BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : VII**
BRANCH: CEE **SESSION : MO/2025**

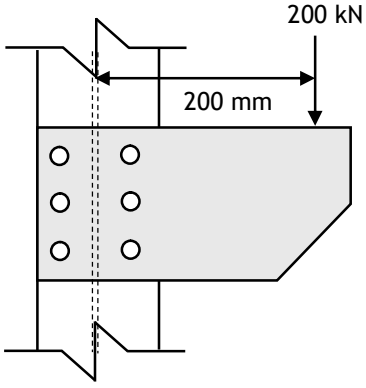
SUBJECT: CE436 ADVANCED STEEL STRUCTURES DESIGN

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
6. IS 800: 2007 code is allowed in the examination hall.

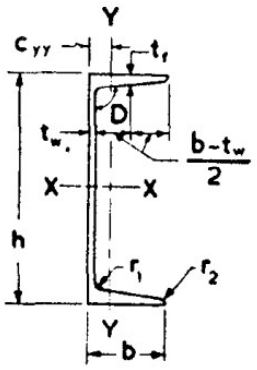
			CO	BL
Q.1(a)	Draw the deflection characteristics of a typical moment-resisting connection and a shear-resisting connection. Draw the schematic diagram of a bracket connection for (i) in-plane bending and (ii) out of plane bending condition and highlight the type of stresses developed in each case.	[5]	1	K1
Q.1(b)	Design a moment resisting bolted connection to withstand the safe load of 200 kN as shown in the figure.	[5]	1	K1 K2 K3



Consider the width of the column flange as 200 mm, thickness of the column flange is 10 mm, the thickness of the bolt is 8 mm and 4.6 grade bolt. fu = 410 MPa and fub = 400 MPa. Choose any other parameter deemed necessary for the calculation.

Q.2	Design a purlin of an industrial factory shed with the section given below and check the section for (i) limit state of strength and (ii) limit state of serviceability. Choose any other parameters deemed necessary for calculation. 1. Width of roof panel = 3 m 2. Inclination of Roof = 30^0 3. Distance between two consecutive truss = 2.5 m 4. Area load of roof coverage = 210 N/m^2 5. Dead Load of Purlin = 100 N/m 6. Wind Pressure = 1.6 kN/m^2 7. Assume continuous beam assumption while calculating the moment.	[10]	2	K1 K2 K3

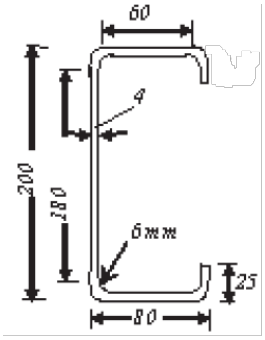
PTO



Section Details: ISMC 200 @ 22.1 kg/m

c/s Area (a) – 28.21 cm^2
depth of section (h) – 200 mm
width of flange (b) – 75 mm
thickness of flange (t_f) – 11.4 mm
thickness of web (t_w) – 6.1 mm
moment of inertia (I_{XX}) – 1819.3 cm^4
moment of inertia (I_{YY}) – 140.4 cm^4
radius of gyration (r_{XX}) – 8.03 cm
radius of gyration (r_{YY}) – 2.23 cm
elastic section modulus (Z_{XX}) – 181.9 cm^3
elastic section modulus (Z_{YY}) – 26.3 cm^3
plastic section modulus (ZP_{XX}) – 209 cm^3
plastic section modulus (ZP_{YY}) - 51.1 cm^3

Q.3(a)	Draw a typical arrangement of gantry girder including the crane system showing its different components (both top and front view). Explain the condition of maximum bending moment in gantry girder with two moving wheel loads.	[3+2]	2	K1 K2
Q.3(b)	Calculate the design bending strength of a 7 m long ISMB 400 laterally unsupported beam about its major axis (X-X). Assume that beam simply supported (K=1), section is plastic (β_b=1), f_y=250 MPa, E=2x10^5 MPa, α_{LT}=0.21 (rolled), c1=1.046, Assume anything else you feel necessary. Section properties are given in Annex H (Table 46) and other relevant values are given in Table 13, 14, 15 of IS 800:2007. Mention each step and reference tables clearly during calculation.	[5]	2	K2 K3
Q.4(a)	What are the differences between hot rolled and cold rolled process for production of structural steel sections? Pint out the advantages of cold formed section over hot rolled section for structural use.	[2+3]	3	K1 K2
Q.4(b)	Calculate the compressive strength of the cold formed channel section with lips (200 x 80 x 25 x 4.0 mm, radius of curve=6mm) under direct compression following BS 5950 part 5 code. Internal radious of the corners =1.5t (t=thickness) Magnitude of applied compressive stress f_c = 240 MPa Design strength p_y = 240 MPa γ_m = 1.15 Use the follwing codal formula where you find it relevant: Local buckling stress = $p_{cr} = 185000k(t/b)^2$ $f_c/p_{cr} > 0.123$ then $b/b_{eff} = [1+14\{(f_c/p_{cr})^{0.5}-0.35\}^4]^{-0.2}$ $f_c/p_{cr} <= 0.123$ then $b/b_{eff} = 1$ $k_1=7-\{1.8h/(0.15+h)\}-1.43h^3$ $k_2=k_1h^2(t_1/t_2)^2$ $h=B_2/B_1$ B1, B2 are the width of web and flange element excluding curve part t1, t2 are their respectve thickness Also minimum k value is 4 for stiffended element and 0.425 for unstiffened element.	[5]	3	K2 K3



Q.5(a)	Classify and discuss microwave tower in term of its support system. Explain shortly the different steps to be taken for design a microwave tower.	[2+3]	3	K1 K2
Q.5(b)	What are the differences between suspension and tension transmission tower? Draw a schematic layout of a typical transmission tower and show its different components. Which is the IS code we need to follow for wind load calculation of transmission tower?	[2+2+1]	3	K1 K2

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