TED (15) – 6013

(REVISION — 2015)

Reg. No. ....

Signature ....

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2018

STRUCTURAL DESIGN - II

[*Time* : 3 hours

(Maximum marks : 100)

[*Note* :- Use of IS-800-2007, IS-1905, IS-875 and Steel table are permitted.]

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. List any two physical properties of steel.
2. List any two advantages of welded joints.
3. Define 'compression member'.
4. Define 'laterally supported beam'.
5. Define 'Slenderness ratio' of a masonry wall. $(5 \times 2 = 10)$

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Write any six advantages of steel structures.
2. Calculate the safe load transmitted by a shop welded joint, if the size of weld is 5 mm and its length is 250 mm, the ultimate shear stress of the weld is 410 MPa.
3. Determine the strength due to yielding of gross section of ISA $100 \times 65 \times 10$mm and fy = 250 Mpa.
4. With neat figure write short notes for the use of lacing and battening.
5. Write short notes on classification of sections based on plastic analysis.
6. Calculate the live load on the roof truss if the angle of pitch is 18 degree.
7. Write short notes on :

   (a) Cavity wall (b) Faced wall (c) Veneered wall $(5 \times 6 = 30)$

Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

III (a) Two plates of 16 mm thickness are to be 'lap joined' using M20 bolts of grade 4.6, determine the bolt value if Fe 415 steel plates are used. 9

(b) Write any six advantages of welded connections. 6

OR

IV (a) A tie member of a roof truss consists of 2 ISA $150 \times 75 \times 8$mm. The angles are connected to either sides of a 10 mm gusset plates and the member is subjected to a working load of 350 KN. Design the welded connection. Assume connections are made in the work shop. 9

(b) Define the terms :

(i) Pitch (ii) Gauge distance (iii) Edge distance. 6

UNIT — II

V (a) Determine the design axial load capacity of a column ISHB 300@577 N/m, if the length of column is 3 m and pinned at both ends, fy = 250 MPa, $E = 2 \times 10^5$ N/mm^2. 9

(b) Define the terms :

(i) Gross area (ii) Net area (iii) Net effective Area 6

OR

VI (a) A T-section ISHT 75 @ 153N/m is used as a tie member, the flange is to be connected to a gusset plate by side and end fillet welds, keeping length of connection equal to the width of flange of section, determine the design strength due to yielding and rupture of given tension member, take 'fy = 300MPa' and 'fu = 440 MPa'. 9

(b) In a truss a strut 3m long consists of two angles ISA $100 \times 100 \times 6$mm. Find the factored strength of the member, if the angles are connected on both sides of 12 mm gusset by welding. 6

UNIT — III

VII (a) An ISWB 350@569 N/m carries maximum shear force 90 KN, check the safety of the beam in shear, with fy = 250MPa. 9

(b) List the components parts of a plate girder. 6

OR

Marks

VIII (a) Determine the design bending strength of a laterally supported beam of ISMB 300 @442 N/m, the yield stress of steel is 250 Mpa. 9

(b) Write the design procedure of a laterally supported beam. 6

UNIT — IV

IX (a) Determine the dead load and live load on roof truss for a factory building for a span 20m and pitch of '1/5'. The height of truss at eve's level is 10 m, the spacing of truss is 4.50m, the factory building is 36m long is located at Delhi, Provide A.C. sheeting. 9

(b) Write short notes on :

(i) Stress reduction factor (ii) Area reduction factor 6

OR

X (a) Write short notes on :

(i) Dead load (ii) Live load (iii) Wind load acting on a roof truss 9

(b) A masonry wall 200 mm thick carries an axial load of 50KN and an eccentric load of 30 KN at an eccentricity of 30 mm from the centre of wall. Determine stress in masonry at the plane of loading. 6

version . B

1

(18)

