

# University of Mumbai

Examinations Summer 2022

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Program: Electronics and Telecommunication Engineering

Curriculum Scheme: Rev2019

Examination: Third Year Semester VI

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

## QUESTION BANK

<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
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 $\oint \mathbf{H} \cdot d\mathbf{L}$ 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 $\lambda/2$ -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 $E(\theta) = \cos \theta \cos 2\theta$ . The first null beam width of the antenna is:
Option A:	$45^\circ$
Option B:	$90^\circ$
Option C:	$180^\circ$
Option D:	$120^\circ$
20.	For end-fire array, the progressive phase shift should be
Option A:	zero
Option B:	infinite
Option C:	finite
Option D:	$-\beta d$
21.	If the length of elements of an array is greater than $\lambda/2$ , 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 $1.5 \lambda$ 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 $6\lambda$
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 $4 \times 10^6$ electrons/cm <sup>3</sup> , 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 $6\lambda$
Option A:	$0.11^\circ$
Option B:	$60^\circ$
Option C:	$23^\circ$
Option D:	$11.66^\circ$
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/r <sup>2</sup> term
Option D:	1/r <sup>3</sup> 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

Questions	
<b>A</b>	<b>5 marks each</b>
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	$\vec{E} = E_m \sin(\omega t - \beta z) \vec{a}_y$ in free space. Find $\vec{D}$ , $\vec{B}$ , $\vec{H}$ , displacement current density.
7	$\vec{D} = z r \cos^2 \varphi \vec{a}_z$ . Calculate the charge density at $(1, \pi/4, 3)$ . 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 $x^2 + y^2 = 9$ , $z=0$ carries a direct current of 10 A along $\vec{a}_\varphi$ . Determine $\vec{H}$ 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 cassegrain feed of reflector antenna.
13	A parabolic antenna with a circular aperture is to have a power gain of 1000 at $\lambda =$

	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>B</b>	<b>10 marks each</b>
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, $V = 6xy^2z + 8$ . Find electric field intensity $\mathbf{E}$ and volume charge density $\rho_v$ at point P (1, 2, -5).
25	In nonmagnetic medium $\vec{E} = 4 \sin(2\pi * 10^7 t - 0.8x) \vec{a}_z$ v/m. Find $\epsilon_r$ , $\eta$ , time average power carried by the wave, total power crossing $100 \text{ cm}^2$ 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 $2.5 \text{ m}^2$ effective aperture at 5 GHz. The receiving antenna has an effective aperture of $0.5 \text{ m}^2$ and is located at a 15 km line of sight distance from the transmitting antenna. Assuming lossless, matched antennas, find the power delivered 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 $0.1 \lambda$ , $0.5 \lambda$ , $\lambda$ , $3 \lambda$ 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 $\lambda/2$ apart.
35	What are the characteristics, advantages and disadvantages and applications of microstrip antennas. Discuss feeding mechanism of microstrip antennas.
36	Explain Horn antenna in detail. The pyramidal horn antenna is designed at 1GHz with the dimensions $A=50\text{cm}$ , $B=40\text{cm}$ . Efficiency=70%, calculate the gain of the horn.
37	Explain the Cassegrain feed of reflector antenna. A parabolic antenna with a

	circular aperture is to have a power gain of 1000 at $\lambda = 10$ 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.

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



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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

<b>Question Number</b>	<b>Correct Option (Enter either 'A' or 'B' or 'C' or 'D')</b>
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