ when both the ends are fixed			
	$= \frac{6000}{2} = 300mm$			
	$Ixx = \frac{15 \times 20^3}{12} = 10000\ cm^4$ $= 10000 \times 10^4\ mm^4$	2		
	$Iyy = \frac{20 \times 15^3}{12} = 5625\ cm^4$ $= 5625 \times 10^4\ mm^4$	2		
	Iyy is less than Ixx, ∴ the column will tend to buckle in Y-Y-direction			
	$P = \frac{\pi^2 \times 17.5 \times 5625 \times 10^4}{3000}$ $= 1079.48\ kN$	2		
	(ii) Safe load			
	factor of safety = 3			
	Safe load = $\frac{\text{crippling load}}{f.s}$ $= \frac{1079.48}{3}$ $= 359.8 \simeq 360kN$	1	7	15

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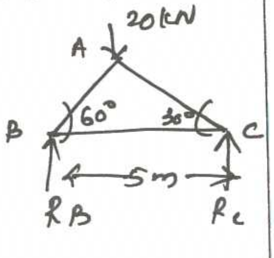
Course Title: Theory of structures II

Qs No	Scoring Indicators	Split up score	Sub Total	Total
IV a)	A structure made up of several members riveted or welded together is known as frame.	2		
	The different types of frames are i) Perfect frame:- The frame which is composed of such members, which are just sufficient to keep the frame in equilibrium when the frame is supporting an external load is known as perfect frame. $n = 2j - 3$ $n \rightarrow$ no. of members j – no. of joints	2		
	ii) Imperfect frame:- A frame in which number of members and no. of joints are not given by $n = 2j - 3$ is known as an imperfect frame. $n < 2j - 3$ — deficient frame $n > 2j - 3$ — Redundant frame.	3	7	
(b)	$\angle BAC = 90^\circ$ $AB = BC \cos 60^\circ$ $= 5 \times \cos 60^\circ$ $= \underline{\underline{2.5\,m}}$ 			

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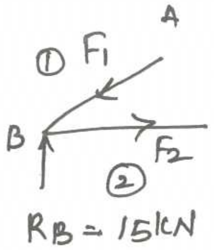
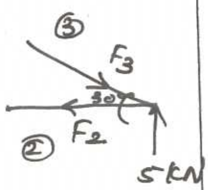
Qs No	Scoring Indicators	Split up score	Sub Total	Total
	The distance of line of action of 20kN from B is $AB \times \cos 60^\circ$ $2.5 \times \frac{1}{2} = 1.25m.$ Taking moment about B $R_C \times 5 = 20 \times 1.25 = 25$ $R_C = \frac{25}{5} = 5kN$ $R_B = 20 - 5 = 15kN.$	2		
	Joint B Resolving the forces acting on the joint B vertically,  $F_1 \sin 60^\circ = 15$ $F_1 = \frac{15}{\sin 60} = 17.32kN$	2		
	Resolving horizontally, $F_2 = F_1 \cos 60$ $= 17.32 \times \frac{1}{2} = 8.66kN$	2		
	Joint C Resolving vertically  $F_3 \sin 30^\circ = 5.$ $F_3 = \frac{5}{\sin 30} = 10kN$	2	8	15

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(Scoring Indicators)

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
V (a)	Let P – Eccentric load on column e – Eccentricity σ_0 – Direct stress σ_b – Bending stress b – width of column d – depth of column $A = b \times d$ $M = P \times e$ $\sigma_0 = \frac{P}{A}$			
	$\frac{M}{I} = \frac{\sigma_b}{y}$ $\sigma_b = \frac{M}{I} \times y$	1		
	$I_{yy} = \frac{db^3}{12}$ Sub I_{yy}, $\sigma_b = \frac{M}{\frac{db^3}{12}} \times y = \frac{12M}{db^3} \times y$	1		
	Bending stress at the the extreme $y = \frac{b}{2}$ $\sigma_b = \frac{12M}{d \cdot b^3} \times \frac{b}{2} = \frac{6M}{db^2} = \frac{6Pe}{db^2}$ $= \pm \frac{6Pe}{d \cdot b \cdot b} = \pm \frac{6Pe}{A \times b}$	1		
	$\sigma_{max} = \sigma_0 + \sigma_b = \frac{P}{A} + \frac{6Pe}{A \cdot b}$			