SCHEME OF VALUATION

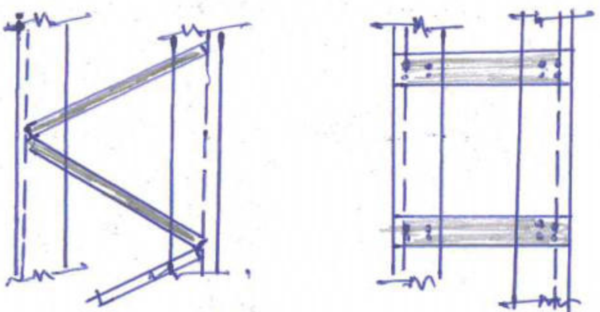
(Scoring Indicators)

Revision: 2015 **Course code: 6013**

Course title: Structural design II

Qn no.	Scoring Indicator	Spilt up score	Sub total	Total
	PART A (max: mark 10)			
I				
1.	(i) Density = 7850 Kg/m³ (ii) Youngs modulus E = 2x10⁵ N/mm² (iii) Poissons ratio μ = 0.30 (iv) modulus of rigidity N = 0.769x10⁵ N/mm². (v) Co-eff. of thermal expansion = 12x10⁻⁶/°C (Any two)	1+1	2	
2.	(i) Joints are more stiff (ii) Better appearence. (iii) Less weight (iv) Less noise pollution. (v) Speed of fabrication is high etc. (Any two)	1+1	2	
3.	Compression members are linear members in which axial forces act to cause compression	2	2	
4.	A beam in which compression flange is laterally supported by flooring.	2	2	
5.	Slenderness ratio: It is ratio of eff. height divided by eff. thickness or effective length divided by eff. thickness whichever is less	2	2	10
	PART-B (max. mark: 30) Each Qn. carries 6 marks.			
II				
1.	Advantages of Steel structure: 1. high strength per unit mass. 2. Assured quality and durability. 3. High speed of construction. 4. strengthened at any later time			

Qn.	**PART B**	Split	Sub T.	Total
	5. Best water and gas resistant structure			
	6. By using bolted connection it can be dismantled and transported quickly.			
	7. material is renewable (Any 6)	6x1	6.	
2.	Given:			
	Size of weld $S = 5$ mm.			
	length of weld $L_w = 250$ mm.			
	$f_u = 410\ N/mm^2$.			
	Solution:			
	Throat thickness $t = 0.70 \times S$			
	$= 0.70 \times 5 = \underline{3.5mm}$			
	design stress $f_{wd} = \frac{f_u}{\sqrt{3}\,\gamma_{mw}}$ $\left[\gamma_{mw} = 1.25 \text{ shop weld}\right]$	2		
	$\therefore f_{wd} = \frac{410}{\sqrt{3} \times 1.25} = 151.85\ N/mm^2$			
	Design strength $= (L_w \cdot t) f_{wd}$			
	$= (250 \times 3.50)\, 151.85 = \underline{132.87 KN}$	2		
	factor of safety $= \frac{\text{Ult. load}}{\text{Safe load}}$			
	$\therefore$ Safe load $= \frac{\text{Ult. load}}{FS} = \frac{132.87}{1.50}$			
	$= \underline{88.58\ KN}$	2	6.	
3.	Given: ISA $100 \times 65 \times 10$ mm.			
	$f_y = 250\ N/mm^2$.			
	Solution: $T_{dg} = \frac{A_g f_y}{\gamma_{m0}}$	2.		
Qn no.	**Scoring Indicator**	**Spilt up**	**Sub total**	**Total**

Qn.	PART B	Split	Sub T.	Total
	A_g (from steel table) $= 1551\ mm^2$	2		
	$\therefore T_{dg} = \frac{A_g f_y}{\gamma_{mo}} = \frac{1551 \times 250}{1.10} =$ $= 352.50\ KN$	2	6	
4.	Lacing  Lacing on face A battlened column	2		
	To achieve max. value of for min. radius of gyration, without incresing the area of the section, a number of elements are placed away from principal axis suitable lateral system.	2		
	(a) Lacing (b) battening. Lacing: Rolled steel flats and angles are used for lacing. One can use single or double lacing system. battens: Instead of lacing battens are also used to keep members of columns at required distance.	2	6	
5.	Classification of sections:			
	1) class -1- (Plastic): These section can develop plastic hinges and have the rotation capacity required for failure of structure by formation of plastic hinge	1½		
Qn no.	Scoring Indicator	Spilt up	Sub total	Total

