

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

Exam.	Regular	
Level	BE	Full Marks 80
Programme	BEI, BEX	Pass Marks 32
Year / Part	III / II	Time 3 hrs.

Subject: - Propagation and Antenna (EX 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. Sketch the current distribution and radiation pattern of center fed vertical dipole for following lengths. [3]
2. Explain the following antenna parameters with necessary derivations: [4]
 - a) Fractional Bandwidth (FBW)
 - b) Antenna Gain (G)
3. What are broadside and endfire arrays? Derive an expression for the total field in case of two isotropic point sources with equal amplitude and opposite phase. [2+6]
4. What is a travelling wave antenna? Draw the structure, radiation pattern and explain the working function of an axial mode helix antenna. [1+6]
5. Explain the construction and working principle of a log-periodic antenna. Discuss its radiation characteristics and its applications. [6]
6. List the major characteristics of MW and VHF radio propagation system. [3+3]
7. Describe space wave propagation and derive the expression for the maximum line-of-sight (LOS) distance between transmitting and receiving antennas. [2+3]
8. Derive the formula to establish the relationship between maximum usable frequency (f_{MUF}) and skip distance (D) assuming earth is flat. [5]
9. Derive the Friis transmission equation for free space communication and also find out free space loss for 6 GHz and 14 GHz frequencies for 36,500 km line-of-sight distance (R). [3+4]
10. A parabolic antenna with an antenna efficiency of 85% is designed for a 4.8 GHz resonant frequency. The combined waveguide and feeder loss is 2 dB. Determine the antenna diameter if the transmitting power is 500 W and the EIRP is 46.2 dBW. [5]
11. Explain the principle of light propagation through a fiber with necessary diagrams. Derive the relation between numerical aperture and acceptance angle. [3+4]
12. Define attenuation in optical fiber communication. Explain the different types of attenuation and discuss the main factors that affect it. [2+6]
13. Write short notes on: (Any Three) [3×3]
 - a) Retarded time
 - b) Patch antenna
 - c) Radio duct
 - d) Knife edge diffraction

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Kartik

Exam.	Back		
Level	BE	Full Marks	80
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Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. What is a retarded time? Find out the retarded vector potential of an electric current at a distance, r from a point source for the far field region. [2+4]
2. Derive the expression for the total field in case of two isotropic point sources with an equal amplitude and quadrature phase and draw the radiation field patterns when spacing between the two point sources are $\lambda/2$ and $\lambda/4$. [5+2]
3. Explain the following antenna parameters: [3+3]
 - a) Equivalent isotropic radiated power (EIRP)
 - b) Radiation efficiency
4. Derive the Friis Transmission Equation for the free space propagation. Also show the free space path loss equals to $22 + 20\log(R/\lambda)$, where R is the distance between Tx and Rx antennas and λ is the wavelength of the frequency being used. [5+2]
5. Sketch the current distribution and radiation pattern of the infinitesimal dipole antenna. Design a 3 element Yagi antenna for the operating frequency band of 2785 MHz to 2895 MHz and dipole as a driven element. Take an effective length of the dipole $0.48\lambda_c$ and consider spacing is $0.15\lambda_c$. [3+6]
6. Compare resonant and non-resonant antennas. Explain the construction, working principle and features of Vee antenna. [2+6]
7. List the main characteristics of sky wave. Write its major advantages and disadvantages. [4+3]
8. Define the maximum usable frequency (f_{MUF}). Derive an expression for the relation between skip distance and critical frequency (f_{CRT}) in HF propagation assuming that the Earth is curve. [2+7]
9. Explain the principle of light propagation through an optical fiber with clear sketch. Derive the relation between numerical aperture and acceptance angle. [3+4]
10. List the advantages and disadvantages of optical fiber over metallic cable communication system. [5]
11. Write short notes on: (Any Three) [3×3]
 - a) Maximum power transfer theorem
 - b) Radio duct
 - c) Cassegrain reflector antenna
 - d) Two-ray propagation model

