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Manipal Institute of Technology, Manipal

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III SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: MECHANICS OF STRUCTURES [CIE 2102]

28-11-2015

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A.	Define the following: **(a)** Castigliano's theorems **(b)** Influence line diagram **(c)** Maxwell's theorem of reciprocal deflection **(d)** Conjugate beam	**(02+01+01+01=05)**
1B.	For the truss loaded as shown in **FIG. Q1B**, find the force in the members **AB, BC, GC, GF, CF** and nature of the member forces. Tabulate the results stating the magnitudes.	**(05)**
2A.	A hollow steel column section has an external radius of **150mm** and thickness of **15mm**. the length of the column is 5m with both the ends fixed. Calculate slenderness ratio, Rankine's constant **α**, Euler's buckling load and Rankine's critical load. Crushing stress=**326MPa**, Young's modulus=**210GPa**	**(05)**
2B.	A cantilever beam of symmetrical **I** section **125mm x 300mm** deep with uniform thickness of flange and web **20mm** carries a point load of **"W"** at the free end. If maximum bending stress and maximum shear stress are restricted to **150MPa** and **45MPa** respectively, calculate the values of span "**L**" and point load "**W**".	**(05)**
3A.	A solid shaft is to transmit **337.5KW** at **120 rpm**. If the maximum shear stress is limited to **80MPa**, calculate the diameter of the shaft. If the solid shaft is then replaced by a hollow shaft of same material and length, what is the percentage saving in material weight? The ratio of internal to external diameter of the hollow shaft is **3/5**	**(05)**
3B.	At a certain point on planes at right angles to each other direct stresses of **40MPa(C**) and **80MPa(T)** are acting on vertical plane and horizontal plane respectively. There is also a shearing stress of **48MPa** on each of these planes. Determine the planes and magnitude of maximum shear stress at this	**(05)**

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	point. Also calculate the resultant stress on the planes of maximum shear stress.	
4A.	A three hinged parabolic arch is supported at different levels as shown in **FIG.Q4A**. Calculate the difference in levels between the two springing. Also determine the support reactions, normal thrust and radial shear just to the left of the point load with respect to the left hinge **A**. What is the value of maximum bending moment between **B & C?**	**(05)**
4B.	Determine the slopes at **A & B** and deflection at **C** and the maximum deflection for the beam shown in **FIG.Q 4B** using conjugate beam method. **EI=100000kNm^2**	**(05)**
5A.	Four point loads **120 kN, 160 kN, 160 kN and 80 kN** spaced equally apart at a distance of **2 meters** between consecutive loads roll over a simple girder of **25m** span from left to right with **120kN** load leading. Calculate the maximum bending moment at **8m** from left hand end. **Make use of Influence lines**	**(04)**
5B.	Determine the horizontal displacement of roller at point **D** of the frame shown in **FIG.Q5B** using castigliano's theorem. Consider the strain energy due to bending only. **E=200x10^6 kN/m^2, I=500x10^{6}mm^4**	**(06)**