Qn.	**PART B**	Split	Sub T.	Total
	ii) Class : 2 (Compact) : Such section can develop plastic moment of resistance but have inadequate plastic hinge rotation capacity for formation of plastic mechanism, due to local buckling.	1½		
	iii) Class : 3 (Semi compact) : These are the sections in which the extreme fibre in compression can reach yield stress, but can't develop the plastic moment resistance due to local buckling.	1½		
	iv) Class : 4 (Slender) : The elements of which buckle locally, even before reaching yield stress belong to this category.	1½	6.	
6.	Given : Angle of pitch = 18°.			
	Solution : Given θ = 18°.			
	for 'θ' value less than 10°; Live load taken as 750 N/mm²	2		
	∴ Live load on roof = 750 − (θ − 10°)20 = ~~750 − (18 −~~ = 750 − (18° − 10°)20 = 590 N/m²	2		
	∴ Live load on truss = 2/3 × 590 = 393.33 N/m²	2	6.	
7)	(a) Cavity wall : A wall comprising of two leaves, each leaf being seperated by a cavity and tied together with			
Qn no.	Scoring Indicator	Spilt up	Sub total	Total

Qn.	PART B	Split	Sub T.	Total
	metal tie or bonding units to ensure that the two leaves act as one structural unit, the space between the leaves being either left as continuous cavity or filled with non load bearing insulating and water proofing material.	2.		
	b) Faced wall: A wall in which facing and backing of two different materials are bonded together to ensure common action under load is called faced wall.			
	c) Veneered wall: A wall in which the facing is attached to the backing but not so bonded as to result in common action under load is called veneered wall.	2	6.	
	~~UNIT - III~~			
	PART - C			
	~~UNIT - I~~.			
	(Max. mark : 60, each full Qn: carries 15 marks).			
	UNIT - I			
11) a)	Given: Thickness of plate $t = 16$ mm			
	4.60 grade M20 bolts.			
	$f_u = 410\ N/mm^2$, ~~f_y = 415~~ 410 N/mm^2.			
	~~Condition~~: Lap Joint:			
	Solution: for 4.60 grade bolt			
	$f_{ub} = 400\ N/mm^2$			
	dia. of bolt = 20 mm.			
	$\therefore A_{nb} = 0.78 \times \frac{\pi \times 20^2}{4} = 245.04\ mm^2$	1		
Qn no.	Scoring Indicator	Spilt up	Sub total	Total

Qn.		score split	Sub T	Total
	PART C			
	Strength of bolt in single shear			
	$V_{dsb} = \frac{V_{nsb}}{\gamma_{mb}}$			
	where $V_{nsb} = \frac{f_u}{\sqrt{3}}(n_n A_{nb} + n_s A_{sb})$			
	For single shear $n_n = 1$, $n_s = 0$.			
	$\therefore V_{nsb} = \frac{410}{\sqrt{3}}(1 \times 245.04) = 58.\ KN$			
	$\therefore V_{dsb} = \frac{V_{nsb}}{\gamma_{mb}} = \frac{58}{1.25} = 46.40 KN$	3		
	Bearing capacity of bolt:			
	$V_{dpb} = \frac{V_{npb}}{\gamma_{mb}}$.			
	$V_{npb} = 2.50\, k_b . d . t . f_u$.			
	where kb is least of the following			
	i) $\frac{e}{3d_0} = \frac{30}{3 \times 22} = 0.45$. [Assuming e = 1.5 x d, $d_0 = d + 2mm$]			
	ii) $\frac{P}{3d_0} - 0.25 = \left(\frac{50}{3 \times 22}\right) - 0.25 = 0.50$. [Assuming p = 2.50d]			
	iii) $\frac{f_{ub}}{f_u} = \frac{400}{410} = 0.975$.			
	iv) 1			
	Hence $K_b = 0.45$.			
	$\therefore V_{npb} = 2.50 \times 0.45 \times 20 \times 16 \times 410$	3		
	$= 147.60 KN$			
	$\therefore V_{dpb} = (147.60)/1.25 = 118.08 KN$	2	9.	
	(bolt value least of 46.40, 118.08 KN)			