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2081 Ashwin

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Full Marks	80
Pass Marks	32
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Subject: - Propagation and Antenna (EX 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. What is the retarded potential? Explain the operation of $\lambda/4$ monopole antenna with the help of necessary diagrams and the field pattern. [2+6]
2. What is the reciprocity theorem and the Thevenin theorem used in antenna function? Explain with necessary diagrams. [3+3]
3. Explain the principle of pattern multiplication with a suitable example. Differentiate between a broadside array antenna and end-fire array antenna. [3+5]
4. Explain the working principle, construction, design, advantages and application of log periodic antenna. [7]
5. Define the maximum usable frequency (f_{MUF}). Find out the relationship between the critical frequency (f_{CR}) and skip distance (D) considering that the earth is curvature surface. [2+7]
6. What is an aperture antenna? Explain dual-parabolic reflector antennas with their types, characteristics and applications. [2+6]
7. A microwave link is 70 Km long. It operates at 2.8 GHz with antenna gain of 20dB at either end. What is the voltage available at the terminals of a receiver with 50 Ohm load impedance if the transmitted power is 2.4 W? Assume that it is line of sight communication in case of neglecting atmospheric losses and ignoring problems of fading. Also find out the free space loss (L_{FS}) for the communication link. [7 +2]
8. What is a tropospheric duct? List the major characteristics of UHF band of propagation. [2+5]
9. Explain the different types of losses that are considered in the optical fiber communication. What are the advantages and disadvantages of multimode fiber over the single mode fiber? [4+5]
10. Write short notes on: (Any three) [3×3]
 - a) Receiving power intensity (P_r)
 - b) Ionospheric wave
 - c) Radio frequency spectrum
 - d) Two-ray propagation model
 - e) Numerical Aperture (NA)

TRIBHUVAN UNIVERSITY
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2080 Ashwin

Exam.	Back	
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Year / Part	III / II	Time 3 hrs.

Subject: - Propagation and Antenna (EX 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. What is the retarded time? Explain the retarded vector and scalar potential with mathematical expression. [2+5]
2. What are the superposition theorem and maximum power transfer theorem used in antenna? Explain with necessary diagrams. [3+3]
3. Define pattern multiplication. Derive the expression for far field pattern of an array of two isotropic point sources having equal amplitude and quadrature phase with $d = \lambda/4$. [2+6]
4. Explain the construction, working principle and characteristics of V-antenna with necessary diagrams. [6]
5. Describe the radiation pattern, antenna gain and power-flux density with mathematical derivation if necessary. [3+3+3]
6. What is free space propagation? Derive the mathematical expression of Friis free space equation. Also, find the expression of free space path loss. [2+4+2]
7. What is the sky wave? Explain the ionospheric wave propagation showing its different layers. [2+6]
8. Find out the relation between the critical frequency (f_{cr}) and skip distance (D) considering that the Earth is flat. [7]
9. Name the parasitic elements used in Yagi-Uda array. Explain their significance in the array. Compare Yagi-Uda antenna with Log periodic dipole array. [1+2+3]
10. What are the various elements of an optical communication system? Explain each element in brief. [6]
11. Write short notes on: (Any Three) [3×3]
 - a) Effective isotropic radiated power (EIRP)
 - b) Monopole antenna
 - c) Medium wave
 - d) Optical source and Optical detector
 - e) Helical antenna

TRIBHUVAN UNIVERSITY
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Full Marks	80
Pass Marks	32
Time	3 hrs.