SCHEME OF VALUATION

(Scoring Indicators)

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Course Title: Theory of structures I

Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$= \frac{P}{A}\left(1+\frac{6e}{b}\right)$	2		
	$\sigma_{min} = \sigma_0 - \sigma_b$			
	$= \frac{P}{A}\left(1-\frac{6e}{b}\right)$	2	7	
(b)	$A = \frac{\pi}{4}(D^2-d^2) = 30000 \times \pi \; mm^2$	1		
	$I = \frac{\pi}{64}(D^4-d^4) = 3.75\times10^8 \times \pi \; mm^4$	1		
	$P = 80kN = 80\times10^3 N$			
	$\sigma_0 = \frac{P}{A} = \frac{80000}{30000\pi}$	1		
	$M = P\times e = 80000\times e$			
	$\frac{M}{I} = \frac{\sigma_b}{y}$			
	$\sigma_b = \frac{My}{I}$			
	$y = \frac{d}{2} = \frac{400}{2} = 200mm$			
	$\sigma_b = \frac{80000 \times e \times 200}{3.75\times10^8\times\pi}$	1		
	$\sigma_{min} = \sigma_0 - \sigma_b$			

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$= \frac{80000}{30000 \times \pi} - \frac{80000 \times e \times 200}{3.75 \times 10^8 \times \pi}$	2		
	there will be no tension if $\sigma_{min} = 0$			
	$0 = \frac{80000}{30000 \times \pi} - \frac{80000 \times e \times 200}{3.75 \times 10^8 \times \pi}$	2	8	15
	$e = 62.5\,mm$			
VI (a)	(i) Resultant force on dam			
	$F = w \times A \times \bar{h}$			
	$= 9810 \times (h \times 1) \times \frac{h}{2}$			
	$= 9810 \times 15 \times \frac{15}{2}$			
	$= 1103625N$ acting at a $\frac{15}{3} = 5m$ above the base	1		
	W = wt. density of masonry × Area of dam × 1			
	$= w_0 \times \left(\frac{a+b}{2}\right) \times H \times 1$			
	$= 19620 \times \left(\frac{4+8}{2}\right) \times 18 \times 1\,N$	1		
	$= 2118960N$			

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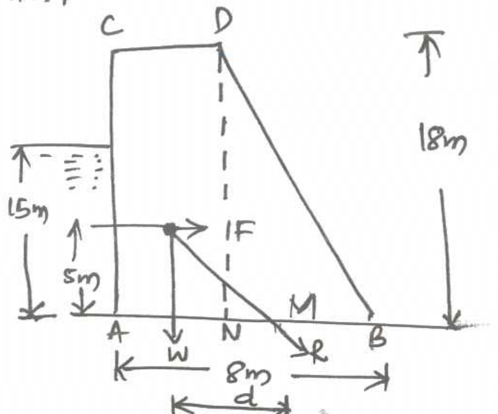
Qs No	Scoring Indicators	Split up score	Sub Total	Total
	Distance of line of action of W from line AC $4 \times 18 \times 2 + \frac{4 \times 18}{2} \times \left(4 + \frac{1}{3} \times 4\right) = \left(\frac{4+8}{2}\right) \times 18 \times AN$ $AN = 3.11m$	1		
				
	(i) Resultant $R = \sqrt{F^2 + W^2}$ $= \sqrt{1103625^2 + 2118960^2}$ $= 238925.5N$ $= \underline{\underline{2.389 \text{ MN}}}$	2		
	ii) The point where the resultant cuts the base $x = \frac{F}{W} \times \frac{h}{3}$			

