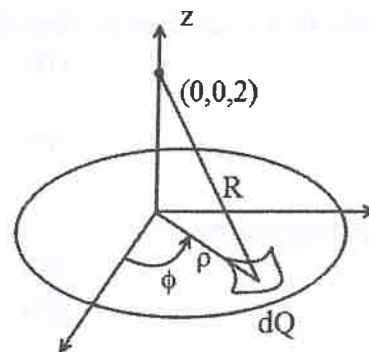


- b. A total charge of $\frac{40}{3} \text{ nC}$ is uniformly distributed in the form of a circular disk of radius 2 cm. Find the potential due to this charge at a point on the axis, 2 m from the disk. Compare this potential with that which results if all of the charges are at the centre of the disk.



29. a. Derive the Maxwell's equation for electric and magnetic field in integral and differential form.

(OR)

- b.i. In the region $0 < r < 0.5 \text{ m}$, in cylindrical coordinates, the current density is $J = 4.5e^{-2r} a_z \text{ (A/m}^2\text{)}$ and $J=0$ else where. Use Ampere's law to find H.
- ii. Given the general vector field $A = 5r \sin \phi a_z$ in cylindrical coordinates, find curl A at $(2, 2, 0)$.
30. a. Derive the expression for the field strength for TE mode in rectangular waveguide.

(OR)

- b. An electric field in free space is given by $E = 50 \cos(10^8 t + \beta x) a_y \text{ V/m}$
- (i) Find the direction of wave propagation
- (ii) Calculate β and the time it takes to travel a distance of $\frac{\lambda}{2}$
- (iii) Sketch the wave at $t=0, \frac{T}{4}$ and $\frac{T}{2}$.
31. a. Derive the line equation of a general transmission line.
- (OR)
- b.i. What are nodes and antinodes? Sketch the standing waves on open circuited line.
- ii. A 50 ohm lossless transmission line has a pure reactance of $(j100)$ ohms as its load. Find the V_{SWR} in the line.
32. a. Write short notes on
- (i) Slotted line
- (ii) Impedance matching using QWT

(OR)

- b. A 75Ω lossless transmission line is to be matched with a $100 - j80 \Omega$ load using single stub. Calculate the stub length and its disturbance from the load corresponding to the frequency of 30 MHz using Smith chart.

Reg. No.

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
Third Semester

18ECC105T – ELECTROMAGNETICS AND TRANSMISSION LINES
(For the candidates admitted during the academic year 2018-2019 onwards)

Note:

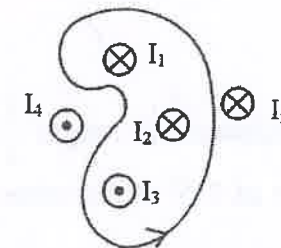
- (i) Part - A should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
- (ii) Part - B and Part - C should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer ALL Questions

- Electric field intensity is
(A) Directly proportional to the force applied
(B) Inversely proportional to the force applied
(C) Directly proportional to the permittivity
(D) Inversely proportional to the charge
- The amount of work done in moving a charge from one point to another along an equipotential line or surface charge is
(A) Infinity
(B) Two
(C) Zero
(D) One
- Evaluate $\nabla \cdot F$, if the vector $F = x^2 a_x + yz a_y + xy a_z$
(A) $Z + 2$
(B) $2x + Z$
(C) $x + Z$
(D) $2x + 2Z$
- Three point charges, $Q_1 = 30 \text{ nC}$, $Q_2 = 150 \text{ nC}$ and $Q_3 = -70 \text{ nC}$, are enclosed by surface S. What net flux crosses S?
(A) 250 nC
(B) 110 nC
(C) -110 nC
(D) 100 nC
- According to Ampere's law, the path integral $\oint_C B \cdot dl$ around the closed loop C is given by



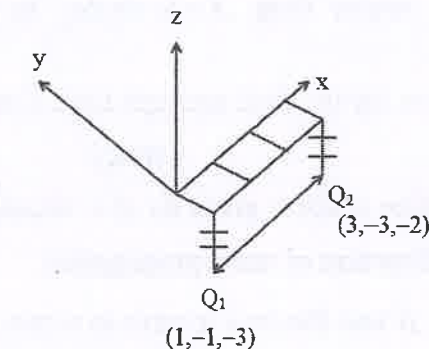
- (A) $\mu_0 (I_1 + I_2 - I_3)$
(B) $\mu_0 (-I_1 - I_2 + I_3)$
(C) $\mu_0 (I_1 + I_2 + I_3)$
(D) $-\mu_0 (+I_1 + I_2 + I_3)$
6. Biot-Savart law in magnetism is analogous to which law in electricity?
(A) Gauss law
(B) Faraday's law
(C) Ampere law
(D) Coulomb's law