Subject: - Propagation and Antenna (EX 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. Explain how single wire can radiate electromagnetic waves with necessary radiation patterns and conditions. State reciprocity theorem and equality of directional patterns theorem. [4+4]
2. A 100 megahertz circuit consists of a transmitting and receiving antenna of 30 dB and 25 dB gains respectively. The power radiated by the transmitting antenna is 120 watts. Find received power in dB at a distance of 0.75 km over a free space. Derive the expression for free space path loss propagation. [5+3]
3. Describe a helical antenna with the help of a neat diagram. Explain its two modes of operation with necessary diagrams. [8]
4. How can we increase the directivity of an antenna? Compare Log-periodic Antenna and Yagi-Uda antenna with necessary diagram. [2+6]
5. Explain the different factors that affect the space wave propagation. List the major features of UHF wave propagation. [5+3]
6. Explain what will happen if a radio wave with a frequency greater than critical frequency is propagated to the ionosphere? Will it return back. Find out the derivation of the relation between critical and maximum usable frequency when the earth is assumed it not curved. [3+5]
7. Define shadow region. Explain knife-edge and rounded surface diffraction effects. [2+6]
8. What are the advantages and disadvantages of optical fibre over metallic wire? Explain the losses in optical fibre. [4+4]
9. Discuss the structure and refractive index profile of single mode and multi-mode step index fibres with related mathematical equations. [7]
10. Write short notes on: (Any Three) [3×3]
 - a) Linear polarization
 - b) Marconi antenna
 - c) Effect of curvature of earth in space wave propagation
 - d) Two ray propagation model

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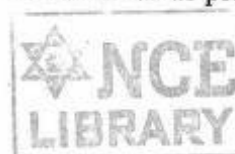
1. Define an antenna. Explain the radiation mechanism and conditions of a single wire antenna that can radiate electromagnetic waves or not. [2+4]
2. Derive the expressions for the total field in case of two isotropic point sources with (i) an equal amplitude and opposite phase (ii) an equal amplitude and same phase. [4+4]
3. Explain the following antenna parameters: [3+3]
 - a) Receiving antenna gain (G_r)
 - b) Free space loss (L_{FS})
4. List the main characteristics of UHF band. Explain the construction, working principle and characteristics of Log-periodic antenna with necessary diagram. [4+6]
5. Sketch the current distribution and radiation pattern of folded dipole antenna. Design a 5 element Yagi-Uda antenna for the operating frequency band of 785 MHz to 895 MHz and dipole as a driven element. Take an effective length of the dipole $0.48\lambda_c$. [3+6]
6. Define a critical frequency f_{CRT} . Derive an expression for the relation between skip distance and maximum usable frequency (f_{MUF}) in SW propagation assuming that the Earth is Flat. [2+6]
7. Explain the surface wave propagation. Write its major advantages and disadvantages. [5+4]
8. Explain the working principle of optical fiber communication system. What are the advantages and disadvantages of optical fiber over wireless communication system? [3+5]
9. What is an acceptance angle? Derive the expression for numerical aperture (NA) of a stepped index optical fiber. [2+5]
10. Write short notes on: (Any Three) [3×3]
 - a) Compensation theorem
 - b) Polarization
 - c) Fresnel knife edge diffraction
 - d) Aperture antenna

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1. Define an antenna. Explain the operation of infinitesimal dipole with the help of mathematical relations and the field pattern. [2+6]
2. Explain the following antenna theorems: (a) Compensation theorem (b) Maximum power transfer theorem [3+3]
3. Derive the Friis transmission equation for the free space propagation. Also find out the free space loss (L_{FS}) equation that equals to $22+20\log(d/\lambda)$, where d is distance between T_X and R_X antennas and λ is wavelength of the frequency being used. [7+3]
4. Derive an expression for the total field in case of two isotropic point sources with same amplitude and out of phase. Also show the condition of maxima, minima direction of intensity with radiation pattern. [6+2]
5. What is the main role of driven element of the Yagi-Uda antenna? Design five-element Yagi-Uda antenna with operating frequency 760 MHz and length of driven element $0.48\lambda_c$. [3+6]
6. Define the critical frequency (f_{cr}). Find out the relationship between the maximum usable frequency (f_{muf}) and skip distance (D_{skip}) considering that the earth is not curvature surface. [2+7]
7. What is a radio frequency spectrum? Explain characteristics of MW and SW radio propagation. [2+4+4]
8. Explain the principle of light propagation through a fiber with necessary diagram. Derive the relationship between numerical aperture and acceptance angle. [5+6]
9. Write short notes on: (Any Three) [3×3]
 - a) Power flux density (PFD)
 - b) Knife edge diffraction
 - c) Cassegrain antenna
 - d) Polarization
 - e) Light source and photo detector

