31. a. Derive the transmission line equation to determine the voltage and current at any point at a distance 's' from the receiving end.

(OR)

b. Calculate the received power of a generator of 1 v, 1000 cycles. supplies power to a 100 mile open wire line terminated in Z_0 and having the parameters, $R = 10.4\Omega / mile$, L=0.00367 H/mile, $G = 0.8\times10^{-6}$ ℧ / *mile and* $C = 0.00835\,\mu F$ / *mile.*

32. a.i. Using slotted line, explain impedance measurement in detail.

ii. Explain and relate the parameters reflection coefficient and VSWR with expressions. Calculate reflection coefficient and transmission coefficient for a transmission line, has a characteristics impedance of 75+j0.01Ω and is terminated in a load impedance of $70 + j50\Omega$.

(OR)

b. Using smith chart, determine SWR, load admittance, stub length and the distance of the stub from the load for the given complex load $Z_L = 26 - j16$ is to matched to 75 Ω line using short circuited stub.

* * * * *

Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2019
1st to 7th Semester

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

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. Gradient of a scalar function is a
   (A) Unit function (B) Scalar function
   (C) Periodic function (D) Vector function

2. The divergence of curl is
   (A) $\nabla.(\nabla\times H) = 0$ (B) $\nabla.\nabla H = 0$
   (C) $\nabla\times(\nabla H) = 0$ (D) $\nabla\times\nabla\times H = 0$

3. The relationship between electric field intensity E and potential V is given by
   (A) $\vec{E} = \nabla V$ (B) $\vec{E} = -\nabla V$
   (C) $V = -\nabla\times\vec{E}$ (D) $V = -\nabla\vec{E}$

4. The electric field lines $\vec{E}$ _____ to equipotential surface.
   (A) Opposite (B) Tangential
   (C) Normal (D) Unrelated

5. Maxwell's equation involves
   (A) Magnetic intensity (B) Charge density
   (C) Flux density (D) Current density

6. Biot-Savart's law is a modification of
   (A) Ampere's law (B) Lenz's law
   (C) Faraday's law (D) Kirchoff's law

7. What is the unit of magnetic charge?
   (A) Ampere-meter squared (B) Coulomb
   (C) Ampere (D) Ampere-meter

8. Which of the following is true?
   (A) $\nabla\times B = 0$ (B) $\nabla.B = 0$
   (C) $\nabla\times D = 0$ (D) $\nabla.D = 0$

9. Waves are confined in waveguides due to
   (A) Refraction (B) Reflection and refraction
   (C) Total internal reflection (D) Diffraction

10. Which of the following modes does not exist in a rectangular waveguide?
   (A) TE_{10} (B) TM_{01}
   (C) TM_{11} (D) TE_{01}

11. The phase velocity of EM waves in a hollow metal waveguide is
   (A) Equal to group velocity (B) Lesses than velocity of light in freespace
   (C) Greater than velocity of light in freespace (D) Equal to velocity of light in free space

12. The dominant mode in a rectangular waveguide is
   (A) TE_{11} (B) TE_{10}
   (C) TM_{10} (D) TM_{11}

13. When the length of the transmission line is same as that of the wavelength, which condition holds good?
   (A) $Z_{in} = Z_0$ (B) $Z = Z_0$
   (C) $Z_L = Z_0$ (D) $Z_{in} = Z_L$

14. When $E_{max} = E_{min}$, the amount of power transmitted will be
   (A) Greater (B) Low
   (C) Equal (D) Medium

15. What is the effect of standing wave on a transmission line?
   (A) Prevention of arcing (B) A cooler operating line
   (C) Decrease in the power fed to antenna (D) Increase in the power fed to antenna

16. If a transmission line terminated with a load equal to the characteristic impedance, the reflection coefficient is
   (A) –1 (B) +1
   (C) 0 (D) Infinity

17. A quarter wave transformer is used for matching the transmission line to the load Z_L when Z_L is
   (A) High (B) Low
   (C) Complex (D) Purely resistive

18. A matching stub should be placed
   (A) Nearest to the transmitter (B) Nearest to the load
   (C) Midway between load and transmitter (D) Anywhere

19. Smith chart is based on the polar plot of
   (A) Reactance (B) Voltage
   (C) Current (D) Voltage reflection coefficient

20. A modern device that replaces a slotted line for impedance measurement is
   (A) Digital CRO (B) Generators
   (C) Network analyzers (D) Computers

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

21. A point charge of $Q_1 = 3\times10^{-4} C$ *and* $Q_2 = -10^{-4} C$ are located at $(1,2,3)$ and $(2,0,5)$. Find the electric force F on Q_2 *by* Q_1.

22. State divergence theorem and give its expression.

23. Given $\vec{D} = 0.3r^2\vec{a}_r\ nC/m^2$ in free space. Find the total charge with in the sphere r =3.

24. Derive an expression for magnetic field intensity due to infinite line current using Ampere's circuital law.

25. Write the significance of wave propagation in a good conductor with relevant parameters.

26. An ideal loss-less quarter wave transmission lien of characteristics impedance 60 Ω is terminated in a load impedance Z_L. Calculate the value of input impedance of line when $Z_L = 0, \infty$ *and* 60Ω.

27. Explain single stub matching on a line.

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

28. a.i. Deduce the electric field of dipole.

ii. Derive energy density in the electrostatic field.

(OR)

b. Evaluate both sides of divergence theorem for the fields $D = xyz\vec{a}_x + 2xy^2z\vec{a}_y + 5yz^3\vec{a}_z\ C/m^2$ and is formed by the planes $x = 0$ *and* 3, $y = 0$ *and* 1 *and* $z = 0$ *and* 2.

29. a. Using Biot-Savart's principle,derive the expression for magnetic field intensity due to infinitely long straight conductor.

(OR)

b. State and derive Maxwell's equations for time varying fields in point and integral form.

30. a. With relevant field components, explain rectangular waveguide with perfectly conducting walls filled with lossless material and also mention four different mode categories of rectangular waveguide.

(OR)

b. In a rectangular waveguide, for which a =1.5 cm, b =0.8 cm, $\sigma = 0$, $\mu = \mu_0$, $\varepsilon = 4\varepsilon_0$ and $H_x = 2\sin\left(\frac{\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right)\sin\left(\pi\times10^{11}t - \beta_z\right)A/m$. Determine the mode of operation, cut off frequency, phase constant (β), propagation constant (γ) and intrinsic wave impedance (η).