

**MASTER OF CONSTRUCTION ENGINEERING EXAMINATION, 2017**  
(1<sup>st</sup> Semester)

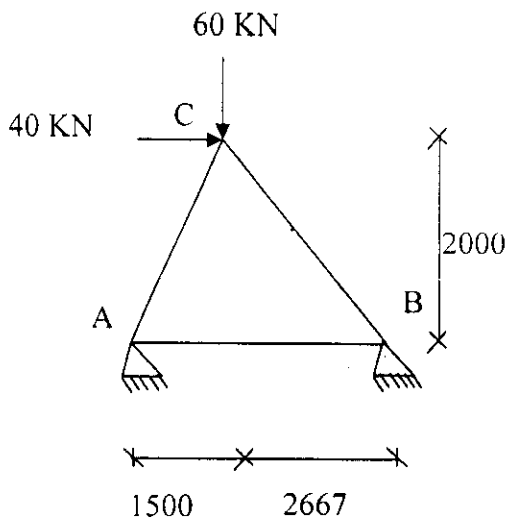
Time : Three hours

**ADVANCED STRUCTURAL ANALYSIS**

Full Marks : 100

Answer any **four questions**. All question carry equal marks. Explain your answer with neat sketches if necessary. Assume any other relevant data not provided.

1. a) Deduce the **Transformation matrix (T)** of a pin-jointed truss element from local to global coordinate system in matrix method of analysis. Express the elemental stiffness matrix in global co-ordinate systems. 10
- b) Calculate the **deflection of point C** of the truss ABC as shown below in Fig.1 by matrix method of analysis with the given member properties. 15



$E = 2.1 \times 10^5 \text{ MPa}$  for all Members.

c/s Area of AC =  $2 \times 15.39 \text{ cm}^2$  (2 ISA 100X100X8)

c/s Area of BC =  $2 \times 15.39 \text{ cm}^2$  (2 ISA 100X100X8)

c/s Area of AB =  $1 \times 15.39 \text{ cm}^2$  (ISA 100X100X8)

Fig. 1: Truss Problem

2. a) Derive the **stiffness matrix of beam element** in local coordinate system adopting finite element method. 15
- b) Deduce the expression for **consistent** load vector adopting virtual work approach. 10
3. a) Deduce the expression of isotropic plate bending problem adopting **finite difference method (FDM)** from the basic governing equation. 17
- b) What will be the modification of the above formulation in case of **fixed support** at one edge? 8

4. a) Define **Displacement Function** and derive the same for Beam Element. 10
- b) Deduce the **shape functions for a rectangular element** in plain stress problem and indicate the relationship with shape function of truss element. 15
5. a) Discuss the significance of '**Pascal Triangle**'. What are the steps to be adopted in general in FEM formulation? 10
- b) Deduce the strain-displacement and stress-strain relationship for a **Constant Strain Triangular element** in plain stress problem. 15