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1. What is an antenna? Explain the different conditions for a simple conductor to be a good antenna. [2+4]
2. State the following antenna theorem: (a) Thevenin (b) Reciprocity [3+3]
3. Explain the following parameters of antenna: [3+3+3]
 - a) Directivity (b) Polarization (c) Input impedance
4. Derive an expression for the total field in case of two isotropic point sources with equal amplitude and opposite phase [8]
5. Explain the working principle, characteristics, advantage of a rhombic antenna and its applications. [7]
6. Explain in detail about the operation of parabolic reflector. What is Cassegrain feed system? [5+3]
7. Find the received power in dB at a distance of 50 km over a free space with 10 GHz frequency consisting of transmitting antenna with 25 dB gain and a receiving gain of 20 dB. The power radiated by transmitting antenna is 150 dB. [6]
8. Describe multiple HOP and explain how atmospheric ducts can be used for microwave propagation. [2+6]
9. Derive the expression between skip distance and maximum useable frequency (MUF) assuming earth's curvature. [7]
10. Explain about the principle of light propagation in optical fiber. Define numerical aperture, and acceptance angle with necessary figures and mathematical expressions. [2+2+2]
11. Write short notes on: (Any Three) [3×3]
 - a) Knife edge diffraction
 - b) Splicing
 - c) Horn Antenna.
 - d) Optical fiber loss
 - e) Microstrip antenna

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Exam.	Regular		
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Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX 653)

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- ✓ Attempt All questions.
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1. Define antenna. Explain the radiation mechanism in single wire antenna. Explain travelling wave long wire antenna with required diagrams. [2+3+3]
2. State the following antenna theorem: [2+2+4]
 - a) Compensation theorem
 - b) Reciprocity theorem

Write the features of end-fire array.
3. Explain the construction, working principle and characteristics of Rhombic antenna with necessary diagram. [8]
4. Explain the special features of reflector antenna and discuss on different types of feed used with necessary diagrams. [8]
5. Describe briefly the structure of the ionosphere and its uses for radio frequency spectrum. Write the characteristics of ground wave propagation. [4+4]
6. Derive the formula for maximum usable frequency and skip distance assuming earth is perfectly flat. [8]
7. A free space LOS (Line of Sight) microwave link operating at 10 GHz consists of a transmit and receive antenna each having gain of 25 dB. Calculate the path loss of the link and received power for 100 Km distance. Derive Friis transmission equation. [5+3]
8. What is acceptance angle? Derive the expression for Numerical Aperture with neat diagram. [3+5]
9. Explain the block diagram of optical communication system. State advantages and applications of optical fiber compared to microwave communication link. [3+4]
10. Write short notes on (Any Three): [3×3]
 - a) Effective antenna height
 - b) Fresnel Zones
 - c) Microstrip antenna
 - d) Radio frequency spectrum

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Exam.	Regular		
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- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. State the following antenna theorem: [2+2]
 - a) Maximum power transfer
 - b) Reciprocity
2. Explain the following antenna parameters: [3×2]
 - a) Radiation patterns
 - b) Polarization
 - c) Beam width
3. What is the importance of antenna array? Describe the principle of End fire and Broadside array. [2+6]
4. How are aperture type of antennas different from the conventional antennas? Explain the theory of radiation from a rectangular horn. [2+4]
5. Explain the operation of ionospheric communication with the help of different layers created in the atmosphere. [8]
6. A parabolic reflector antenna having antenna efficiency 75% is designed for 3 GHz resonant frequency with 2.5dB waveguide loss. Find out the antenna diameter if effective isotropic radiated power (EIRP) is calculated 46dBW and transmitting power is 500W. [7]
7. Draw the structure, radiation pattern and explain the working of a V-antenna. [6]
8. Explain the helical antenna with respect to structural design, working principle in axial mode and normal mode, their merits, demerits and applications. [8]
9. Explain the contribution of microscope and macroscopic fiber bends towards the bending losses in optical fiber. [7]
10. List out different optical sources and explain the losses in optical fiber briefly. [2+6]
11. Write short notes on: (Any Three) [3×4]
 - a) Effective isotropic radiated power (EIRP)
 - b) Marconi antenna
 - c) Fresnel diffraction at a knife edge
 - d) Optical source and Optical detector