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$= \frac{1103625}{2118960} \times \frac{15}{3}$			
	$= 2.604m$			
	or			
	Taking moments of all forces abt the point M			
	$F \times 5 = W \times x$			
	$x = \frac{F}{W}$			
	$= \frac{1103625}{2118960} = 2.604m$	1		
	The distance AM = d			
	$d = AN + NM$			
	$= 3.11 + x$			
	$= 3.11 + 2.604$			
	$= 5.714m$			
	$e = d - \frac{b}{2}$			

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$= 5.714 - \frac{8}{2}$ $= 1.714m$	1		
	iii) The maximum and minimum stress intensities $\sigma_{max} = \frac{W}{b}\left(1 + \frac{6e}{b}\right)$ $= \frac{2118960}{8}\left(1 + \frac{6 \times 1.714}{8}\right)$ $= 605360 N/m^2$	1		
	$\sigma_{min} = \frac{W}{b}\left(1 - \frac{6e}{b}\right)$ $= \frac{2118960}{8}\left(1 - \frac{6 \times 1.714}{8}\right)$ $= -75620 N/m^2$ -ve sign shows that stress is tensile	1	9	

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
b)	The following are the advantages of a fixed beam over a simply supported beam:			
	i) For the same loading, the maximum deflection of a fixed beam is less than that of a simply supported beam	1 ½		
	ii) For the same loading, the fixed beam is subjected to a lesser maximum bending moment	1 ½		
	iii) The slope at both ends of a fixed beam is zero	1 ½		
	iv) Fixed beam is more stable, stronger and stiffer than the simply supported beams.	1 ½	6	15
VII (a)	$I = \frac{bd^3}{12} = \frac{200 \times 300^3}{12} = 4.5 \times 10^8 \ mm^4$	1		
	$w = 9 kN/m = 9000 N/m$			
	$W = wL = 45000 N$	1		

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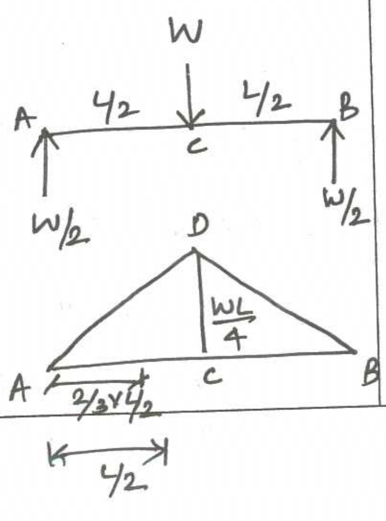
Qs No	Scoring Indicators	Split up score	Sub Total	Total
	(i) Slope at the supports			
	$\theta_A = -\dfrac{WL^2}{24EI}$	1		
	$= -\dfrac{45000 \times 5000^2}{24 \times 1 \times 10^4 \times 4.5 \times 10^8}$	1		
	$= 0.0104$ rad			
	ii) Maximum deflection			
	$y_c = \dfrac{5}{384} \dfrac{WL^3}{EI}$	2		
	$= \dfrac{5}{384} \times \dfrac{45000 \times 5000^3}{1 \times 10^4 \times 4.5 \times 10^8}$	2		
	$= 16.27$ mm			
(b)	Slope at A = $\dfrac{\text{Area of BM diagram between A \& C}}{EI}$ 	2		

