

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- V (New) EXAMINATION – WINTER 2019

Subject Code: 2154001

Date: 04/12/2019

Subject Name: Advanced Structural Analysis

Time: 10:30 AM TO 01:00 PM

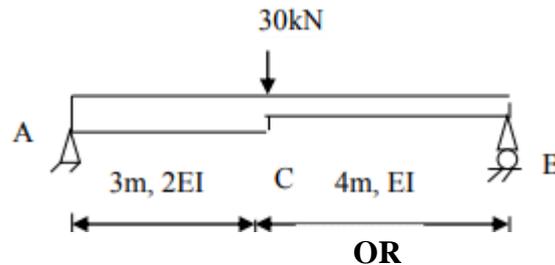
Total Marks: 70

Instructions:

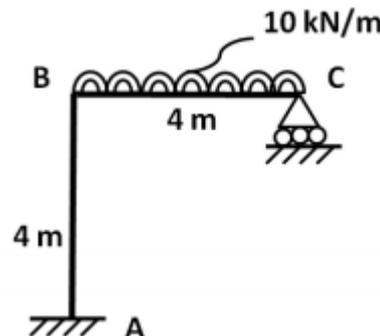
1. Q. 1 is compulsory.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.
5. IS 1893:2002 is allowed in the examination.

MARKS

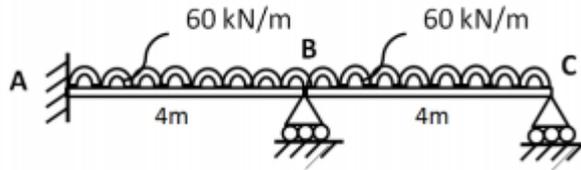
- Q.1**
- (a) State and explain the Muller-Breslau’s Principle. **03**
 - (b) A UDL of intensity 16 kN/m, 5 m long moving on a beam of 10 m span. Find maximum bending moment at a section 4m from left support. **04**
 - (c) Three point loads 90 kN, 75 kN and 55 kN equally spaced 3m respectively, cross a girder of 30 m span from left to right, the 55 kN load leading. Calculate absolute maximum bending moment in the beam and its location **07**
- Q.2**
- (a) Discuss the criteria to determine the absolute maximum bending moment and its location for a simply supported beam under rolling concentrated loads. **03**
 - (b) Calculate deflection at free end B for a cantilever beam AB having length 5m and loaded by a UDL of 15 kN/m over whole span using energy principle. **04**
 - (c) A simply supported beam AB shown below, have varying moment of inertia. It is subjected to an eccentric load. Calculate deflection under the load using energy principle. **07**



- (c) Using Castigliano’s 1st theorem, calculate the deflection at point C for the beam shown in Figure – 1. **07**

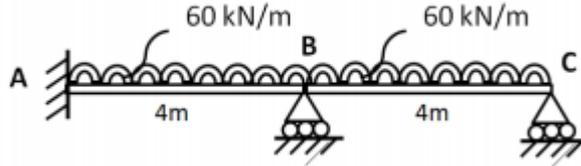


- Q.3**
- (a) Define: Carry over factor, Distribution, Factor, Stiffness factor. **03**
 - (b) What do you mean by force method and displacement method? **04**
 - (c) Find the matrices: [DQ], [DQL], [F] and [Q] with usual notations for the beam shown below. Use Flexibility method assuming vertical support reaction at B (RB) and vertical support reaction C (RC) as redundant. **07**

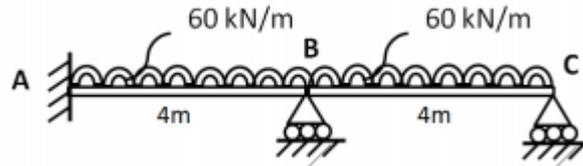


OR

- Q.3 (a) Explain strain energy with illustration. **03**
 (b) Find distribution factors for the beam shown **04**



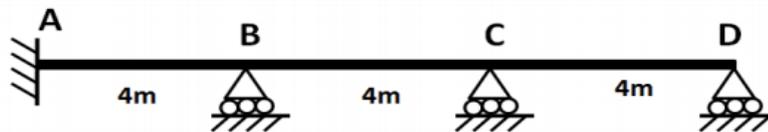
- (c) Find the matrices: [AD], [ADL], [S] and [D] with usual notations for the beam shown below, using Stiffness method. **07**



- Q.4 (a) Explain with illustrations the characteristics of flexibility / stiffness matrices **03**
 (b) A two span beam ABC has support A as fixed support and support B and C as roller support, span AB=3m and BC=3m. If the entire beam is loaded by udl of 20kN/m, Analyze the beam by flexibility matrix method assuming support moment at A and reaction at B as unknowns. **07**
 (c) Draw bending moment diagram for the above mentioned beam in Q.4(b). **04**

OR

- Q.4 (a) Define: Stiffness and Flexibility. Enlist the properties of Flexibility matrix **03**
 (b) Differentiate between “restrained structure” and “released structure”. Draw any four possible released structures for the beam shown below. **04**
 (c) Derive the Stiffness matrix [S] for the beam shown below. Also show that it satisfies the basic properties of a stiffness matrix. **07**



- Q.5 (a) Explain four virtues of an earthquake resistant design. **03**
 (b) Discuss briefly the two measures of earthquake. **04**
 (c) A five storeyed building has size of 30m x 30m. It is located in Bhuj and resting on hard soil. The weights of floors and height of the floors are 1800kN, 2300kN, 2300kN, 2300kN and 2000kN and 4.5m, 3.5m, 3.5m, 3.5m and 3.5m respectively from slab no.1 from bottom. Assuming the building as special moment resisting office building, calculate the horizontal shear forces acting at the each slab level by equivalent lateral force method. **07**

OR

- Q.5 (a) Explain the plate tectonic theory and its mechanism. **03**
 (b) What is the basic design philosophy of seismic design of structures? **04**
 (c) A Five storey hospital building having special moment resisting frame (SMRF) located in Ahmedabad on medium soil with following data: **07**
 (i) No. of bay in x and y-direction = 4
 (ii) Width of each bay = 4m
 (iii) Thickness of slab = 150 mm

(iv) Storey height = 4 m

(v) Size of beam and column = 300 mm x 450 mm

(vi) Live load = 55 kN/m²

Calculate Seismic Weight of the Building, Natural Period of Building, Base shear of building, Distribution of base shear as per IS 1893:2002. (Assume any additional data if required and neglect the weight of the infill wall panels.)