TRIBHUVAN UNIVERSITY
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2076 Baisakh

Exam.	Back		
Level	BE	Full Marks	80
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Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX 653)

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1. Derive a relation for the field intensity for the array of two element isotropic radiators with current equal in magnitude but opposite in phase. Show the condition for maxima and minima direction of intensity and draw the radiation pattern. [6+3]
2. What is the importance of antenna array? Differentiate between End fire and Broadside array. [2+6]
3. Explain the following antenna parameters. [2 x 3]
 - a) Radiation patterns.
 - b) Antenna gain and directivity
 - c) Beam width
4. Sketch the current distribution and radiation pattern of center-fed vertical dipole for following lengths. [4]
 - i) $\lambda/2$
 - ii) $3\lambda/2$
5. Name the parasitic elements used in Yagi-Uda array. Explain their significance in the array. Compare Yagi-Uda antenna with Log periodic dipole array. [1+2+4]
6. Draw the structure of ionosphere and explain the mechanism of ionosphere propagation. [6]
7. Define transmission loss. Derive the Friis transmission equation of free space propagation. [2+6]
8. What is the maximum power that can be received over a distance of 15.5 Km line-of-sight free space with a 3.4 GHz frequency consisting of the transmitting antenna gain of 25 dB and receiving antenna diameter 6.4m with 75% antenna efficiency? Where transmitted power is 250W. [7]
9. Explain the construction and types of optical fiber with necessary diagrams. [5]
10. What are the various feature of graded index fiber? Explain the refractive index profile and ray transmission in a multimode graded index fiber. [3+5]
11. Write short notes on (any three): [3 x 4]
 - i) Corner reflector antenna
 - ii) V antenna
 - iii) Critical frequency
 - iv) Light sources in optical communication

TRIBHUVAN UNIVERSITY
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2076 Bhadra

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1. What is the retarded potential? Explain how electromagnetic waves are generated by a conductor. [2+4]
2. State following antenna theorem: (a) Maximum power transfer (b) Superposition theorem [3+3]
3. Explain the working principle, construction, advantages and application of V antenna. Sketch radiation patterns of both types of V antennas. [6+2]
4. Describe the antenna gain, antenna efficiency and antenna polarization with mathematical relation if necessary. [6]
5. What is reflector antenna? With necessary diagrams, explain parabolic reflector antenna and its different types of feeding systems. [1+6]
6. With neat diagram design the 5 element Yagi-Uda antenna for the receiving 100 MHz radio signal showing design steps. consider effective dipole length equal to $0.48 \lambda_c$ and spacing between elements is $0.15 \lambda_c$. [7]
7. Explain the importance of different layers in Ionospheric communication. [6]
8. Define and derive the relation of MUF and skip distance for the case of flat earth. [7]
9. Derive Friis transmission equation and path loss in case of free space propagation and find out distance of line of sight as: $d = 3.57(\sqrt{h_t} + \sqrt{h_r}) \text{ Km}$ [4+3]
10. Explain the construction and propagation mechanism and application of different types of optical fibers. Define numerical aperture. [5+2]
11. Where are optical fibers most widely used? Explain the various advantages and disadvantages of optical fibers over metal wire communication. [2+5]
12. Write short notes on: (Any two) [2×3]
 - a) Knife edge diffraction phenomenon
 - b) Rhombic Antenna
 - c) MW Propagation