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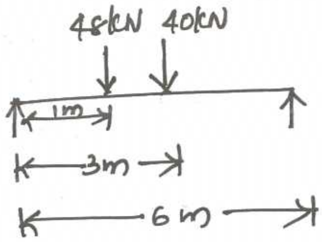
Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$= \frac{1}{2} \times \frac{L}{2} \times \frac{WL}{4} = \frac{WL^2}{16}$	1		
	Slope at A or $\theta_A = \frac{WL^2}{EI}$	2		
	$y = \frac{A\bar{x}}{EI}$			
	$\bar{x} = \frac{2}{3} \times \frac{L}{2} = \frac{L}{3}$			
	$y = \frac{\frac{WL^2}{16} \times \frac{L}{3}}{EI} = \frac{WL^3}{48EI}$	2	7	15
VIII (a)	Taking moments abt A 			
	$R_B \times 6 = 48 \times 1 + 40 \times 3$			
	$= 168$			
	$R_B = 28kN$			
	$R_A = (48 + 40) - 28 = 60kN$			
	$EI\frac{d^2y}{dx^2} = R_A x \mid -48(x-1) \mid -40(x-3)$			
	$= 60x \mid -48(x-1) \mid -40(x-3)$			
	$EI\frac{dy}{dx} = \frac{60x^2}{2} + C_1 \mid -48\frac{(x-1)^2}{2} \mid -40\frac{(x-3)^2}{2}$			

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Qs No	Scoring Indicators	Split up score	Sub Total	Total
	$EI\,y = \frac{30x^3}{3} + C_1 x + C_2 \Big\vert -\frac{24(x-1)^3}{3} \Big\vert -\frac{20(x-3)^3}{3}$			
	at $x=0,\ y=0$ $\therefore C_2 = 0$			
	at $x=6m,\ y=0$ $\therefore C_1 = \frac{-980}{6} = -163.33$	2		
	$EIy = 10x^3 - 163.33x - 8(x-1)^3 - \frac{20}{3}(x-3)^3$			
	(i) Deflection under 1st load			
	$EIy_C = 10\times1^3 - 163.33\times1$			
	$= \frac{-153.33\times10^{12}}{2\times10^5\times85\times10^6}$			
	$= -9.019mm$	2		
	ii) Deflection under second load			
	$EIy_D = 10\times3^3 - 163.33\times3 - 8(3-1)^3$			
	$y_D = \frac{-283.99\times10^{12}}{2\times10^5\times85\times10^6} = -16.7mm$	2		
	iii) Maximum Deflection			
	$x = 2.87m$			
	$EI\,y_{max} = 10\times2.87^3 - 163.33\times2.87 - 8(2.87-1)^3$			
	$= \frac{-284.67\times10^{12}}{2\times10^5\times85\times10^6}$	2	8	
	$= -16.745mm$			

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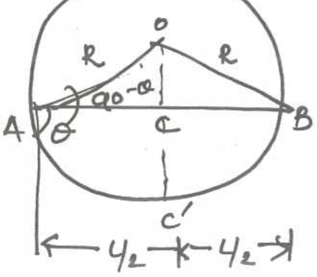
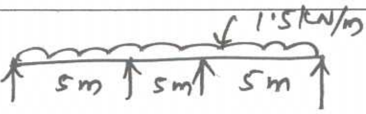
Qs No	Scoring Indicators	Split up score	Sub Total	Total
(b)	$\frac{dy}{dx} = \theta$			
	$\frac{L}{2} \times \frac{L}{2} = 2(R-y) \times y$			
	$\frac{L^2}{4} = 2Ry - y^2$			
	$\frac{L^2}{4} = 2Ry$			
	$y = \frac{L^2}{8R}$ 	2		
	From bending Equation			
	$\frac{M}{I} = \frac{E}{R}$			
	$R = \frac{EI}{M}$			
	$y = \frac{L^2}{8 \times \frac{EI}{M}}$	2		
	$y = \frac{ML^2}{8EI}$			
	Slope θ			
	From Δ AOB,			
	$\sin\theta = \frac{AC}{AO} = \frac{\left(\frac{L}{2}\right)}{R} = \frac{L}{2R}$			
	$\theta = \frac{L}{2R} = \frac{L}{2 \times \frac{EI}{M}} = \frac{ML}{2EI}$	3	7	15

