Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. END SEMESTER EXAMINATIONS

NOVEMBER 2018

SUBJECT: MECHANICS OF STRUCTURES [CIE 2102]

Date of Exam: **22 /11/2018** Time of Exam: **9:00 AM to 12 NOON** Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed

1A.	Determine the forces in **AB, AF, BC, BF and CF** of the truss shown in **Fig.Q1A**. Tabulate the magnitude of the forces indicating the nature of forces	**5**	**CO1**
1B.	The cross section of a cantilever beam subjected to a point load of **20kN** at its free end and span **3m** has an unsymmetrical **I**-Section of overall depth **240mm**. Width of top and bottom flanges are **160mm** and **100mm** respectively, thickness of top and bottom flanges are **20mm** and **10mm** respectively and web thickness is **10mm**.Calculate the maximum shear stress and maximum bending stress in tension**.** $\mathbf{I_{NA} = 51.69x10^6\ mm^4}$	**5**	**CO1**
2A.	Derive the relationship between Twisting Moment, Shear Stress and angle of Twist for a circular shaft subjected to pure torsion with usual notations. Also state the assumptions made in the derivation of relationship.	**5**	**CO2**
2B.	A slender built up column, **8m** long and both end fixed is having **symmetrical H - cross** section of dimensions as shown in **Fig.Q2B**. Calculate the safe load the column can carry for a factor of safety of **3.** Also calculate the slenderness ratio. Use Euler's formula. **E = 190 GPa**.	**5**	**CO2**
3A.	A solid circular shaft **30 mm** in diameter is subjected to a torque of **8 kNm**. Find the principal stress in the shaft.	**2**	**CO2**
3B.	At a point in the section of a beam there is shear stress of **50MPa** and tensile stress of **80MPa**. Find the normal and shearing stresses on a plane inclined at $\mathbf{45^0}$ (anticlockwise) to the plane on which tensile stress is acting	**3**	**CO2**
3C.	A train of wheel loads **50kN ,60kN ,38kN and 50kN** spaced at **1.0m, 2.0m and 1.2m** respectively with **50 kN** leading moves from left to right on a simply supported bridge of span **30m**. Determine the absolute maximum bending moment	**5**	**CO3**
4A.	Determine the slope and deflection at mid span for a simply supported beam of span **6m** carrying a downward point load of **30kN** at **2m** from left support. **E = 200GPa** and $\mathbf{I=40\times10^6\ mm^4}$. Use moment area method. Flexural rigidity **EI** is uniform	**5**	**CO4**
4B.	Determine horizontal and vertical displacement of the free end **C** of vertical bent shown in **Fig.Q4B** using unit load method. Flexural rigidity **EI** is uniform	**5**	**CO4**
5A.	Using Macaulay's method, determine the vertical displacement at mid-point of a simply supported beam of length **5m**. Also find the slope at the right hand support. The beam is	**5**	**CO5**

	subjected to downward concentrated load **12kN** at **2m** from left hand support and a clockwise couple **8kN-m** at **3m** from left hand support. **E = 210GPa**, **I=50×10^6 mm4**. Flexural rigidity **EI** is uniform.		
5B.	A three hinged parabolic arch of span **25m** and central rise **5m** is subjected to UDL of **30kN/m** on left half span and a point load of **200kN** at **5m** from right end. Find bending moment, normal thrust and radial shear at a section **5m** from left support	**5**	**CO5**

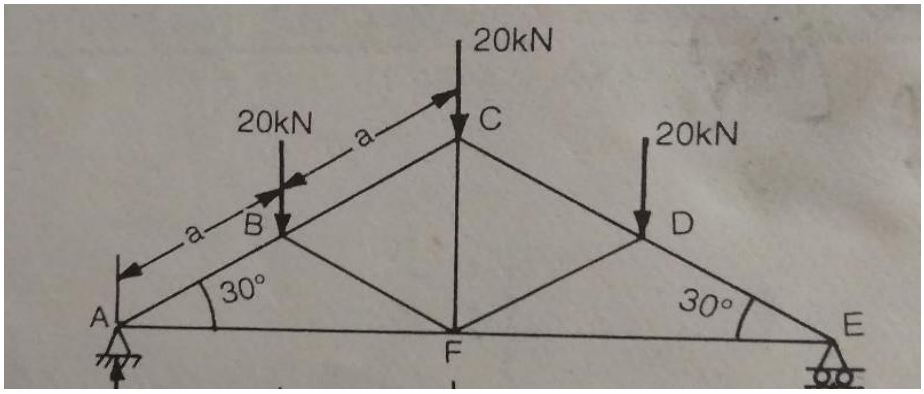

Fig.Q1A

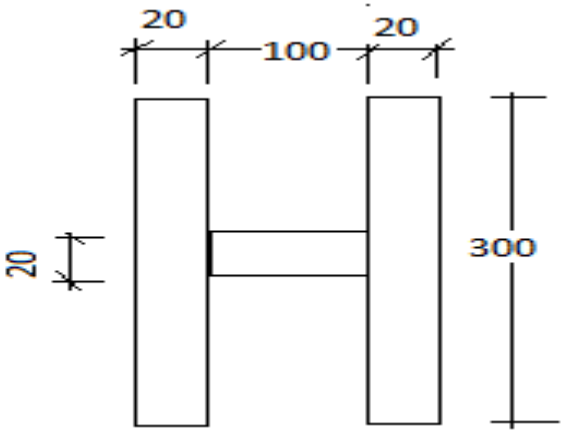

Fig.Q2B **All dimensions in mm**

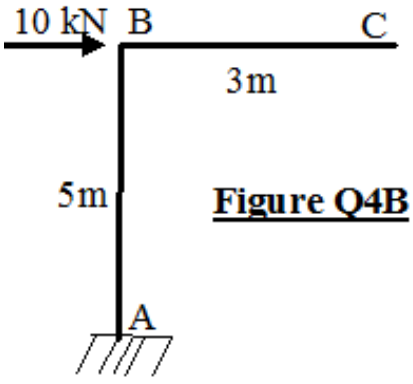

Figure Q4B