9. (a) Explain '.OP', '.TF','.AC' and '.PLOT' statements in SPICE.

(b) A series R-L-C circuit with L=1H and C=1F is excited with a 10V, DC source. Write a SPICE program to plot the voltage across inductor (V_L) and voltage across capacitor (V_c) up to 10 seconds for R = 1Ω,2Ω and 10Ω respectively. **6+6 = 12**

Field Theory
(ELEC 2103)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions) 10 x 1=10

Choose the correct alternatives for the following:

i) Which one of the following vector field is conservative:
(a) $F_1=xa_x+ya_y$ (b) $F_2=-xa_y+ya_x$
(c) $F_3=ya_x$ (d) none of these.

ii) A potential field is given by v=xy+z. Then electric field will be
(a) $E=ya_x + xa_y + a_z$ (b) $E=ya_x + xa_y$
(c) $E=ya_x + xa_y + xya_z$ (d) E=0.

iii) The magnetic flux density and the magnetic vector potential are related by:
(a) $A=\nabla\times B$ (b) $B=\nabla\times A$
(c) $B=\nabla.A$ (d) $A=\nabla.B$.

iv) Two parallel wire carrying current in the same direction. The direction of force between the conductor is
(a) parallel to the wire (b) perpendicular to the line & attract
(c) perpendicular to the line & repulsive (d) none of these.

v) Which one of the following is correct
(a) $\nabla^2A=-\mu_0 J$ (b) $\nabla^2B=-\mu_0 J$
(c) $\nabla.E=0$ (d) $\nabla\times B=0$.

vi) The direction of propagation of EM wave is obtained from
(a) E×H (b) H×E
(c) H (d) none of these.

vii) For lossless line characteristic impedance is given by
(a) $\sqrt{\frac{C}{L}}$ (b) $\sqrt{\frac{L}{C}}$
(c) $2\pi\sqrt{\frac{C}{L}}$ (d) $2\pi\sqrt{\frac{L}{C}}$.

(viii) The velocity of electromagnetic wave propagating in free space is

(a) $\mu_0\varepsilon_0$ (b) $\frac{1}{\mu_0\varepsilon_0}$

(c) $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$ (d) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$.

(ix) The skin depth is given by

(a) $\delta = \sqrt{2/(\omega\mu\sigma)}$ (b) $\delta = \sqrt{\pi/(\omega\mu\sigma)}$

(c) $\delta = 2/\sqrt{(\omega\mu\sigma)}$ (d) $\delta = \pi/\sqrt{(\omega\mu\sigma)}$.

(x) Displacement current flows through

(a) inductor (b) capacitor

(c) resistor (d) none of these.

Group – B

2.(a) Given vector $B=r^2\mathbf{a}_r + \text{Sin}\theta\mathbf{a}_\phi$ are in spherical coordinate system. Express the ve cylindrical coordinate system.

(b) Two points in cylindrical coordinate systems are P(10,60°,2) & Q(5,30°,-4). Dete the distance between the two points.

(c) Explain the physical significance of Divergence, Curl & Gradient.

6 + 4 + 2

3.(a) Find the line integral of the vector field H given below along the curve $y=x^2$ from (0,0) to (1,1)

$H= x^2\,\mathbf{a}_x + y^2\,\mathbf{a}_y$.

(b) Find the gradient of the following scalar field, given below:

$H=r^2*\text{Cos}\theta*\text{Cos}\varphi$

(c) Which one of the following vector fields F_1 &F_2 can be written as gradient of a sc

$F_1=x\mathbf{a}_z$; $F_2=x\mathbf{a}_x+y\mathbf{a}_y$

4 + 4 + 4

Group – C

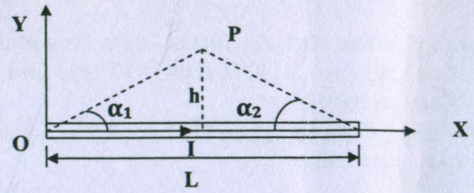
4.(a) Find the potential V due to the line charge density '+λ' C/m, bent in the for circular ring of radius 'R' at the height of 'H' along the axis.

(b) Given the potential function V=7x+4y+5z in the free space, find the store energy 1-m^3 volume centered at the origin.

(c) State and explain Gauss's law in differential form.

5 + 4 + 3

the flux density and field intensity at point p due to a straight conductor a current I as shown in the Fig. below



en magnetic vector potential 'A' in cylindrical coordinates $A=5r\text{Sin}\varphi\,\mathbf{a}_z$, find the density at (2, π, 0).

e and explain Ampere's law in differential form of magnetostatic.

5 + 4 + 3 = 12

Group – D

a certain region with σ=0, μ= μ_0 and ε=4 ε_0, the magnetic field of EM wave is given low. Find β and corresponding E using Maxwell equations.

$H=0.6*\text{Cos}\,\beta x\ \text{Cos}10^8t\ \mathbf{a}_z$

plain the Transformer and Motional EMF.

8 + 4 = 12

Establish Poynting Theorem.

n free space E(z,t) (V/m)is given below. Find the average power crossing a circular rea of radius 2.5 m in the plane z=constant.

$E(z,t) = 50\,\text{Cos}(\omega t - \beta z)\,\mathbf{a}_x$

Determine the propagation constant γ for a material having μ_r =1, ε_r = 6, and σ=0.15pS/m, if the wave frequency is 16 MHz.

5 + 4 + 3 = 12

Group – E

) Find the characteristic impedance, propagation constant and velocity of propagation for transmission line having the following parameters:

R=40Ω/Km G=10^{-6} mho/m L=0.02 H/km C=0.07μF/km f=1000Hz.

) Find the expression of input impedance of transmission line. What do you mean by distortion less line in transmission line?

5 + (4 +3) = 12

Answer any *three*

7. (a) Two point charge
and (2, 0, 5) m
permeability 2.5.
(b) A circular disc of
at the origin. Char
point (0, 0, h).

8. (a) A plane polarized
graphically the var
wave.
(b) Develop the analo
transmission line.
(c) A lossless transmi
600 MHz. The line
(i) the characteris
velocity.

(a) Using Biot-Savart
of a long co-axial
($b>a$) respectively.
(b)
Prove that $\nabla \times \vec{H} =$
(c) Write Lorentz forc
a straight conducto

(a) State and explain
(b) Distinguish betwee

(a) Derive the wave e
(b) What is polarizatio

9.(a) Derive the general wave equation of transmission line.

(b) A lossless transmission line with $Z_0=50\Omega$ is 100m long and operate at1MHz. T
is terminated with a load $Z_L=60+j30\ \Omega$. If $u=1\times10^8$m/s find
i. the reflection coefficient
ii. the standing wave ratio
iii. the input impedance

6+

MAULANA ABUL KALAM AZAD UNIVERSITY
WEST BENGAL

M(CS)-301

NUMERICAL METHODS

Time Allotted: 3 Hours

The questions are of equal value.
The figures in the margin indicate full m
Candidates are required to give their answers in their own w
All symbols are of usual significanc

GROUP A
(Multiple Choice Type Questions

1. Answer any *ten* questions.

(i) Lagrange's interpolation can be used for

(A) only equi-spaced nodes
(B) only unequi-spaced nodes
(C) for both cases of (a) and (b)
(D) none of these

(ii) The inherent error for Trapezoidal rule of integration is
have their usual meanings)

(A) $-\frac{nh^5}{140}f''(x_0)$ (B) $-\frac{nh^5}{140}f^{iv}(x_0)$

(C) $-\frac{nh^3}{12}f''(x_0)$ (D) none of these