**University of Mumbai**

**Examinations Summer 2022**

Program: Electronics and Telecommunication Engineering

Curriculum Scheme: Rev2019

Examination: Third Year Semester VI

Course Code: ECC 601 and Course Name: E and A

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 **QUESTION BANK**

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| **Q1.** | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**  |
| 1. | Coulomb law is employed in |
| Option A: | Electrostatics |
| Option B: | Magnetostatics |
| Option C: | Electromagnetics |
| Option D: | Maxwell theory |
|  |  |
| 2. | The electric field intensity is defined as |
| Option A: | Product of force and work done |
| Option B: | Force on a test charge |
| Option C: | Force per unit charge on a test charge |
| Option D:  | Product of force and charge |
|  |  |
| 3.  | The Poynting vector is the power component that is calculated by the |
| Option A: |  Product of E and H |
| Option B: | Ratio of E and H |
| Option C: | Dot product of E and H |
| Option D:  | Cross product of E and H |
|  |  |
| 4. | In the conversion of line integral of H into surface integral, which theorem is used? |
| Option A: | Green theorem |
| Option B: | Gauss theorem |
| Option C: | Stokes theorem |
| Option D:  | It cannot be converted |
|  |  |
| 5. | A charge Q is enclosed by a Gaussian spherical surface of radius R. If R is doubled then the outward flux is |
| Option A: | Doubled |
| Option B: |  Increased four times |
| Option C: | Reduces to quarter |
| Option D:  | Remains unaltered |
|  |  |
| 6. |  The ratio of the transverse electric field to the transverse magnetic field is called as |
| Option A: |  waveguide impedance  |
| Option B: |  waveguide wavelength |
| Option C: |  phase velocity  |
| Option D: | Poynting vector |
|  |  |
| 7.  | The tangential component of electric field intensity at the boundary of separation of the medium for a dielectric- dielectric interface will be |
| Option A: | Same |
| Option B: | Different |
| Option C: | Negative |
| Option D:  | Inverse |
|  |  |
| 8. | Ampere law states that, |
| Option A: | Divergence of H is same as the flux |
| Option B: | Curl of D is same as the current |
| Option C: | Divergence of E is zero |
| Option D:  | Curl of H is same as the current density |
|  |  |
| Q9. |  Continuity equation is also called as the law of conservation of |
| Option A: | Mass |
| Option B: |  Energy |
| Option C: |  Charge |
| Option D: |  Power |
|  |  |
| 10. | An electromagnetic field can exist if it satisfies  |
| Option A: | Gauss's law |
| Option B: | Faraday's law |
| Option C: | Coulomb's law |
| Option D:  | All Maxwell's equations |
|  |  |
| 11.  | The value of ∫ H.dL will be |
| Option A: | J |
| Option B: |  I |
| Option C: |  B |
| Option D:  | H |
|  |  |
| 12.  | The electric flux density is the |
| Option A: | Product of permittivity and electric field intensity |
| Option B: |  Product of number of flux lines and permittivity |
| Option C: | Product of permeability and electric field intensity |
| Option D: | Product of number of flux lines and permeability |
|  |  |
| 13. | Biot Savart law in magnetic field is analogous to which law in electric field? |
| Option A: | Gauss law |
| Option B: | Faraday law |
| Option C: | Coulomb’s law |
| Option D: | Ampere law |
|  |  |
| 14. | Electromagnetic waves are transverse in nature due to |
| Option A: | Reflection |
| Option B: | Diffraction |
| Option C: | Interference |
| Option D:  | Polarization |
|  |  |
| 15. | In free space, the Poisson equation becomes |
| Option A: | Maxwell equation |
| Option B: | Ampere equation |
| Option C: | Laplace equation |
| Option D: | Steady state equation |
|  |  |
| 16.  | Antenna is a \_\_\_\_\_\_\_\_\_\_ element |
| Option A: | Active |
| Option B: | Passive  |
| Option C: | Resistive |
| Option D:  | Capacitive |
|  |  |
| 17. | For a monopole antenna over an infinite ground plane, the directivity is \_\_\_\_\_ and input impedance is \_\_\_\_\_, as compared to a λ/2-dipole antenna.  |
| Option A: | Twice, Twice  |
| Option B: | Twice, Half  |
| Option C: | Half, Half |
| Option D: | Half, Twice |
|  |  |
| 18. | Steradian is a measurement unit of-----  |
| Option A: | Point angle  |
| Option B: | Linear angle  |
| Option C: | Plane angle  |
| Option D:  | Solid angle |
|  |  |
