MANIPAL INSTITUTE OF TECHNOLOGY
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A Constituent Institution of Manipal University

III SEMESTER B.TECH. END SEMESTER EXAMINATIONS
NOVEMBER 2017
SUBJECT: MECHANICS OF STRUCTURES [CIE 2102]

Date of Exam: **18/11/2017**   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 all the members of the truss shown in **Fig.Q1A**. Tabulate the magnitude of the forces indicating the nature of forces	**5**	**CO1**
1B.	A cantilever beam of symmetrical **I**-Section has a span of **"L"**. The beam carries a point load of **"W"** at the free end. The flanges have a width of **125mm** with thickness of both flanges and web at **20mm**.The overall depth of the section is **300mm**.If the maximum bending stress and maximum shear stress are restricted to **100MPa** and **50MPa** respectively, calculate the values of **"L" and "W".**	**5**	**CO1**
2A.	A solid steel shaft is to transmit a power of **325kW** at **120 rpm**. If the shear stress is not to exceed **40MPa**, find the diameter required. Now the shaft is replaced by a hollow shaft of the same material and length with diameter ratio **3:5**.Calculate the percentage saving in weight, if the shear stress remains unchanged	**5**	**CO2**

2B.	Define principal stress and principal plane
	
	Find the principal stresses and maximum shear stress with corresponding planes in the material for the following cases
	
	   (i) A solid shaft **100 mm** diameter subjected to a torque of **6kNm**
	
	   (ii) A solid rectangular steel bar of cross section **100mmx 50mm** and length **300mm** subjected to compressive load of **50kN** along its longitudinal axis (01+02+02)
		5	**CO2**

3A.	A hollow circular cast iron column **5m** long, fixed at both the ends is required to carry an axial load of **600kN**. Determine the section of the column using a factor of safety of **4**. The thickness of the wall is to be **1/10** the external diameter. Rankine's constant **α=1/1600**, crushing strength of cast iron σ_c =**570 MPa**	**5**	**CO2**
3B.	The wheel loads shown in **FigQ3B**. roll over a simply supported beam of span **20m**. Find the maximum bending moment and shear force at a section **7m** from the left support. Assume that load can move in either direction. Also calculate the absolute maximum bending moment	**5**	**CO3**
4A.	Determine the vertical displacement at the free end of a cantilever beam of span **3m** subjected to downward UDL **20kN/m** on entire span and clockwise moment **20kN-m** at the free end. **E = 25000MPa** and **I=2×10^9 mm^4.** EI is constant. Make use of Castigliano's theorem considering strain energy stored due to bending only	**5**	**CO4**
4B.	Using Macaulay's method, determine the vertical displacement at mid-point of simply supported beam of span **8m** carrying downward UDL of **25kN/m** on left quarter span along with an anticlockwise moment **15kN-m** at mid span. Assume uniform EI	**5**	**CO4**
5A.	Determine the slope and deflection at mid span for a simply supported beam of span **8m** carrying a downward point load of **50kN** at **3m** from right support. **E = 200GPa** and I=**50×10^6** mm^4. Use moment area method. EI is uniform.	**5**	**CO5**

5B.	A cable having a horizontal span of **100 m** has a central dip of **16 m**. It carries an UDL of **20kN/m** over its entire horizontal span. Determine the maximum tension in the cable. If the permissible stress in the cable is **50N/mm²,** calculate the sectional area required for each cable. Determine the horizontal and vertical forces exerted on each of the piers, if the cable passes over frictionless pulleys on the end piers. The backstay makes an angle of **35º** with the horizontal.	5	CO5

Fig.Q1A

FigQ3B