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MANIPAL INSTITUTE OF TECHNOLOGY
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**MANIPAL INSTITUTE OF TECHNOLOGY**

**DEPARTMENT OF CIVIL ENGINEERING**

**VI SEMESTER B. TECH (CIVIL ENGINEERING)**

**END SEMESTER EXAMINATION, MAY 2024**

**DESIGN OF STEEL STRUCTURES (CIE 4064)**

**Date & Time: 08/05/24, 2.30PM to 5.30PM Max. Marks: 50**

***Note: 1 Answer all questions. Any missing data may be suitably assumed.***
***2 Use of IS 800:2007 and SP-6 is permitted. Use Fe410 grade steel with $f_y$=250 MPa.***

| SL. No | Questions | Marks | CO |
|---|---|---|---|
| **1** | A 24 m span I-plate girder having 540 mm x 32 mm flanges and 14 mm x 1200 mm web carries a factored bending moment of 4250 kN-m and a factored shear force of 700 kN. The load capacity of the web is inadequate at the support which needs end stiffeners to strengthen. Design end stiffeners only, and check the adequacy of end stiffeners against buckling resistance, and bearing resistance. | **10** | **1** |
| **2A.** | A simply supported manually operated gantry girder made up of ISWB 600 (113.7 kg/m) only having a span of 6 m supports the maximum factored bending moment of 600 kNm and the maximum factored bending moment due to lateral forces is 50 kNm. Analyze the lateral torsional buckling resistance of the section and also check the combined moment capacity of the section as per the IS:800. Assume the imperfection parameter is 0.21. | **7** | **2** |
| **2B.** | A manually operated 7 m span gantry girder supports a crane girder with a wheelbase of 3.5 m which transfers a maximum static wheel load of 190 kN to the girder. Determine the vertical deflection of the gantry girder and check with permissible limit. Assume E = 200 GPa and $I_z$ = $1355x10^6$ $mm^4$. | **3** | **2** |
| **3A.** | Illustrate the web crushing, web crippling of cold-formed light gauge sections | **3** | **5** |
| **3B.** | Design the slab base plate for a column of ISHB 250 at 51 kg/m loaded with 500 kN axial load with 45 kNm bending moment. Assume M25 grade concrete for the pedestal. | **5** | **3** |
| **3C.** | Explain the difference between purlin and beam. | **2** | **4** |
| **4A.** | Design the shear connectors to transfer a load of 560 kN for the composite bridge deck with RCC deck slab of thickness 300 mm and steel plate girder of flanges 500 mm x 30 mm and web 10 mm x 1000 mm. The spacing of the main girder is 2 m center to center. Assume M40 grade of concrete and $f_y$ = 250 MPa, and depth of neutral axis for composite slab is at distance 192.5 mm from the top of slab. | **5** | **4** |
| **4B.** | Design an I-section purlin for a workshop building provided with a pitched roof supported over trusses of an effective span of 14.5 m at a spacing of 3.6 m. The pitch of the roof is $30^0$ and purlins over the trusses | **5** | **4** |

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|---|---|---|---|
| | are placed 1.5 m center to center. The weight of roofing material consisting of GI sheets with fixtures is 0.175 kN/m$^2$. The intensity of wind pressure in the region may be taken as 1.4 kN/m$^2$. The grade of structural steel for the purlin section is Fe 410. Deflection checks are not required. | | |
| **5A.** | Illustrate stiffened and unstiffened elements. What conditions a flat compression element is considered as a stiffened element? | **4** | **5** |
| **5B.** | Illustrate how pre-engineered buildings differ from steel structures. List their advantages and disadvantages. | **4** | **5** |
| **5C.** | Explain the torsional buckling effect of the thin-walled section used in cold-form structures. | **2** | **5** |