SCHEME OF VALUATION

(Scoring Indicators)

Revision: 2015 **Course Code:** 4014

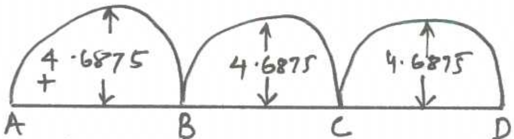
Course Title: Theory of structures II

Qs No	Scoring Indicators	Split up score	Sub Total	Total
IX	$M_A = M_D = 0$ $M_B = M_C$  $M_A L_1 + 2M_B(L_1+L_2) + M_C \cdot L_2 = \frac{6a_1\bar{x}_1}{L_1} + \frac{6a_2\bar{x}_2}{L_2}$	3		
	$0\times5 + 2M_B(5+5) + M_C\times5 = \frac{6}{5}(a_1\bar{x} + a_2\bar{x}_2)$ $20M_B + 5M_C = \frac{6}{5}(a_1x_1 + a_2x_2)$	3		
	a_1 = Area of BM $= 15.625$ $\bar{x}_2 = \frac{L_1}{2} = 2.5m$ $20M_B + 5M_C = \frac{6}{5}(15.625\times2.5 + 15.625\times2.5)$	3		
	$M_B = 3.75\ kN/m = M_C$ Support Reactions $R_A = R_D$ $R_B = R_C$ $M_B = R_A\times5 - 1.5\times5\times\frac{5}{2}$ $R_A = 3kN = R_D$	3		

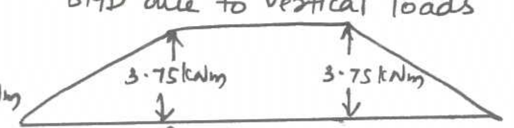
$\frac{W_1 L_1^2}{8}$

$\frac{15\times5^2}{8}$

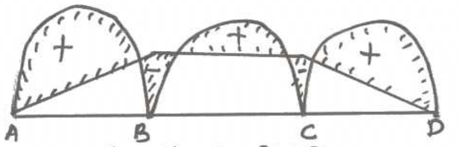
$= 4.6875\ kNm$



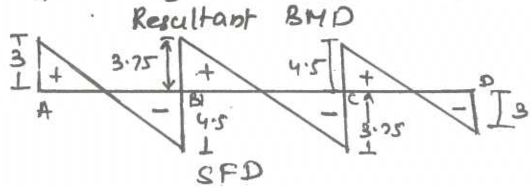
BMD due to vertical loads



BMD due to support reaction



Resultant BMD



SFD

SCHEME OF VALUATION

(Scoring Indicators)

Revision: 2015 **Course Code:** 4014

Course Title: Theory of structures II

Qs No	Scoring Indicators	Split up score	Sub Total	Total
X	$R_A + R_B + R_C + R_D = \text{Total load}$ $R_A + R_B = 11.25$ $R_B = 11.25 - 3 = 8.25 = R_C$	3		15
	$M_{FAB} = -\frac{wl^2}{12} = -\frac{20\times6^2}{12} = -60 kNm$ $M_{FBA} = \frac{wl^2}{12} = 60 kNm$ $M_{FBC} = -\frac{wl}{8} = \frac{120\times6}{8} = -90 kNm$ $M_{FCB} = \frac{wl}{8} = 90 kNm$	2		
	Stiffness factor at joint B $K_{BA} = \frac{4EI}{l} = \frac{4EI}{6} = \frac{2EI}{3}$ $K_{BC} = \frac{4EI}{l} = \frac{4EI}{6} = \frac{2EI}{3}$	2		
	At joint B the distribution factors are $DF_{BA} = \frac{K_{BA}}{\Sigma K_B} = \frac{2EI}{3} \times \frac{3}{4EI} = \frac{1}{2}$ $DF_{BC} = \frac{K_{BC}}{\Sigma K_B} = \frac{2EI}{3} \times \frac{3}{4EI} = \frac{1}{2}$	2		
	Unbalanced moment at joint B $M_B = -90+60 = -30 kNm$			

