Reg. No. | | | | | | | | | | |

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

II SEMESTER M.TECH. (STRUCTURAL ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: **FINITE ELEMENT METHOD OF ANALYSIS - II [CIE 5251]**
REVISED CREDIT SYSTEM

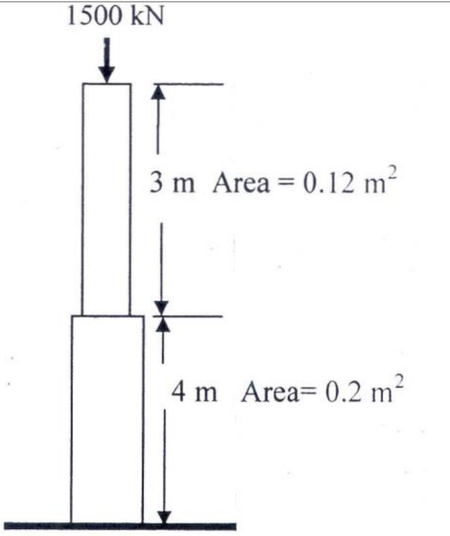
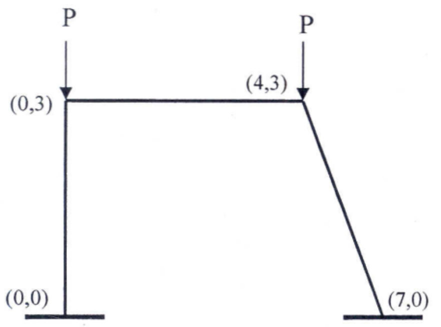
(20/04 /2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Explain the procedure to obtain stiffness matrix for eight noded three dimensional brick element	**5**
1B.	Obtain the constitutive matrix, C, for a thick plate bending element	**5**
2A.	Explain the term band width and its minimization for a simple plane frame structure.	**4**
2B.	Differentiate between geometric and material nonlinearity	**2**
2C.	Obtain the mass matrix for three noded triangular element for plane-stress condition	**4**
3A.	Obtain the equation dynamic equilibrium for a continuous beam shown in figure **Fig.Q3A**. Take EI = 100 kN/m^2 and mass density = 2 $kNsec^2/m^4$, c/s area =0.1 m^2. Write the equation in finite difference form if a point load of 100 kN is suddenly applied at the free end  **Fig Q.3A**	**08**
3B.	What is beam column element? When this element is used in finite element analyses	**02**
4A.	Axially loaded column having two parts with different c/s areas as shown in figure **Fig. Q.4A** is subjected to axial load of 1500 kN. The modulus of elasticity of the column is modeled using a nonlinear relationship $E_i=2x10^5[0.4-\varepsilon_i/0.3]^2$. Where ε_i is the strain in each part of the structure. Using incremental method obtain the displacements at the nodes and forces in each element of the column after two load increments.	**5**

	 **Fig Q. 4A**	
4B.	Calculate the critical load P for a pin jointed members shown in figure **Fig.Q.4B**. Take size of each member as 0.2m x 0.2m and modulus of elasticity $2x10^7$ *kN/m^2* for all the members  **Fig Q. 4B**	**5**
5A.	Obtain the equation of State equilibrium for a wall resting on a footing and Supporting soil as shown in figure **Fig Q. 5A**. Model the soil adjacent to the wall and below the footing using Winkler element. Hard stratum is at a depth of 3 m below the footing. The properties of structure, footing and soil are as follows: **Wall:** *c/s* area=$0.1m^2$ modulus of elasticity =$2x10^7$ *kN/m^2* **Footing:** EI= 1000 kNm^2 **Soil:** modulus of elasticity =1000 *kN/m^2*	**5**

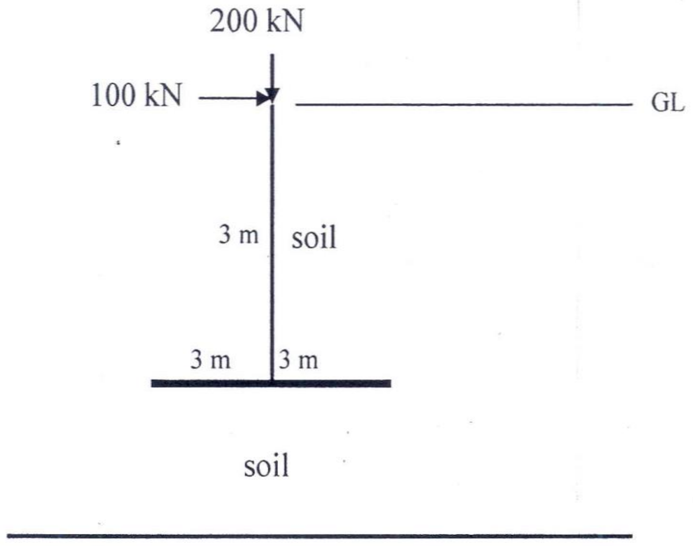


Fig Q. 5A

5B.	Write short notes on i) Static condensation technique ii) Aspect ratio	