Registration No.: | | | | | | | | | | |

Total Number of Pages: 03 **Course: IDD (B.Tech and M.Tech)**
Sub_Code: CIPC2004

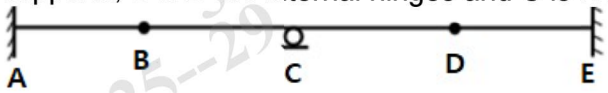
4th Semester Regular Examination: 2024-25
SUBJECT: Structural Analysis
BRANCH(S): C&EE, CIVIL, CE
Time: 3 Hours
Max Marks: 100
Q.Code: S372

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

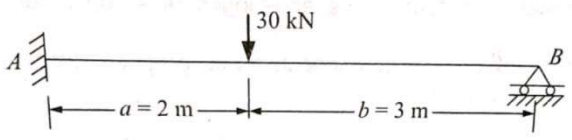
a) A beam is fixed at one end and hinged at other end. Find the kinematic indeterminacy of the beam.
b) What will be the support condition of conjugate beam if the support is fixed in real beam?
c) Write about Castigliano's theorem.
d) State maximum normal stress theory.
e) Estimate the deflection at the free end of a cantilever of length L with uniformly distributed load "w" on entire span. Flexural rigidity EI is constant on entire span.
f) State the concept of potential energy.
g) Show the normal thrust, radial shear force of a three hinged arch with neat sketch.
h) What will be the maximum bending moment for a simply supported beam of length 10 m with uniformly distributed load of 2 kN/m passing over the entire length?
i) State the principle of virtual work.
j) Find the degree of static indeterminacy of the structure as shown below. A & E are fixed supports, B & D are internal hinges and C is roller support.



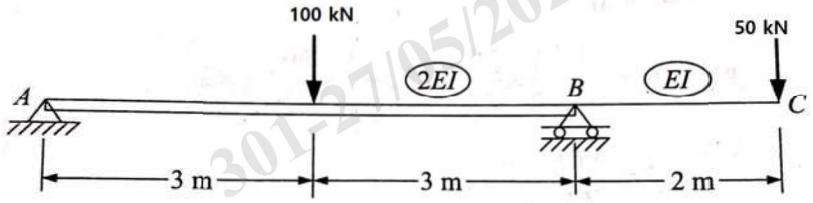
Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) A beam of length 12 m fixed at both ends is subjected to uniformly distributed load 20 kN/m on entire span. Find the fixed end moments by moment area method. EI is constant throughout the length.
b) Determine the reaction components in support A and support B.



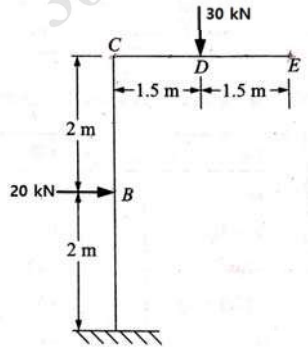
c) Determine the rotation at A and deflection at C in the overhanging beam as shown below by conjugate beam method.



d) A simply supported beam of span "L" carries a concentrated load "P" at a distance "a" from the left hand support. Using Castigliano's theorem, determine the deflection under the load point.

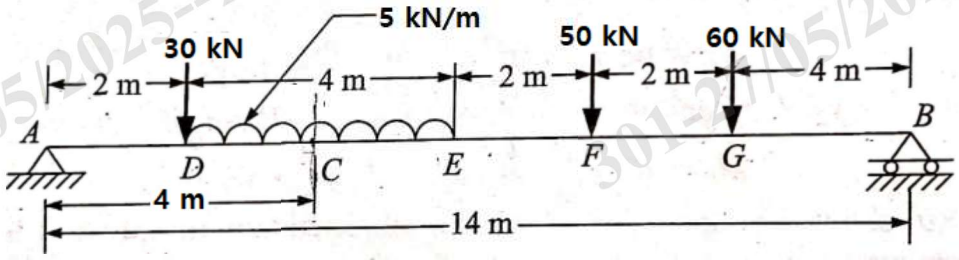
e) Using strain energy method, determine the deflection at the free end of a cantilever of length 5 m subjected to uniformly distributed load 5 kN/m on entire span. EI is same on entire span.

