Reg. No.

# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

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ADVANCED DESIGN OF STEEL STRUCTURES [CIE 5013]

II SEM M.Tech Structural Engineering.- END SEM EXAM MAY 2023

Date- 29 -05- 2023 Marks 50

Note: Answer all questions. Assume Fe410 steel with fy=250N/mm$^2$ if not given.
Assume missing data suitably.IS 800 -2007 and SP6 is permitted.

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| **1.A** | A simply supported thin web plate girder **20 m** in span and laterally restrained throughout. It has to support a uniform service load **45 kN/m** throughout the span. Evaluate only the cross section of the plate girder without intermediate stiffeners. | **5** | **CO3** | **5** |
| **1.B** | Evaluate size of uniaxial industrial column of unsupported length **3.6 m** height subjected to following loads and moments: Factored axial load **600 kN**, Factored moment Mz @ top **15 kN-m**, Factored moment Mz @bottom **45 kN-m**. Assume effective length of column as **0.75L**. Check for Combined Axial Force and Bending Moment , overall check is not required. | **5** | **CO2** | **5** |
| **2.A** | Evaluate the load carrying capacity of a solid strut with effective length of 3.8m having solid rectangular section 100 mmx40 mm of grade Fe410 steel. What will be the load carrying capacity, if the bar is divided into 4 pieces of 100mmx10mm each and welded to form hollow square section 110 mm x 110 mm. | **5** | **CO4** | **5** |
| **2.B** | In a truss a tie carrying service tension of 120 kN meets at an angle of $30^0$ with the principal rafter carrying service compressive and tensile forces of 150 kN and 100 kN respectively. Design the principal rafter using tubes of grade $Y_{st}$ 210. The panel length of the principal rafter is 2.5 m. Design of weld is not required . | **5** | **CO4** | **6** |
| **3.A** | Design the shear connectors used in composite bridge to transfer a vertical shear of 1000kN.<br>Given: Spacing of girders 2.0mc/c<br>Thickness of the slab 350mm and M25 Grade concrete<br>Flange thickness( 40x600)mm<br>Web size( 10x1200)mm<br>CG of the composite section is at a distance 220 mm from the top of RCC slab. Assume 16 mm Diameter steel connectors. | **5** | **CO5** | **6** |
| **3.B** | Evaluate the design capacity in bending and shear of a steel ISMC150 purlin section subjected to factored $M_Z$=12 kN-m, $M_y$ =2.5kN-m , Fz=11 kN Fy=1.75kN. | **5** | **CO5** | **5** |
| **4.A** | Evaluate the resistance to Combined Axial Force and Bending Moment (as per 9.3.1-IS 800) of column section of ISHB250 @63kg/m used as industrial column of height 4.5 m, subjected to factored axial load 700kN and maximum factored moment Mz=50kN-m at bottom and Mz=20 kN-m at top. Assume effective length 0.8L. | **5** | **CO1** | **5** |
| **4.B** | Evaluate the height required for the transmission line tower given the following particulars.<br>Single circuit three phase transmits 60MW, 50Hz for 250KV power factor 0.70. Voltage transmitted 132KV power conductors are of ACSR type 20mm nominal dia, weight of the conductor 12N/m. Permissible maximum tension is 30 kN. Youngs modulus 0.80x10$^5$ N/mm$^2$ and co-efficient of thermal expansion=0.00002000/$^o$C. Shape factor for the cable is 0.75. Ground wire 12 mm nominal dia, permissible tension 28 kN. Verticle clearance for conductor 7.0 m above G.L. Vertical spacing between the | **5** | **CO5** | **5** |

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| | conductor 3.0 m minimum. Horizontal spacing between the conductor 6.0 m minimum. Height of the ground wire above top most power conductor is half the horizontal spacing of the conductor. Minimum and maximum temperatures are $15^0$ and $60^0$. Wind pressure at site 2.0 kN/$m^2$. Weight span of the tower is 200 m. | | | |
| **5.A** | Illustrate different span lengths considered in the design of transmission line towers. | **4** | **CO5** | **3** |
| **5.B** | Discuss the factors considered while configuring the transmission line tower. | **3** | **CO5** | **3** |
| **5.C** | Discuss advantages of the pre-engineered buildings. | **3** | **CO1** | **3** |