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09ENG3.5

**Third Semester B.Arch. Degree Examination, Dec.2016/Jan.2017**  
**Structures – III**

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer any FIVE full questions.**  
**2. Any missing data may be suitably assumed.**

- 1 a. State the assumptions made in theory of pure torsion. (06 Marks)  
b. Find the maximum shear stress induced in a solid circular shaft of dia 150mm, when the shaft transmits 150kN power at 180rpm. (14 Marks)
- 2 a. With usual notations show that  $\frac{J}{R} = \frac{C\theta}{L}$ . (06 Marks)  
b. A solid steel shaft has to transmit 100kW at 160 rpm. Taking available shear stress as 70 N/mm<sup>2</sup>, find the suitable diameter of the shaft. The maximum torque transmitted in each resolution exceeds the mean by 20%. (14 Marks)
- 3 a. Define polar modulus torsional rigidity and torsional strength. (06 Marks)  
b. Find the maximum torque that can be safely applied for a shaft of diameter 80mm of length 5m bears angle of twist 1.5°. The shaft produces a shear stress of 42 N/mm<sup>2</sup>. Take C = 84 GPa. (14 Marks)
- 4 a. What are the assumptions made in the Euler's theory, for an axially loaded column? (06 Marks)  
b. A solid sand bar of 3m long and 50mm in diameter is used as a strut with four end conditions. Determine the crippling load for each condition E = 2 × 10<sup>5</sup> N/mm<sup>2</sup>. (14 Marks)  
i) Both ends hinged.  
ii) One and fixed other free.  
iii) Both ends fixed.  
iv) One end fixed other hinged.
- 5 a. Derive Euler's formula for crippling load of long column with both ends hinged. (06 Marks)  
b. A column of timber section 150mm × 200mm is 6m long with both ends fixed if E = 17.5 kN/mm<sup>2</sup>. Determine: i) Crippling load; ii) Safe load when FS = 3. (14 Marks)
- 6 a. A steel cantilever of span 2.5m carries a point load of WkN at its free end. The moment of inertia of the section is 9900 × 10<sup>-8</sup>m<sup>4</sup>. If the deflection at the free end is not to exceed 0.75cm. What must be the value of W? E = 210 GN/m<sup>2</sup>. (10 Marks)  
b. A steel cantilever projecting 3m from wall is loaded with a udl 20 kN/m run. Find the slope and deflection of the beam if the MI of the beam section is 7550 × 10<sup>-8</sup>m<sup>4</sup>. (10 Marks)
- 7 A timber beam of rectangular section 10cm × 25cm is simply supported over a span of 4m. What udl is kN/m should the beam carry to produce a central deflection of 0.6cm? Calculate slope also. (20 Marks)
- 8 Determine the maximum slope and deflection for,  
i) Cantilever beam with a concentrated load at the free end.  
ii) Simply supported beam with udl through out.  
Use moment area method. (20 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.