7. When a magnet is in motion relative to a coil the induced emf does not depend upon
 (A) Motion of the magnet (B) Resistance of the coil
 (C) Number turns of the coil (D) Pole strength of the magnet
8. What is the magnitude of the induced EMF? If $B = 0.4T$, $L = 0.5m$ and $V = 3m/s$?
 (A) 0.6 V (B) 3 V
 (C) 2.6 V (D) 0 V
9. Which of the following statement is not true about waves in general?
 (A) The phenomenon may be a function of time only (B) The phenomenon may be sinusoidal
 (C) The phenomenon must be a function of time and space (D) For practical reasons, it must be a finite in extent
10. For an electromagnetic wave. The direction of $\vec{E} \times \vec{B}$ gives the direction of
 (A) The emf induced by the wave (B) Electric field
 (C) Magnetic field (D) Wave propagation
11. Indicate which one of the following mode do NOT exist in a rectangular cavity
 (A) TM 1,0 (B) TM 1,1
 (C) TE 1,0 (D) TE 0,1
12. Determine the wavelength of light waves in free space, if the frequency is $5 \times 10^{14} \text{ Hz}$.
 (A) 0.06 mm (B) 0.6 μm
 (C) 0.6 m (D) 6 mm
13. The range of VSWR is between
 (A) 0 and 1 (B) -1 and +1
 (C) 0 and ∞ (D) 1 and ∞
14. Transmission line is distortionless is
 (A) $GR=LC$ (B) $LG=RC$
 (C) $LG=\frac{1}{RC}$ (D) $RL=GC$
15. A transmission line of 50Ω characteristics impedance is terminated with a 100Ω resistance. The minimum impedance measured on the line is equal to
 (A) 0Ω (B) 25Ω
 (C) 50Ω (D) 100Ω
16. A lossless transmission line having 50Ω characteristics impedance and length $\frac{\lambda}{4}$ is short circuited at one end and connected to an ideal voltage source of 1 V at the other end. The current drawn from the voltage source is
 (A) 0.01A (B) ∞
 (C) 0 (D) 0.02A
17. If a transmission line of a characteristics impedance 50Ω is terminated with a load impedance of 100Ω , then the reflection coefficient is
 (A) 0.6667 (B) 1.6
 (C) 0.334 (D) 1.333

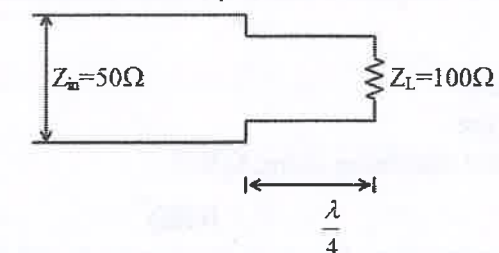
18. A transmission line is matched, when
 (A) $Z_L = Z_0$ (B) $Z_L = 2Z_0$
 (C) $Z_L = \sqrt{Z_0}$ (D) $Z_L = \frac{Z_0}{2}$
19. _____ transmission line is used as an impedance inverter.
 (A) $\frac{\lambda}{8}$ (B) $\frac{\lambda}{2}$
 (C) $\frac{\lambda}{4}$ (D) 2λ
20. Propagation constant γ is given by
 (A) $\alpha + j\beta$ (B) $\alpha - j\beta$
 (C) $\frac{\alpha}{j\beta}$ (D) $\alpha \cdot j\beta$

PART – B (5 × 4 = 20 Marks)
 Answer ANY FIVE Questions

21. Point charge $Q_1 = 300 \mu\text{C}$, located at $(1, -1, -3)m$, experiences a force due to $Q_2 = -40 \mu\text{C}$ located at $(3, -3, -2)$. Apply Coulomb's law to find the force on Q_1 .



22. Define Gauss's law and derive its point form.
23. An infinite current sheet lies in the $Z=0$ plane with $K = K_y a_y$. Find H.
24. In a lossless dielectric for which $\eta = 60Z$, $\mu_r = 1$. Find ϵ_r .
25. Find the characteristics impedance of the $\frac{\lambda}{4}$ transformer as shown



26. Compare circuit and field theory.
27. Differentiate transverse magnetic (TM) mode and transverse electric (TE) mode.

PART – C (5 × 12 = 60 Marks)
 Answer ALL Questions

28. a. Derive the electric field intensity due to infinite line charge using Coulomb's law.

(OR)