b. Derive the E and I for a high frequency transmission line, also find the node and antinode of short-circuited and open-circuited line.

32. a. A 50Ω transmission line is connected to a cellular phone antenna with load impedance Z_L=25–j50Ω. Find the position and the length of a shunt short-circuit stub required to match the 50Ω line. (note: use smith chart).

(OR)

b.i. Write short notes on Quarter wave transmission (QWT). (4 Marks)

ii. A load Z_L=100+j50Ω is connected across a transmission line with Z_0=50Ω and $l=0.4\lambda$. Use smith chart to find the standing wave ratio, reflection co-efficient and input impedance of the line. (8 Marks)

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Reg. No.														

B.Tech. DEGREE EXAMINATION, NOVEMBER 2019
First to Eighth Semester

15EC207 – ELECTROMAGNETICS AND TRANSMISSION LINES
(For the candidates admitted during the academic year 2015 – 2016 to 2017 – 2018)

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

1. Convert the point $(3,\pi/3,-4)$ from cylindrical to Cartesian co-ordinates
   (A) $(3/2,3\sqrt{3}/2,4)$ (B) $(3/2,3\sqrt{3}/2,-4)$
   (C) $(3\sqrt{3}/2,3/2,-4)$ (D) $(3\sqrt{3}/2,3/2,4)$

2. Divergence of gradient of a vector function is equivalent to
   (A) Laplacian operation (B) Curl operation
   (C) Double gradient operation (D) Tangent

3. A point charge 2nC is located at origin. What is the potential at (1,0,0)?
   (A) 12 (B) 14
   (C) 16 (D) 18

4. The electrostatic energy in an electric field does not depend on which of the following?
   (A) Magnitude of charges (B) Permittivity
   (C) Applied electric field (D) Flux lines

5. Calculate the magnetic field at a point on the center of the circular conductor of radius 2m with current 8A
   (A) 1 (B) 2
   (C) 3 (D) 4

6. The point form of Ampere law is given by
   (A) Curl(B) = I (B) Curl(D) = J
   (C) Curl(V) = I (D) Curl (H)=J

7. An implication of the continuity equation of conductor is given by
   (A) $J=\sigma E$ (B) $J=E/\sigma$
   (C) $J=\sigma/E$ (D) $J=j\omega E\sigma$

8. In conductors, which condition will be true?
   (A) $\sigma\omega\varepsilon>1$ (B) $\sigma/\omega\varepsilon<1$
   (C) $\sigma/\omega\varepsilon>1$ (D) $\sigma\omega\varepsilon<1$

9. The attenuation constant in lossless dielectrics will be
   (A) 1 (B) 0
   (C) –1 (D) ∞

10. A device used for coupling microwave energy is known as
   (A) Transmitter (B) Resonator
   (C) Waveguide (D) Loop

11. The modes of propagation supported by a rectangular wave guide is
   (A) TM, TEM, TE modes (B) TM, TE
   (C) TM, TEM (D) TE, TEM

12. At DC field, the displacement current density will be
   (A) 0 (B) 1
   (C) JC (D) ∞

13. The reflection coefficient of a wave with transmission coefficient 0.35 is
   (A) 0.7 (B) 0.35
   (C) 1.35 (D) 0.65

14. The condition that hold good in a distortionless transmission line is
   (A) RL=GC (B) L/R=C/G
   (C) R/L=G/C (D) RG/LC

15. Standing wave occurs due to
   (A) Impedance match (B) Impedance mismatch
   (C) Reflection (D) Transmission

16. The short circuit impedance of the transmission line is given by
   (A) $Z_{sc} = jZ_0 \cot \beta l$ (B) $Z_{sc} = jZ_0 \tan \beta l$
   (C) $Z_{sc} = -jZ_0 \cot \beta l$ (D) $Z_{sc} = -jZ_0 \tan \beta l$

17. The attenuation constant is 0.5 units, the skin depth will be
   (A) 0.5 (B) 0.25
   (C) 4 (D) 2

18. The smith chart consists of the
   (A) Constant R and constant × circles (B) Constant R and variable × circles
   (C) Variable R and constant × circles (D) Variable R and variable × circles

19. The input impedance of a half wave transmission line with a load impedance of 12.5 ohms is
   (A) 25 (B) 50
   (C) 12.5 (D) 6.25

20. For a matched line, the input impedance will be equal to
   (A) Zero (B) Output impedance
   (C) Load impedance (D) Characteristic impedance

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

21. Find the electronic field intensity at P(–4, 6, –5) in free space caused by a charge of 0.1mC at (2,–1,–3).

22. Give the relation between E and V and find the field intensity of $T = 2y^2 - 5z \ at \ (-2,1,4)$.

23. State Biot Savart's law and find the magnetic field intensity when the flux density is 8×10^{-6} Tesla in the medium of the air.

24. Compare transverse magnetic and transverse electric wave.

25. Determine the standing wave ratio if load impedance is 120 – j60Ω and the characteristic impedance is 300Ω.

26. What is an infinite line and give its physical significance.

27. The short circuit impedance is given by 18Ω and the characteristic impedance is 50Ω. Find the open circuit impedance.

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

28. a. Derive the expression for electric field intensity due to a dipole.

(OR)

b. A uniform line charge, infinite in extent, with $\rho_L = 20nC/m$, lies along Z-axis. Derive the electric filed intensity and find its value at (6,8,3)m.

29. a. Derive the magnetic field intensity of an infinitely long co-axial transmission line carrying a uniformly distributed current 'I' in the inner conductor and '–I' in the outer conductor.

(OR)

b.i. Given $E = E_m \sin(\omega t - \beta z) ay$ in free space, find D, B and H. (5 Marks)

ii. Derive Maxwell's equation for free space. (7 Marks)

30. a. Derive the electric and magnetic field components of TE waves in rectangular wave guide.

(OR)

b. In a rectangular waveguide for which a=1.5cm, b=0.8cm, σ=0, μ=μ_0, ε=ε_0, β=1. The waveguide is operating in TM_{13} mode. Determine cut-off frequency, phase constant and propagation constant of $H_x = 2\sin\left(\frac{\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right)\sin\left(\pi.10^{11}t - \beta z\right) A/m$.

31. a. Derive the input impedance for open and short circuited transmission lines and calculate the power for various cases.

(OR)