| 19.  | An antenna has a field pattern E (θ) =cos θ cos 2θ. The first null beam width of the antenna is: |
| Option A: | 450 |
| Option B: | 900 |
| Option C: | 1800 |
| Option D:  | 1200 |
|  |  |
| 20.  | For end-fire array, the progressive phase shift should be |
| Option A: | zero |
| Option B: | infinite |
| Option C: | finite |
| Option D: | -βd |
|  |  |
| 21.  | If the length of elements of an array is greater than λ/2, which will be the operating region of an array? |
| Option A: | transmission line region |
| Option B: | active region |
| Option C: | reflective region |
| Option D:  | reactive region |
|  |  |
| 22.  | What does the beam width of an antenna tell us? |
| Option A: | Signal strength |
| Option B: | Signal power |
| Option C: | Directivity |
| Option D:  | Degradation |
|  |  |
| 23. | In broadside array, all the elements in the array should have similar \_\_\_\_\_\_\_excitation along with similar amplitude excitation for maximum radiation. |
| Option A: | Phase |
| Option B: | Frequency |
| Option C: | Current |
| Option D: | Voltage |
|  |  |
| 24.  | A helical antenna is used for satellite tracking because of its |
| Option A: | circular polarization |
| Option B: | high gain |
| Option C: | broad bandwidth |
| Option D:  | good front-to-back ratio |
|  |  |
| 25. | What is the half power beam width for a half wave dipole antenna? |
| Option A: | 78° |
| Option B: | 180° |
| Option C: | 50° |
| Option D: | 250° |
|  |  |
| 26. | Design a dipole antenna at 0.7 GHz of diameter 4mm.The approximate length in cm is  |
| Option A: | 10 |
| Option B: | 20 |
| Option C: | 30 |
| Option D: | 40 |
|  |  |
| 27.  | A circular loop antenna has a diameter of 1.5 λ has directivity of  |
| Option A: | 3.18 |
| Option B: | 6 |
| Option C: | 10 |
| Option D:  | 1.5 |
|  |  |
| 28. | Horn is treated as a/an \_\_\_\_\_\_\_\_\_\_\_\_\_ antenna. |
| Option A: | linear |
| Option B: | planar |
| Option C: | aperture |
| Option D:  | array |
|  |  |
| 29.  | Duct propagation is useful |
| Option A: | To create shadow zones |
| Option B: | To lower the frequency |
| Option C: | To lower the distance of transmission |
| Option D:  | To reduce the effect of curvature of the earth. |
|  |  |
| 30. | The directivity for a paraboloid reflector whose aperture diameter is 6λ |
| Option A: | 230 |
| Option B: | 400 |
| Option C: | 1.5 |
| Option D: | 6 |
|  |  |
| 31. | A log periodic antenna is a |
| Option A: | Frequency independent antenna |
| Option B: | Frequency dependent antenna |
| Option C: | Directional antenna |
| Option D:  | Dipole Antenna |
|  |  |
| 32. | The waves that travel within the substrates of microstrip antennas are called |
| Option A: | space waves |
| Option B: | surface waves |
| Option C: | transverse electric waves |
| Option D: | transverse magnetic waves |
|  |  |
| 33. | If the maximum electron density for F-layer in ionosphere is 4x106 electrons/cm3, then what will be the critical frequency of EM wave for F-layer? |
| Option A: | 4 MHz |
| Option B: | 9 MHz |
| Option C: | 18 MHz |
| Option D:  | 25 MHz |
|  |  |
| 34. | Which antennas are renowned as patch antennas especially adopted for space craft applications?  |
| Option A: | Aperture |
| Option B: | Microstrip |
| Option C: | Array |
| Option D:  | Lens |
|  |  |
| 35.  |  The half power beam width for a paraboloid reflector whose aperture diameter is 6λ |
| Option A: | 0.11o |
| Option B: | 60o  |
| Option C: | 23o  |
| Option D:  | 11.66o  |
|  |  |
| 36. | Which antenna is used for direction finding |
| Option A: | Loop antenna  |
| Option B: | Folded dipole  |
| Option C: | Yagi- Uda antenna  |
| Option D:  | Horn Antenna |
|  |  |
| 37. | For square corner reflector the flaring angle is……………………. |
| Option A: | 30 degrees  |
| Option B: | 60 degrees  |
| Option C: | 90 degrees  |
| Option D:  | 180 degrees  |
|  |  |
| 38. | The far field is indicated by the presence of |
| Option A: | r term |
| Option B: | 1/r term |
| Option C: | 1/r2 term  |
| Option D:  | 1/r3 term |
|  |  |
| 39.  | For avoiding ground losses, better is the surface conductivity, less is the |
| Option A: | Attenuation |
| Option B: | Phase velocity |
| Option C: | Propagation constant |
| Option D:  | Tilt angle |
|  |  |
| 40. | Ground wave propagation is useful for |
| Option A: | Microwave |
| Option B: | Medium Wave |
| Option C: | Short wave |
| Option D:  | Long distance |
|  |  |