6/

Qn.		Score split	Sub T	Total
	PART C			
b)	Advantages of welded connection:			
	1) welded structures are lighter.			
	2) welding process is quicker			
	3) Even circular tubes can be easily connected			
	4) possible to achieve 100% efficiency.			
	5) Noise produced is less.			
	6) Good aesthetic appearance			
	7) Air tight and water tight.			
	8) Rigid.			
	9) No problem of mismatching of holes			
	10) Alterations in connection can be easily made			
	(Any 6)	~~6×½~~ 6×1	~~9~~ 6	15
	OR			
IV a)	Given: 2 ISA 150 75, 8 mm thick			
	thickness of gusset plate = 10 mm			
	working load = 350 kN			
	Solution:			
	Factored load = 350×1.50 = 525 kN			
	Thickness of weld: At toe $S = \frac{3}{4} \times 10 = 7.5$ mm			
	At top $S = t - 1.50$			
	$= 10 - 1.50 = 8.50$ mm			
	Hence provide ~~5.5 mm~~ S = 6 mm weld			
	Each angle carries a factored pull $= \frac{525}{2}$			
	= 262.50 kN			
	Assuming normal weld 't' = 0.70×6 = 4.20 mm	3		

Qn.		Score split	Sub T	Total

PART C

Design str. of weld = ~~Lw.t.fu/√3 × 1/γmw~~

$= \frac{Lw.t.fu}{\sqrt{3}\ \gamma_{mw}}$

$= \frac{Lw \times 4.20 \times 410}{\sqrt{3} \times 1.25} = 637.78\,Lw$ ~~236.21 Lw~~.

equating to factored load

~~236.21 Lw = 262.50 KN~~

~~∴ Lw =~~

637.78 Lw = 262.50 KN

∴ Lw = 411.58 mm — 3

centre of gravity of section is at a distance 52.10 mm from top

~~∴ L1 × 52.10 =~~

∴ $L_1 \times 52.10 = L_2 (150 - 52.10)$ [L1 - length of top weld, L2 - length of bottom weld]

$\therefore L_1 = \frac{97.90}{52.10} L_2$

$L_1 + L_2 = 411.58$ mm

∴ $1.879 L_2 + L_2 = 411.58$

∴ $L_2 = 142.95$ mm ≃ 143 mm.

∴ $L_1 = 411.58 - 143 ≃ 269$ mm — 3 — 9.

b) (i) Pitch (p) It is the centre to centre spacing of the bolts in a row, measured along the direction of load. — 2

(ii) Gauge distance (g): It is the distance between two consecutive bolts of adjacent rows and is measured at right angles to the direction of load. — 2

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Qn.		Score Split	Sub T	Total
	PART C			
	iii) Edge distance (e) : It is the distance of centre of bolt hole from the adjacent edge of plate	2	6.	15
	UNIT - II			
V a)	Solution:			
	For rolled steel section ISHB 300 @ 577 N/m			
	$f_y = 250\ N/mm^2$, $f_u = 410\ N/mm^2$, $E = 2\times10^5\ N/mm^2$			
	for both ends pinned column			
	$KL = L = 3m$.			
	For ISHB 300 @ 577 N/m			
	$h = 300\ mm$, $b_f = 250\ mm$, $t_f = 10.60\ mm$			
	$A_e = A = 7484\ mm^2$.			
	$\therefore \frac{h}{b_f} = 1.20$ and $t_f < 40\ mm$.	2		
	Referring table 10			
	It falls buckling class 'a' about ZZ axis and class 'b' for Y-Y-axis.			
	From steel table $r_{min} = r_{yy} = 51.80\ mm$			
	$\therefore f_{cc} = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} = \frac{\pi^2 \times 2\times10^5}{\left(\frac{3000}{51.80}\right)^2} = 588.5\ N/mm^2$			
	non dimensional effective slenderness ratio			
	$\lambda = \sqrt{\frac{f_y}{f_{cc}}} = \sqrt{\frac{250}{588.50}} = 0.65$	3		
	for buckling class . b			
	$\alpha = 0.34$			
	$\therefore \phi = 0.50\,(1+\alpha(\lambda-0)+\lambda^2$			
	$= 0.789$			