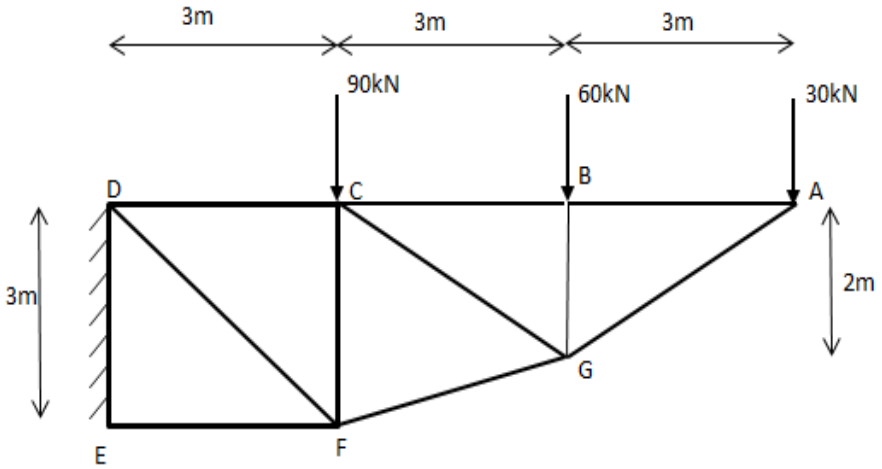

FIG.Q1B

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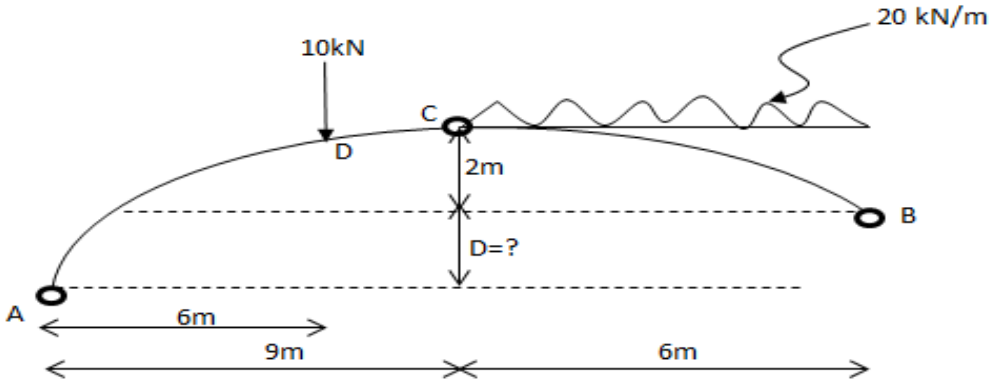

FIG.Q 4A

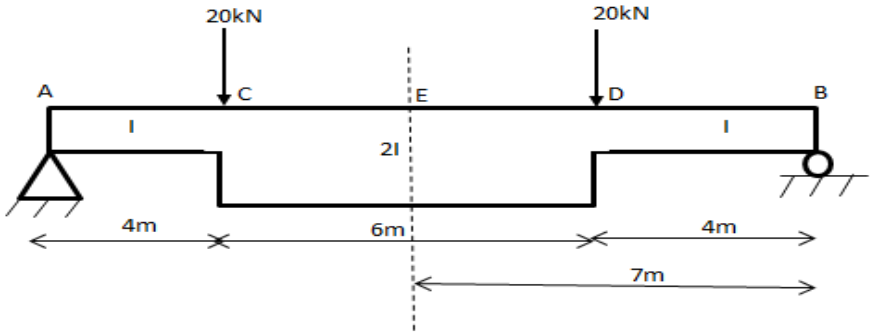

FIG.Q4B

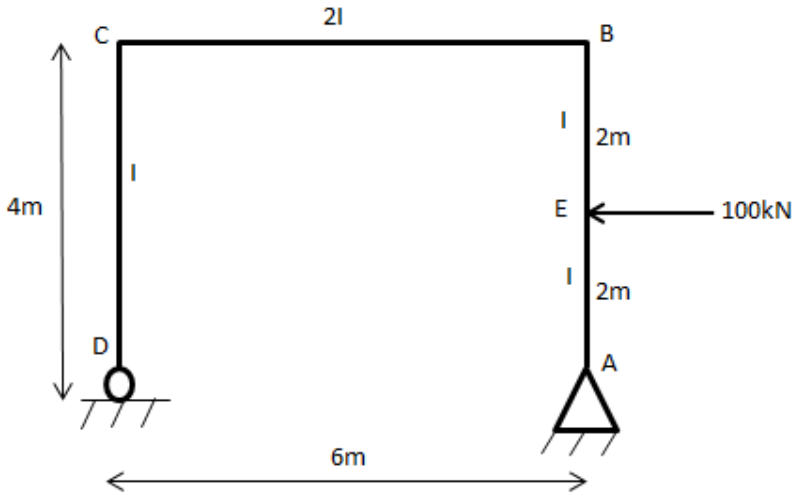

FIG.Q5B