f) Using unit load method, find the vertical deflection at E. Assume uniform flexural rigidity throughout.



g) A three hinged parabolic arch of span 36 m and rise 6 m carries uniformly distributed load of 40 kN/m over the left half span and a concentrated load 100 kN at 30 m from left support. The bottom two hinges are in same level and third hinge is provided in the middle of arch. Analyze the arch and draw the bending moment diagram. Also find the normal thrust and bending moment at a section 10 m from the left support.

h) Using influence line diagram, determine the shear force and bending moment at section "C" in the simply supported beam as shown below.



i) State and prove Maxwell's reciprocal theorem.

j) Draw the influence line diagram for reaction and bending moment at the fixed end of a cantilever of span "L".

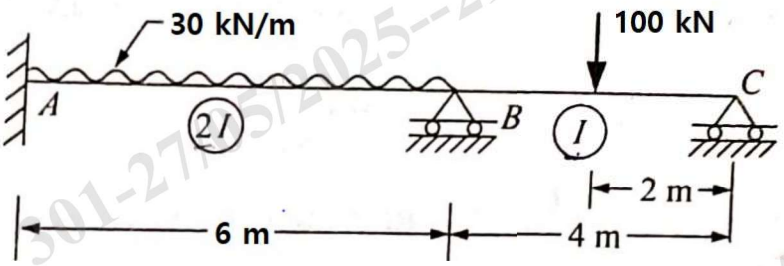
k) A simply supported beam has a span of 20 m. Uniformly distributed load of 30 kN/m and 5 m long crosses the beam from left to right. Draw the influence line diagram for shear force and bending moment diagram at a distance 8 m from left end.

l) List out the differences between statically determinate and redundant (indeterminate) structures.

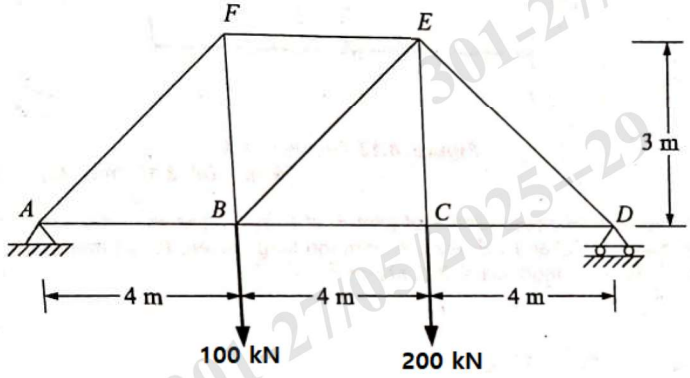
Part-III

Only Long Answer Type Questions (Answer Any Two out of Four) **(16 x 2)**

Q3 Analyze the continuous beam as shown below and draw the bending moment diagram by three moment equation. **(16)**



Q4 Determine the vertical deflection of joint F in the truss shown below. Cross sectional area of all the members are 2500 mm^2.Take Young's modulus = 200 kN/mm^2. **(16)**



Q5 The major principal stress on an element of a steel member is 200 N/mm^2 and tensile in nature. The minor principal stress is compressive. If the tensile yield point of steel is 300 N/mm^2, find the minor principal stress at which the failure will occur according to following theories of failure taking μ = 0.25 **(16)**

I. Maximum strain theory
II. Maximum strain energy theory
III. Maximum shearing stress theory
IV. Maximum distortion energy theory

Q6 A suspension cable with 50 m span and 4 m dip is stiffened by a three hinged girder. The dead load of the girder and the deck is 7.5 kN/m. Find S.F. and B.M. in the girder at a section 10 m from left hinge when a concentrated load of 100 kN is placed at 8 m from the left end. Find the maximum tension in the cable. **(16)**