Qn.		score split	Sub T	Total
	PART C			
	$\therefore f_{cd} = \dfrac{f_y / \gamma_{mo}}{\phi + (\phi^2 - \lambda^2)^{0.50}}$ $= \dfrac{250/1.10}{0.789 + (0.789^2 - 0.6517^2)^{0.50}}$ $= 184.14\ N/mm^2$	2		
	$\therefore$ Strength of column = $P_d = A_e \cdot f_{cd} = 7484 \times 184.14$ $= 1378138\ N$ $= 1378.13\ kN$	2	9	
	(b) (i) Gross area: The total area of cross section of the member without deducting the area of holes in it is called gross area of the member	2		
	ii) Net area: The area of cross section of the member after deducting the area of holes, in that section is called net area	2		
	iii) Net effective area: The equivalent area of an imaginary axially loaded member of equal load carrying capacity is called net effective area of member.	2	6	15
	OR			
VI 9)	Given: ISAT 75@ 153 N/m.			
	Solution: Properties of the section $A = 1949\ mm^2$			

Qn.		Score Split	Sub T	Total

PART C

$h = 75$ mm.

$b_f = 150$ mm.

$t_f = 9$ mm,

$t_w = 8.40$ mm,

$f_y = 300\ N/mm^2$.

$f_u = 440\ N/mm^2$.

Case 1: Design strength in yielding

$$T_{dg} = \frac{A_g f_y}{\gamma_{mo}}$$

$$= \frac{1949 \times 300}{1.10} = ~~53~~ \underline{531.54\ KN}$$ 2

Case - 2:

Design strength due rupture

$$T_{dn} = \frac{0.90\ A_{nc} f_u}{\gamma_{m1}} + \frac{\beta A_{go} f_y}{\gamma_{mo}}$$

$$\beta = 1.40 - 0.076 \left(\frac{w}{t}\right)\left(\frac{f_y}{f_u}\right)\left(\frac{b_s}{L_c}\right)$$

where $W = 75$ mm.

$t =$ ~~Sthick~~ 8.40 mm.

b_s = Shear lag width

$$= \left(w + \frac{b_f}{2} - \frac{t_f}{2}\right)$$

$$= 75 + \frac{150}{2} + \frac{9}{2}$$

$= 145.50$ mm. 4

L_c = Length of connection = width of flange

$\therefore L_c = 150$ mm

$A_{nc} = 150 \times 9 = 1350\ mm^2$.

$A_{go} = (h - t_f)\ t_w = (75 - 9) \times 8.40$

$= 554.40\ mm^2$

Qn.		Score split	Sub T	Total
	PART C			
	$\therefore \beta = 1.40 - 0.076\left(\frac{75}{84}\right)\left(\frac{300}{440}\right)\left(\frac{145.50}{150}\right)$			
	$= \underline{0.951}$	2		
	$T_{dn} = \frac{0.90 \times 1350 \times 440}{1.25} + \frac{0.951 \times 554.40 \times 300}{1.10}$	1	9	
	$T_{dn} = \underline{571.50\ KN}$			
b)	Given : 2 ISA 100x100x 6mm			
	thickness of gusset plate = 12 mm.			
	length of ~~bar~~ strut = 3 m			
	r_{min} = ~~67.96~~ 30.90			
	Solution:			
	Effective length $KL = 0.70L =$			
	$= 0.70 \times 3000 = 2100$ mm			
	$\therefore \frac{KL}{r} = \frac{2100}{30.90} = \underline{67.96}$ ($r_{xx} = r_{min}$ from steel table)	2		
	From table f_{cd} = [Area of section from table 1167 mm²]			
	for $\frac{KL}{r} = 60$, $f_{cd} = 168\ N/mm^2$.			
	$\frac{KL}{r} = 70$ $f_{cd} = 152\ N/mm^2$			
	$\therefore \frac{KL}{r}$ for 67.96 $f_{cd} = 155.26\ N/mm^2$	2		
	$\therefore P_d = 2 \times 1167 \times 155.26 = \underline{362.38\ KN}$	2	6	15
	UNIT – III			
VII a)	Given: $V = 90$ KN; $f_y = 250\ N/mm^2$ | ISWB 350 @ 569 N/m. Properties: $h = 350$ mm, $t_w = 8$ mm.	2		