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1. What is an antenna? Explain the conditions that any type of conductor can radiate electromagnetic wave or not. [2+4]
2. State the reciprocity theorem and compensation theorem for an antenna system. [2+2]
3. Explain the following antenna parameters: (i) Antenna efficiency (ii) Polarization (iii) Band width [3×3]
4. Explain all the layers of ionosphere and their importance to radio wave communication. [6]
5. Microwave link is assumed to be free space condition. The antenna gains are each 40 dB, the frequency is 10 GHz and the path length is 90 km. Calculate the transmission path loss and received power for transmitted power of 10 Kw. [6]
6. What do you mean by aperture antenna? Explain the construction, working principle and the feeding mechanism for Parabolic Antenna. [1+6]
7. Explain the working principle, construction, design, advantages and application of Yagi-Uda antenna. [7]
8. What is Maximum Usable Frequency (MUF)? Derive the expression of MUF critical frequency (f_{ct}) and skip distance assuming curve earth. [2+8]
9. Describe with the aid of neat diagram the basic principle of total internal reflection that enables the fiber to work as a "light conduit". [6]
10. List out different optical sources and explain the losses in optical fiber briefly. [2+5]
11. Write short notes on: (any three) [3×4]
 - i) Marconi antenna
 - ii) Knife edge diffraction
 - iii) Radio frequency spectrum
 - iv) Optical source and Optical detector

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1. What is an antenna? Explain how electromagnetic waves are generated by a conductor. [2+4]
2. Derive an expression for the total field in case of two isotropic point sources with equal amplitude and opposite phase. [6]
3. Name the parasitic elements used in Yagi-Uda array. Explain their significance in the array. Compare Yagi-Uda antenna with Log periodic dipole array. [1+2+4]
4. Explain skip distance and derive the expression for skip distance (D) for flat earth surface. [8]
5. Describe the antenna gain, antenna efficiency and directivity of antenna with mathematical derivation if necessary. [6]
6. Find the received power (in dBm) at a distance of 0.5 km over a free space 1 GHz circuit consisting of a transmitting antenna with 25 dB gain and a receiving antenna gain of 20 dB. The power radiated by the transmitting antenna is 150 W. [5]
7. What is ionosphere? Explain the ionosphere wave propagation showing its different layers. [1+5]
8. List the major characteristics of Marconi antenna with necessary figures. [6]
9. Discuss loss or signal attenuation in an optical fiber with respect to absorption, scattering and bending losses. [8]
10. Define free space communication. Derive complete equation including path loss using Friis space communication. [2+8]
11. Write short notes on: (any three) [3×4]
 - a) Parabolic reflector antenna
 - b) Compare between broadside array and endfire array
 - c) Knife edge diffraction phenomenon
 - d) Optical source and Optical detector

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1. Explain retarded potential and their importance. Describe infinitesimal dipole with the help of suitable diagram, mathematical relations and the field pattern. [2+6]
2. Explain the following antenna parameters. [2+2+2]
 - (a) Radiation pattern (b) Antenna gain (c) Polarization
3. State following antenna theorems: (a) Reciprocity (b) Compensation [2+2]
4. What is Skip distance? Derive the relationship between critical frequency (f_{cr}) and Skip distance (D) assuming flat earth for both antennas. [7]
5. A parabolic reflector antenna having antenna efficiency 75% is designed for 5GHz resonance frequency with 3dB waveguide loss. If Effective Isotropic Radiated Power (EIRP) is calculated 50dBW and transmitting power is 600W calculate its diameter. [8]
6. The antenna of a TV transmitter is located at a height of 125m above ground level. Calculate the distance up to which the LOS communication is possible if the height of receiving antenna is to be 9m. [6]
7. Describe the construction, working principle, and design of Yagi-Uda antenna with necessary diagrams. [8]
8. What is a radio frequency spectrum? Give major propagation characteristics of VHF and UHF bands. [2+6]
9. Define the following: (a) MUF (b) Virtual height
10. Draw the optical fiber communication system. What are the advantages and disadvantages of optical fibers over metal wire communication? [3+6]
11. Write short notes on: (Any four) [4×4]
 - a) Helical antenna
 - b) Super refraction
 - c) Knife edge diffraction
 - d) Numerical aperture (NA)
 - e) Logarithmic antenna

