DRAFT SCHEME

10000CE401122105

Scheme of Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree (S, FE) Examination January 2023 (2015 Scheme)

Course Code: CE401

Course Name: DESIGN OF STEEL STRUCTURES

Max. Marks: 100		Duration: 3 Hours

PART A

		Answer any two full questions, each carries 15 marks.	Marks
1	a)	Single shear: $\frac{1}{1.25} \times \frac{400}{\sqrt{3}} \left(0 + 0.78 \times \frac{\pi}{4} \times 20^2\right) = 45272\ N$ (2.5 marks) Double shear: $\frac{1}{1.25} \times \frac{400}{\sqrt{3}} \left(\frac{\pi}{4} \times 20^2 + 0.78 \times \frac{\pi}{4} \times 20^2\right) = 103314\ N$ (2.5 marks) (Marks can be given even if its considered that two shear passes through threaded portion)	(5)
	b)	Lap joint (two plates 100 mm width and 12 mm thick), Strength of bolt = e=30; p=40, K_b = 0.4907 **(2 Marks)** Nominal shear strength = **(2 Marks)** Design strength in shear = **(2 Marks)** V_{npb} = 2.5 x Kb x d x t/fu = Design strength = Force = No. of bolts = Provide ___ No of bolts **(3 Marks)** (Fig) **(1 Marks)**	(10)
2	a)	Design strength due to yielding of gross section (1.5 Mark) Rupture of critical section. (1.5 Marks) Block Shear (2 Mark)	(5)

	b)	Tie member Working load = Factored load =**(1 Marks)** Check the Size of weld, Provide ___ mm weld **(3 Marks)** Each angle load = Throat thickness, t = **(2 Marks)** Fine effective length of weld, L_w = mm **(4 Marks)** Considering the C.G, provide ___ mm at the top and ___ mm at bottom (Fig)	(10)
3	a)	Shear Failure, Bearing Failure, Bearing Failure of Plate, Tension Failure of Bolts and Tension Failure of plate. Explanation 3 Marks, Figure 2 Mark	(5)
	b)	Find Factored axial load = Find Grossarea, Ag = Provide suitable angle **(2 Marks)** Check Area Use 20 mm dia bolt Finding out single shear value **(2 Marks)** Strength in bearing **(2 Marks)** Rupture strength **(2 Marks)** Taking the least, which is the single shear value Single shear value = No. of bolts required = **(2 Marks)**	(10)
PART B			
Answer any two full questions, each carries 15 marks.			
4		Assuming safe compressive stress f_{cd} = N/mm^2 Area required = mm^2 Area of one channel = mm^2 **(2 Marks)**	(15)

		Try 2 nos suitable ISLC section Area of one ISLC ___ mm^2 Find r_z = mm, r_y = mm Area provided = The spacing has to be made such that $r_y > r_z$ Actual Kl/r= Since it is a laced column 1.05 x Kl/r = **(2 Marks)** Find Stress, f_{cd} = Find Load carrying capacity = Check for safety Spacing of the channel **(2 Marks)** Let 'd' be the clear distance I_{xx} = ___cm^4 I_{yy} = ___cm^4 Equating I_{xx} to I_{yy} we get, d= Provide d= Design of lacing: **(2 Marks)** Lacing is provided at 45 degrees to the horizontal Horizontal length of the lacing = mm Vertical spacing = mm Least r of 1 channel, Check KL/r of channel Find Transverse shear to be resisted by lacing Find Shear resisted by each lacing Length of lacing = **(2 Marks)** Find Minimum thickness of lacing, Provide ____mm flat Find Minimum width of lacing for bolt**(1 Marks)** Sectional area = rmin = KL/r = Choose adequate bolts,	

		Single shear value = Find Number of bolts = **(2 Marks)** Check for strength of lacing KL/r = Find f_{cd} = Load carrying capacity = Find Force in lacing and check for safety **(2 Marks)** (Correct Steps may be given adequate marks suitably)	
5		Weight of RCC slab = Find LL, DL & Total Load/m = Factored load = **(2 Mark)** BM = **(2 Marks)** SF = **(2 Marks)** Zp = (M/fy)γ_{m0} = **(3 Marks)** Choose suitable trial section, Check Zpz and check safety Check for shear **(3 Marks)** t_w= Find V_d and check for safety Check for deflection Check with Permissible deflection **(3 Marks)** **(Correct Steps may be given adequate marks suitably)**	(15)
6	a)	L=m, load = kN/m BM = Factored BM = **(2 Marks)** Zp = **(2 Marks)** Select suitable Trial I section Zp =	(10)

		Balance Zp = **(2 Marks)** Ap = Provide ___ mm thick and ___ mm width plate at top and bottom Area = **(2 Marks)** SF = Web thickness = Shear capacity = **(2 Marks)** Check for safety **(Correct Steps may be given adequate marks suitably)**	
	b)	Explanation 1 mark Design procedures (4 Marks)	(5)
PART C			
Answer any two full questions, each carries 20 marks.			
7	a)	1. King post truss (6m span) 2. Queen post truss (6m to 9m) 3. Howe four panel (6m to 15 m) 4. French truss (12 – 18 m) 5 Pratt Truss (16 – 30 m)	(5)
	b)	k_1=, k_2=, k_3= wind velocity at Thiruvananthapuram 39 m/s V_z = $P_z = 0.6\ V_z^2$=	(5)
	c)	L/45 = **(1 Marks)** L/60 =**(1 Marks)** Try suitable ISA section Find DL, LL, Total Find Factored (DL + LL) Factored (DL + WL) BM = **(2 Marks)** Moment, Md = $Z_e\ f_y / \gamma_{m0}$ =	(10)

		Check for safety **(4 Marks)** **(Correct Steps may be given adequate marks suitably)**	
8	a)	1. Color :uniform 2. Odour : pleasant 3. Texture : Fine and even 4. Grain: Thicker and closer 5. Durable, tough and abrasion resistant (1 mark each)	(5)
	b)	Based on growth 1. Exogenous 2. Endogenous Listing and description 1 mark each Based on Young's modulus 1. Class A: E > 12.5 x 10^3 N/mm^2 2. Class B: E = (9.8 to 12.5) x 10^3 N/mm^2 3. Class C: E = (5.6 to 9.8) x 10^3 N/mm^2 Listing and description 1 mark each	(5)
	c)	Span , Load = BM = **(2 Marks)** Z = M/f = Assume b = d/2 Z = $bd^2/6 = d^3/12$ = **(3 Marks)** d = Shear force at d from the support = **(3 Marks)** Shear resistance = > 500 kN, hence safe **(2 Marks)**	(10)
9	a)	For a short column, S/D should be less than 11 D = Provide a column of suitable size Find Safe load	(5)
	b)	S/ D = <11, short column Safe load =	(5)
	c)	Determining the cooefficients K1,K2,K3(3 marks)	(5)

		Determining wind pressure(3 mark)	
	d)	Guidelines to determine wind forces on different components of buildings as per IS 875 part 3 including the following steps a) Determine basic wind speed(2 marks) b)Obtain design wind speed(1mark) C)Calculation of design wind pressure(1mark) d)Calculate wind pressure on roof(1 mark)	(5)
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