Qn.		Score split	Sub T	Total
	PART C			
	$V_u = 1.50 \times 90 = \underline{135\ KN}$			
	V_d = design shear = $\frac{A_v \cdot f_y}{\sqrt{3}\ \gamma_{mo}}$	2		
	$A_v = (h \times t_w) = (350 \times 8)$			
	$\therefore V_d = \frac{(350 \times 8) \times 250}{\sqrt{3} \times 1.10}$ = ~~367.40~~ KN.			
	$= \underline{334.00\ KN}$			
	60% of design shear = $0.60\ V_d$			
	$= 0.60 \times 334 = \underline{200.40\ KN}$	3		
	$0.60\ V_d > V_u$			
	$200.40 > 135\ KN$			
	Hence the beam is safe against shear.	2	9.	
b)	Component parts of plate girder			
	1) web plate 2) flange angle			
	3) bearing stiffners 4) vertical stiffners.			
	5) horizontal stiffners 6) Web splice			
	7) Flange splice (Any ~~5~~ 6)	1x6	6.	15.
	OR			
VIII a)	Given: ISMB 300 @ 442 N/m.			
	$f_y = 250\ N/mm^2$			
	properties of section (from steel table)			
	$h = 300\ mm$ $t_w = 7.50\ mm$			
	$b_f = 140\ mm$ $Z_{xx} = 573.6 \times 10^3\ mm^3$			
	$t_f = 12.40\ mm$	2		

Qn.	PART B	Split	Sub T.	Total
	~~3/db~~ =			
	depth of web $d = h - 2t_f$ $= 300 - 2 \times 12.40$ $= 275.20\ mm$.			
	$M_d = \frac{\beta_b Z_p f_y}{\gamma_{mo}}$	2		
	β_b obtained from section classification (table: 2, IS 800).			
	The given section is plastic			
	$\frac{b}{t_f} = 5.64 < 9.40\varepsilon$ where $\varepsilon = \sqrt{\frac{250}{f_y}}$			
	$\frac{d}{t_w} = 36.69 < 84\varepsilon$			
	for plastic section $\beta_b = 1$.			
	$S = \frac{Z_p}{Z_e} = 1.14$ (For symmetrical I section)			
	$Z_p = 1.14\ Z_{xx}$			
	$Z_p = 1.14 \times 573.60 \times 10^3$ $= 653.90 \times 10^3\ mm^3$.	3		
	$\therefore M_d = \frac{1 \times 653.90 \times 10^3 \times 250}{1.10}$ $= 148.61\ KNm$	2	9.	
b)	**Design procedure of laterally supported beam:**			
	1) Trial section is selected assuming it is going to plastic section.			
Qn no.	Scoring Indicator	Spilt up	Sub total	Total

Qn.	~~PART B~~	Split	Sub T.	Total
	~~(a) keb~~ 2) check for the class it belongs 3) check for bending strength 4) check for shearing strength 5) check for deflection. 6) If any check fails the section is revised	6x1	6	15.
	UNIT - IV			
IX				
a)	**Solution:** Given span L = 20 m. pitch = 1/5. h = ht. of eve's level = 10 m. S = spacing of truss = 4.50 m. max. dimension = 36 m. Sheeting = A.C. Location = Delhi. basic wind speed at Delhi V_b = 47 m/s (from IS 875 - part 3)	2		
	Dead load: 1. Self wt of AC sheet = 200 N/mm² 2. Self wt. of purlin = 100 N/mm² 3. Self wt. of bracing = 20 N/mm² 4. ~~Sf~~ Self wt. of truss = $10\left(\frac{L}{3}+5\right)\frac{S}{4}$ $= 10\left(\frac{20}{3}+5\right)\frac{4.50}{4} = 131.25$ N/m². ∴ Dead load = 451.25 N/m² (Sum of all values).	2		
Qn no.	Scoring Indicator	Spilt up	Sub total	Total