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| **Questions** |  |
| A | **5 marks each** |
| 1 | State and explain Gauss’s Law. |
| 2 | Derive continuity equation. |
| 3 | Derive Faraday’s law with suitable application |
| 4 | Explain Coulomb’s law. |
| 5 | Explain the concept of potential gradient and the relation between electric field and potential. |
| 6 | $\overbar{E}$ = Em sin ($ωt- βz)$ $\overbar{ay}$ in free space. Find $\overbar{D}$, $\overbar{B}$, $\overbar{H}$, displacement current density. |
| 7 | $\overbar{D}$ = z r cos2$φ$ az . Calculate the charge density at (1, π/4, 3). Also find the total charge enclosed by the cylinder of radius 1m with $-2\leq z\leq 2 m$. |
| 8 | A circular loop located on x2 + y2 = 9, z=0 carries a direct current of 10 A along $\overbar{aφ}$ . Determine $\overbar{H}$ at (0,0,4) and (0,0,-4) |
| 9 | Describe five controls of array antenna. |
| 10 | Explain Loop antenna. Write its applications. |
| 11 | Write short note on near field and far field radiation. |
| 12 | Explain the cassergrain feed of reflector antenna. |
| 13 | A parabolic antenna with a circular aperture is to have a power gain of 1000 at λ = 10 cm. find the diameter of the mouth and the half power beamwidth of the antenna. |
| 14 | Define Radiation pattern, radiation intensity, Beamwidth, Radiation resistance |
| 15 | Define Directivity and Gain. And relation between directivity and Gain. |
| 16 | Explain different reflector antennas |
| 17 | Write short note on sky wave propagation. |
| 18 | Define Critical frequency, Virtual height, Maximum usable frequency. |
| 19 | Write short note on ground wave propagation. |
| 20 | Write short note on duct propagation. |
| B | **10 marks each** |
| 21 | Derive Maxwell’s equation for time varying fields in point and integral form and explain its significance. |
| 22 | State Poynting theorem. Derive mathematical expression for Poynting theorem and explain the meaning of each term. |
| 23 | Derive boundary conditions for electrostatics and magnetostatics. |
| 24 |  In free space, V= 6xy2z + 8. Find electric field intensity **E** and volume charge density ρv at point P (1, 2,-5). |
| 25 | In nonmagnetic medium $\overbar{E}=4\sin(\left(2π\*10^{7 }t-0.8x\right))\overbar{a\_{z}}$ v/m. Find $ ε\_{r,}$ $η$, time average power carried by the wave, total power crossing 100 cm2 of plane 2x+y = 5. |
| 26 | Derive an expression for E-field and H-field and radiation resistance of infinitesimal dipole. |
| 27 | Derive Friss transmission formula. State its significance in wireless communication. A radio link has 15 W transmitter connected to an antenna of 2.5 m2 effective aperature at 5 GHz. The receiving antenna has an effective aperature of 0.5 m2 and is located at a 15 km line of sight distance from the transmitting antenna. Assuming lossless, matched antennas, find the power delivered to to the receiver. |