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain briefly radiation mechanism in single wire antenna. [5]
2. What is a linear array? Differentiate between a broadside array and end firearray. [1+4]
3. Explain the constructional features, operating principle and characteristics of rhombic antenna. [8]
4. Explain parabolic reflector antenna with characteristics, radiation pattern and feed system. [7]
5. Briefly discuss the propagation characteristics of space wave and sky wave. [8]
6. A parabolic reflector antenna having the antenna efficiency 85% is designed for 3 GHz resonant frequency with 2.5 dB wavelength loss. Find out the antenna diameter if effective isotropic radiated power (EIRP) is calculated 46 dBW and transmitting power is 500 watt. [8]
7. Write down the factors which affect the surface wave communication. Explain the major characteristics of MW and SW radio propagation. [2+6]
8. Derive the expression for the path loss in case of radio wave propagation. [6]
9. What are the various elements of an optical communication system? Explain each element in brief. [8]
10. Compare optical fiber communication with cable and radio communication systems. Describe numerical aperture (NA) in optical communication system. [4+4]
11. Write short notes on: (Any three) [3×3]
 - i) Helical antenna
 - ii) Tropospheric scatter propagation
 - iii) Friis transmission equation
 - iv) Printed antenna
 - v) Pyramidal horn antenna

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. Define an antenna? List the various types of wired antenna with their radiation pattern and polarization. [2+4]
2. List the parameters of antenna and explain any three of them. [2+6]
3. State the following antenna theorems: [2+2]
 - i) Compensation
 - ii) Reciprocity
4. Explain the construction, working principle and design of log-periodic antenna. [7]
5. Describe the cassegrain method of feeding parabolic reflectors. [6]
6. Explain the phenomenon of Duct propagation. [5]
7. Find the maximum range of tropospheric transmission for which the transmitting antenna height is 100 ft and receiving antenna is 50 ft. [5]
8. What is the main difference between standing wave antenna and travelling wave antenna? Explain with a neat sketch the construction, working principal and characteristic of V antenna. [3+5]
9. Explain the construction, working principle and design of a Yagi-antenna. Design a 5 element Yagi antenna with operating frequency of 800MHZ and dipole as driven element. Take effective dipole length of 0.48π spacing. [5+6]
10. Explain the construction, light propagation mechanism and application of different types of optical fiber. [8]
11. Write short notes on: (any three) [3×4]
 - i) Marconi antenna
 - ii) Knife edge diffraction phenomenon
 - iii) Effective isotropic radiated power (EIRP)
 - iv) Multimode graded index fiber
 - v) MW propagation

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. What is retarded potential? Write the expression of retarded scalar potential and vector potential of infinitesimal dipole antenna in fraunhofer for field region. [2+4]
2. Explain how single wire can radiates electromagnetic waves with necessary radiation patterns and polarization. List the characteristics of omnidirectional antenna. [4]
3. Explain the following antenna parameters: [2×4]
 - a) Antenna efficiency
 - b) Directivity
4. Write the characteristics, working principle and operation of Rhombic antenna. [7]
5. Explain the phenomenon of Duct propagation. [5]
6. A 100 MHz circuit consists of a transmitting and receiving antenna of 30 dB and 25 dB gains respectively. The power radiated by the transmitting antenna is 120 W. using Friis transmission equation find the received power at a distance of 0.75 km over a free space. [6]
7. With neat diagram design the 5 element Yagi-Uda antenna for the receiving 100MHz radio signal showing design steps. [6]
8. Explain the ionospheric wave propagation showing its different layers. [6]
9. Find out the line of sight distance between the transmitting antenna and receiving antenna. If the transmitting antenna height is 45 m. and the receiving antenna height is 25 m. [Given: the radius of Earth is 6,378 km). [6]
10. What are the various elements of an optical communication system? Explain each element in brief. [8]
11. Compare the configuration of different types of fiber. Mention the advantages of single mode fiber. [4+2]
12. Write short notes on: (any four) [4×3]
 - a) Marconi Antenna
 - b) Friis equation and path loss in case of free space propagation
 - c) Knife edge diffraction phenomenon
 - d) NA for meridional rays in optical fiber
 - e) Radio frequency spectrum