Qn.		Score split	Sub T	Total
	PART C Live load $\tan \Phi = \frac{\text{Rise}}{\text{half span}}$ $\text{Rise} = \frac{1}{5} \times 20$ $\therefore \tan \Phi = \frac{4}{10}$ $\therefore \Phi = 21.80^\circ$ Φ exceeds 10° ∴ ~~live load = 750~~ $\therefore$ live load $= 750 - (\Phi - 10^\circ)20$ $= 513.97\ N/m^2$.	3		
	$\therefore$ live load on truss $= \frac{2}{3} \times 513.97$ $= \underline{342.64\ N/mm^2}$	2	9.	
b)	(i) stress reduction factor (K_s) The value of stress reduction factor depends on the slenderness ratio and eccentricity of loading divided by the thickness of the member. Its value varying from 6 to 27 and eccentricity of loading divided by the thickness of the member varying from 0 to 1/3 are given in table (9) of IS 1905-1987	3		
	(ii) Area reduction factor: This factor takes into consideration smallness of the sectional area of the element and is applicable when c/sectional area of the element is less than $0.20 m^2$. The area reduction factor is given by ~~K_b~~ $K_a = 0.70 + 1.50 A$ where A = area of section in m^2.	3	6.	15.

SCHEME OF VALUATION

(Scoring Indicators)

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Qn no.	Scoring Indicator	Spilt up score	Sub total	Total
	~~PART A~~ PART.C			
	OR			
X 9)	Dead load: 1) It includes weight of sheeting 2) self wt of purlins. 3) self wt. of bracing 4) self wt of truss.	3		
	Live load: Live load obtained on the basis of slope of roof 'θ' $\tan\theta = \frac{Rise}{half\ span}$. $\theta = \tan^{-1}\left(\frac{Rise}{half\ span}\right)$ when 'θ' less than 10° - liveload 750 N/mm2 If 'θ' exceeds 10° - Live load = $750 - (\theta - 10°)20$ and live load on truss = 2/3 of Live load	3.		
	wind load: It consist of the following steps. 1) basic wind speed (V_b) 2) Design wind speed (V_z) 3) Design wind pressure (P_d) 4) wind pressure on roof	3	9.	

SCHEME OF VALUATION

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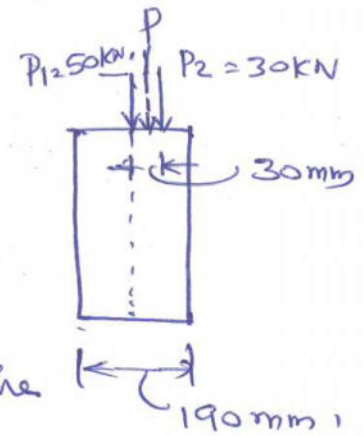
Qn no.	Scoring Indicator	Spilt up score	Sub total	Total
	PART C			
b)	Solution: 			
	Taking moments about the centre line of wall $(P_1 \times 0) + (P_2 \times 30) = P.\bar{e}$ $\therefore \bar{e} = \frac{P_2 \times 30}{P} = \frac{(30 \times 30)}{(30+50)}$ $\therefore \bar{e} = \frac{90}{8}$ mm.	2		
	Stress in masonry = Axial stress ± bending stress $f = \frac{P}{1000 \times t} \pm \frac{P.\bar{e} \times 6}{1000 \times t^2}$ $= \frac{90 \times 10^3}{1000 \times 200} \pm 80 \times 10^3 \times \frac{90}{8} \times \frac{6}{1000 \times 200 \times 200}$ $= 0.450 \pm 0.135$	2		
	$f_1 = 0.45 + 0.135 = 0.585\ N/mm^2$ $f_2 = (0.45 - 0.135) = 0.315\ N/mm^2$ ∴ Both are compressive in nature	2	6.	15.