BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTech. **SEMESTER : II**
BRANCH: ECE (Microwave Engineering) **SESSION : SP/22**

SUBJECT: EC553 Numerical Techniques in Electromagnetics

FULL MARKS: 50

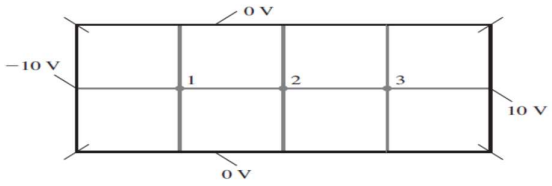
INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. The missing data, if any, may be assumed suitably.
***3*. Before attempting the question paper, be sure that you have got the correct question paper.**
4. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Give a comparative study in terms of advantages and disadvantages of analytical, experimental and numerical methods for solving EM problems. [5]

Q.1(b) What is the difference between open and closed domain problems? [3]

Q.1(c) How a closed boundary can be converted to a open boundary problem? [2]

Q.2(a) Calculate the potential at node 1,2and 3 in the potential system shown in the figure using finite difference method. [5]



Q.2(b) Draw the E and H components in a unit cell of Yee's lattice. [2]

Q.2(c) Write the Finite Difference approximation of the equation [3]

$$\frac{\partial H_y}{\partial t} = \frac{1}{\mu}\left[\frac{\partial E_z}{\partial x} - \frac{\partial E_x}{\partial z}\right]$$

Q.3(a) Classify the following integral equation as Fredholm or Volterra integral equation, linear or nonlinear and homogeneous or non-homogeneous [5]

$$u(x) = x - \frac{1}{6}x^3 + \int_0^x (x-t)u(t)dt.$$

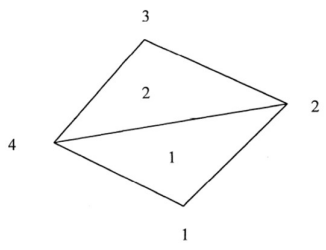
Q.3(b) Find the IE corresponding to the differential equation [5]

$$\Phi''' - 3\Phi'' - 6\Phi' + 8\Phi = 0 \quad \text{subject to } \Phi''(0) = \Phi'(0) = \Phi(0) = 1$$

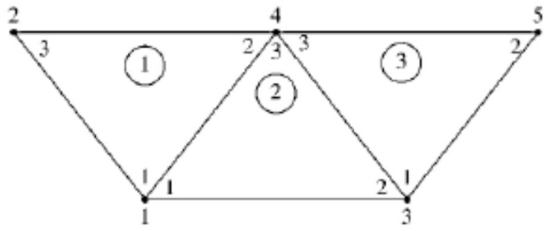
Or

Show that most of the charges are concentrated towards the edge of the wire antenna.

Q.4(a) Given that in the following figure, the coordinates of nodes are: Node1 (2,1); Node 2: (3 , 2.5); Node 3 : (2,2.4); Node 4: (1.5, 1.6). Find the coefficient matrix for element 2 . [5]



Q4(b) Explain the assembling of the elements in FEM by considering the following figure: [5]



Q.5(a) Explain the direct method to generate random variable X from an exponential probability distribution function with the mean μ. [5]

Or

Explain the rejection method to generate random variable X using uniform probability density function

Q.5(b) In the fixed random walk, explain a means of determining which way the particle should move. [5]

02/05/2022 E