Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH. (STRUCTURAL ENGINEERING)

END SEMESTER EXAMINATIONS, APR/MAY 2019

SUBJECT: FINITE ELEMENT METHOD OF ANALYSIS II [**CIE** 5251]

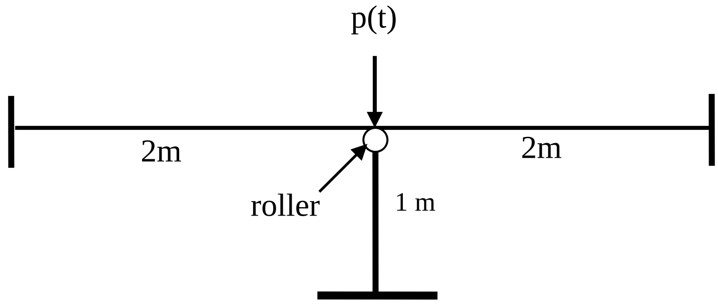
REVISED CREDIT SYSTEM

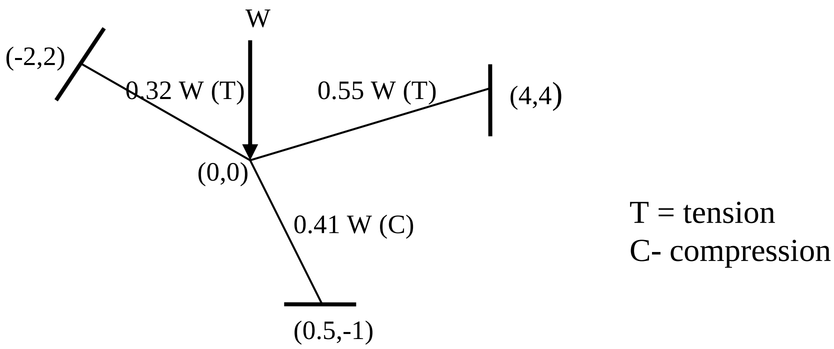
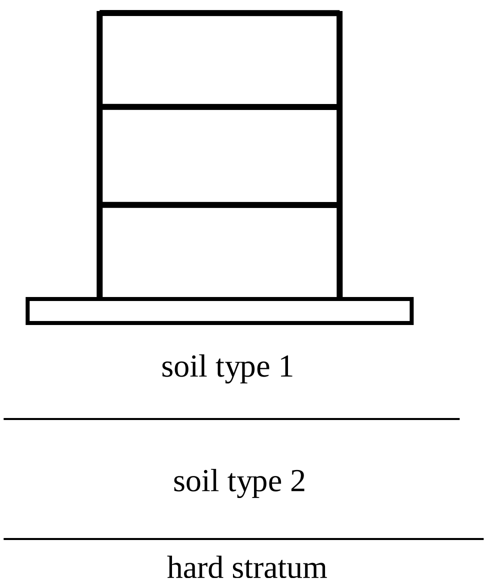
(24 / 04 / 2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

Q. No		MARKS	COS
1A.	Calculate equivalent nodal load vector for eight noded brick element of size 0.6 m x 0.4 m x 0.5 m due to 60 kN load acting at a distance of 0.2m, 0.3m and 0.25 m from node 1 along X –direction	**03**	**CO1**
1B.	Obtain the expression for matrix C for thick and thin plates in bending	**04**	**CO1**
1C.	Explain finite difference technique for the solution of dynamic equation. What is the advantage of finite difference technique compared to mode superposition technique	**03**	**CO2**
2A.	Obtain the expression for consistent mass matrix for two noded plane frame element in local direction and explain how the mass matrix is obtained in global direction	**03**	**CO2**
2B.	Obtain the Eigen values and Eigen vectors for the structure shown in figure Fig. Q. 2B. The dimensions of each element b = 0.3m and d = 0.6 m. Modulus of elasticity is equal to 2×10^7 kN/m^2, mass on horizontal members is 20 kNses^2/m^2 and 7.85 kNsec^2/m^4 on vertical member. Also write the finite difference equation to obtain the response of the structure if sinusoidal load of intensity p(t)=20sin(12t) kN is acting as shown in figure.  **Fig. Q 2B**	**07**	**CO2**

3A	Calculate the displacement, q , at free end due to 500 kN load for a column of length 4 m and c/s area 0.6 m^2 with material property E defined by the equation $E=2x10^7$ $[1\text{-}400q]^3$ kN/m^2. Use modified iterative procedure and three iterations	**04**	**CO3**
3B	Calculate the critical load W for the pin jointed structure shown in figure Fig. Q. 3B. Take $E=2x10^7 kN/m^2$ and c/s area 0.2 m^2. The axial load on each member due to W is as shown in figure  **Fig. Q. 3B**	**06**	**CO4**
4A	Explain soil-structure-interaction analysis using Winkler model for soil. Show the finite element descritization for structure, foundation and soil for a plane frame structure shown in figure Fig. Q4B indicating the node numbers, element numbers, degree of freedoms at each node and connectivity for all the elements. Model the soil using Winkler element.  **Fig Q 4B**	**05**	**CO4**

4B	Explain iterative technique for geometric nonlinearity	**02**	**CO3**
4C	With the example of plane frame structure explain the effects of numbering the nodes on band width	**03**	**CO5**
5A.	What is condensation technique? Obtain the equation of equilibrium for two noded plane frame element of length 2 m, EI= 1000 kN/m^2 and AE=5000 kN with fixed support at node 1 and U,V degrees of freedoms at node 2. The element carries udl of 10 kN/m	**05**	**CO5**
5B.	Explain i)shape functions by degradation technique ii) convergence requirements of displacement model	**05**	**CO5**