| 28 | Design a rectangular microstrip antenna at 2.4 GHz on a substrate with dielectric constant 4.4 and substrate thickness 1.6 mm. |
| 29 | Explain how antenna radiates and also explain near field and far field of antenna. |
| 30 | Draw current distribution and radiation pattern of 0.1 λ, 0.5 λ, λ, 3 λ of simple dipole antenna. |
| 31 | Compare Half wave dipole, short dipole and infinitesimal dipole. Compare Half wave dipole and folded dipole and monopole antenna.  |
| 32 | Explain Dipole and monopole antenna and design Dipole and monopole at 700MHz. |
| 33 | Explain pattern multiplication and differentiate between broadside and endfire array. |
| 34 | Find the radiation pattern of an array of 2 isotropic point sources fed with same amplitude and phase and placed λ/2 apart. |
| 35 | What are the characterestics , advantages and disadvantages and applications of microstrip antennas. Discuss feeding mechanism of microstrip antennas. |
| 36 | Eplain Horn antenna in detail. The pyramidal horn antenna is designed at 1GHz with the dimensions A=50cm, B=40cm. Efficiency=70%, calculate the gain of the horn. |
| 37 | Explain the cassergrain feed of reflector antenna. A parabolic antenna with a circular aperture is to have a power gain of 1000 at λ = 10 cm. find the diameter of the mouth and the half power beamwidth of the antenna. |
| 38 | Explain Yagi -Uda antenna and log periodic in detail. |
| 39 | Explain Helical antenna in detail. |
| 40 | Describe formation of ionised layer in the ionosphere and describe their importance in the radio communication. |
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| **Question Number** | **Correct Option****(Enter either ‘A’ or ‘B’ or ‘C’ or ‘D’)** |
| Q1. | A |
| Q2. | C |
| Q3. | D |
| Q4 | C |
| Q5 | D |
| Q6 | A |
| Q7 | A |
| Q8. | D |
| Q9. | C |
| Q10. | D |
| Q11. | B |
| Q12. | A |
| Q13. | C |
| Q14. | D |
| Q15. | C |
| Q16. | B |
| Q17. | B |
| Q18. | D |
| Q19. | B |
| Q20. | D |
| Q21. | C |
| Q22. | C |
| Q23. | A |
| Q24. | A |
| Q25. | A |
| Q26. | B |
| Q27. | A |
| Q28. | C |
| Q29. | D |
| Q30. | A |
| Q31. | A |
| Q32. | B |
| Q33. | C |
| Q34. | B |
| Q35. | D |
| Q36. | A |
| Q37. | C |
| Q38. | B |
| Q39. | A |
| Q40. | B |

|  |  |
| --- | --- |
| **Question Number** | **Correct Option****(Enter either ‘A’ or ‘B’ or ‘C’ or ‘D’)** |
| Q1. | A |
| Q2. | C |
| Q3. | D |
| Q4 | C |
| Q5 | D |
| Q6 | A |
| Q7 | A |
| Q8. | D |
| Q9. | C |
| Q10. | D |
| Q11. | B |
| Q12. | A |
| Q13. | C |
| Q14. | D |
| Q15. | C |
| Q16. | B |
| Q17. | B |
| Q18. | D |
| Q19. | B |
| Q20. | D |
| Q21. | C |
| Q22. | C |
| Q23. | A |
| Q24. | A |
| Q25. | A |
| Q26. | B |