SCHEME OF VALUATION

(Scoring Indicators)

Revision: 2015 **Course Code:** 4014

Course Title: Theory of structures II

Qs No	Scoring Indicators	Split up score	Sub Total	Total
	Distributed moment to BA			
	$M_{BA} = M_B \times DF_{BA} = 30 \times \frac{1}{2} = 15\,kNm$			
	Distributed moment to BC			
	$M_{BC} = M_B \times DF_{BC} = 30 \times \frac{1}{2} = 15\,kNm$	2		
	Carryover from B to A $= \frac{15}{2} = 7.5\,kNm$			
	Carryover from B to C $= \frac{15}{2} = 7.5\,kNm$			

Joint	A	B		C	Split up score
Distribution factor		$\frac{1}{2}$	$\frac{1}{2}$		
FEM	-60	60	-90	90	
Distribute		15	15		
Carryover	7.5			7.5	2
Final End moments	-52.5	75	-75	97.5	

Final End moments

$M_{AB} = -52.5\,kNm$

$M_{BC} = -75\,kNm$

$M_{BA} = 75\,kNm$

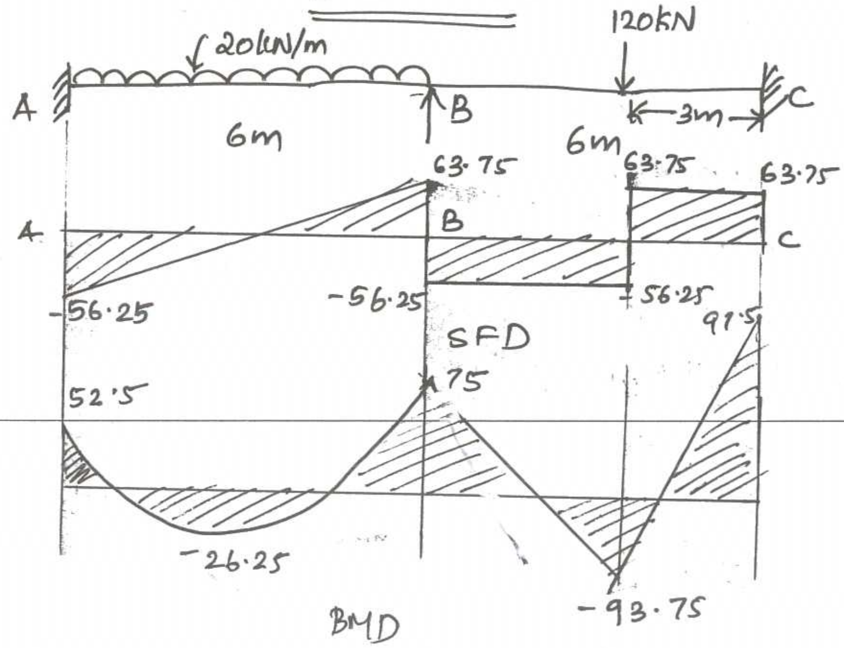
$M_{CB} = 97.5\,kNm$

SCHEME OF VALUATION

(Scoring Indicators)

Revision: 2015 **Course Code:** 4014

Course Title: Theory of structures II

Qs No	Scoring Indicators	Split up score	Sub Total	Total
	BM at C = 97.5 kNm BM at D = 97.5 − 63.75 × 3 = −93.75 kNm BM at B = 97.5 − 63.75 × 6 + 120 × 3 = 75 kNm BM at midspan of AB = 97.5 − 63.75 × 9 + 120 × 6 − 120 × 3 + 20 × 3 × 3/2 = −26.25 kNm BM at A = 97.5 − 63.75 × 12 + 120 × 9 − 120 × 6 + 20 × 6 × 3 = 52.5 kNm	2		
		3		15