Total Number of Pages: 3   **B.TECH**
                                                                PCI4I001

4th Semester Regular Examination 2016-17
STRUCTURAL ANALYSIS - I
BRANCH: CIVIL
Time: 3 Hours
Max Marks: 100
Q.CODE: Z451
Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1   **Answer the following questions:** *multiple type or dash fill up type*   **(2 x 10)**

a) If there are *m* unknown member forces, *r* unknown reaction components and *j* number of joints, then the degree of *static indeterminacy* of a pin-jointed plane frame is given by ----------------
a) $m + r + 2j$ b) $m – r + 2j$ c) $m + r – 2j$ d) $m + r – 3j$

b) Castigliano's first theorem is applicable ----------------
a) for statically determinate structures only
b) when the system behaves elastically
c) only when principle of superposition is valid d) none of the above

c) Bending moment at any section in a *conjugate beam* gives in the actual beam ----------------
a) slope b) curvature c) deflection d) bending moment

d) The three moments equation is applicable only when   ------------------
a) the beam is prismatic   b) there is no settlement of supports
c) there is no discontinuity such as hinges within the span
d) the spans are equal

e) The maximum bending moment due to a train of wheel loads on a simply supported girder ------------------
a) always occurs at centre of span
b) always occurs under a wheel load
c) never occurs under a wheel load d) none of the above

f) The principle of virtual work can be applied to elastic system by considering the virtual work of ----------------------
a) internal forces only   b) external forces only
c) internal as well as external forces d) none of the above

g) The number of independent displacement components at each joint of a *rigid-jointed space frame* is --------------
a) 1 b) 2 c) 3 d) 6

h) The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in ----------------------
a) vertical direction b) horizontal direction
c) inclined direction
d) the direction in which the deflection is required

i) The fixed support in a real beam becomes------------- in the conjugate beam

a) roller support b) hinged support c) fixed support d) free end

j) For a single point load W moving on a symmetrical three hinged parabolic arch of span L, the maximum sagging moment occurs at a distance x from ends. The value of x is---------------

a) 0.211 L b) 0.25 L c) 0.234 L d) 0.5 L

Q2   **Answer the following questions:** *Short answer type*   **(2 x 10)**

a) State the difference between *strain energy method* and *unit load method* in the determination of deflection of structures.

b) Distinguish between *pin jointed* and *rigidly jointed* structure.

c) Draw the *influence line diagram* for *shear force* at a point X in a simply supported beam AB of span 'l' m.

d) What is the *degree of static indeterminacy* of a three hinged parabolic arch?

e) What is the difference between the basic action of an *arch* and a suspension cable?

f) Why is it necessary to compute deflections in structures?

g) Under what conditions will the bending moment in an arch be zero throughout.

h) Define *static indeterminacy* of a structure.

i) State *Maxwell-Betti's* theorem.

j) What are the assumptions made in the *unit load method*?

Part – B (Answer any four questions)

Q3 **a)** A three hinged parabolic arch is subjected to a udl of 10KN/m for the left half portion. Using ILD, find the BM, radial shear and normal thrust at a section 4m from the left support.   **(10)**

    b) Explain with the aid of a sketch, the normal thrust and radial shear in an arch rib.   **(5)**

Q4   A suspension cable with 50m span and 4m dip is stiffened by a three-hinged girder. The dead load of the girder and the deck is 7.5kN/m. Find S.F and B.M. in the girder at a section 10m from left hinge when a concentrated load of 100kN is placed at 8m from the left end. Find the maximum tension in the cable.   **(15)**

Q5 **a)** A simply supported beam AB of span 7.2 m is loaded with a point load of 150kN at a distance of 1.8m from A. Find slope at A and B and central deflection of the beam applying *moment-area method*. Take $E=200 \times 10^6$ kN/m^2, $I=160 \times 10^{-6}$ m^4.   **(10)**

    b) Write the theorems of *Moment-area method*.   **(5)**

Q6   A continuous beam ABCD is fixed at A and D.AB=5m, BC= 4m and CD=6m. A point load of 12kN act at 2m from end D on CD. On BC a udl of 5kN/m is acting throughout the span. At the centre of AB a point load of 5kN is acting. Calculate the support moments at A,B,C and D using three moment theorem. All members have uniform flexural rigidity.   **(15)**

Q7 a) Find the deflection at the midspan of the beam using conjugate-beam method. **(10)**

600 N/m   600 N/m

2 m — 1 m — 2 m
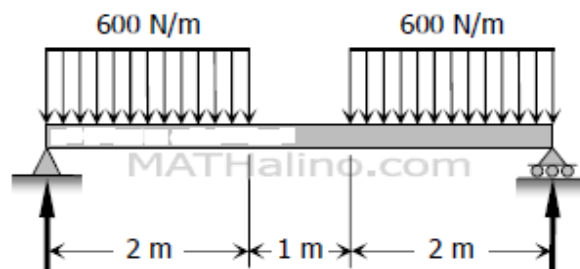
b) Write down the properties of conjugate beam. **(5)**

Q8 a) Find the prop reaction when a propped cantilever of span L, is loaded with a udl w per meter by consistent deformation method. **(10)**

b) Write the theorems of Castigliano. **(5)**

Q9 a) Use unit load method to find the deflection at the centre of the beam. E=200 GPa and I= 400×10^6 mm^4. **(10)**

5 kN   10 kN/m

A   D
B   C

2m   2m   4m
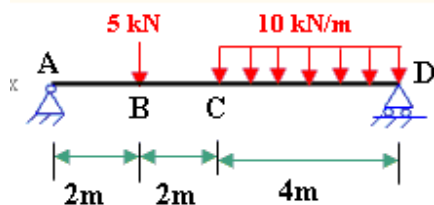
b) Define: Unit load method. What are the assumptions made in the unit load method? **(5)**