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
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1. Sketch the current distribution and radiation pattern of center – fed vertical dipole for following lengths. [6]
 - i) λ
 - ii) $3\lambda/2$
 - iii) 2λ
2. State the following antenna theorems: [2+2]
 - i) Superposition
 - ii) Reciprocity
3. Describe antenna gain, antenna efficiency and beam width of antenna with mathematical derivations if necessary. [6]
4. Why we need antenna array rather than changing the length of single antenna? Derive the expression and draw the pattern for an array of two-isotropic radiators with: [2+6]
 - i) Equal amplitude and phase
 - ii) Equal amplitude and opposite phase
5. What is travelling wave antenna? Explain V-antenna with its characteristics and its types. [2+5]
6. Explain the following for ionospheric region: [2×2]
 - i) Skip zone
 - ii) Virtual height of a layer
7. Find out the relation between the critical frequency (f_{cr}) and the skip distance (D) if it is considered the Earth is flat for both antennas. [8]
8. What are the advantages of Yagi antenna? Design a 3-element yagi antenna with the operating frequency of 3GHz and dipole as driven element. [2+4]
9. Define maximum usable frequency. Derive the relation between the critical frequency and maximum usable frequency. [2+4]
10. What is an optical fiber? What are the different types of losses you can visualize in optical fiber communication? What are the advantages and disadvantages of multimode fiber over the single mode fiber? [1+4+5]
11. What properties do you think to be considered when an optical fiber is to be selected for any communication system? [6]
12. Write short notes on: (any three) [3×3]
 - i) Horn antenna
 - ii) Knife edge diffraction
 - iii) Effective isotropic radiated power
 - iv) Linear polarization
 - v) Parasitic array antenna

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. Derive a relation for the field intensity for the array of two elements isotropic radiators in various conditions. Show the condition for broad side and end fire array with necessary diagrams. [5+6]
2. Explain any five parameters of antenna. [5]
3. Compare Yagi antenna with log periodic antenna. Explain the working principle and design of log-periodic antenna. [2+8]
4. A parabolic reflector antenna having antenna efficiency 85% is designed for 3 GHz resonant frequency with 2.5 dB waveguide loss. Find out the antenna diameter if effective isotropic radiated power (EIRP) is calculated 46 dBW and transmitting power is 500 W. [8]
5. Write down the factors which affect the space wave communication. Explain the major characteristics of MW and SW radio propagation. [5+6]
6. With a mathematical relation of refractive index of ionospheric layer derive a relation of critical frequency and maximum usable frequency (MUF) of radio waves with necessary explanation. Consider the earth is not curved. [8]
7. How do you get Friis transmission equation and path loss in case of free space wave propagation? [4+3]
8. Explain the working principle and design of (a) Marconi antenna (b) Rhombic antenna. [5+5]
9. Explain the construction, light propagation mechanism and application of different types of optical fiber. [10]

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New Back (2066 & Later Batch)			
Examr.	BE	Full Marks	80
Level	BEX	Pass Marks	32
Programme	III / II	Time	3 hrs.
Year / Part			

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Describe the operation of infinitesimal dipole with necessary mathematical relation for electric field and magnetic field. What are basic antenna parameters? Explain briefly on any four parameters. [4+4]
2. Explain the different layers of ionosphere. What are the major characteristics of ionosphere? [5+3]
3. Explain the duct propagation mechanism in radio wave propagation. Define critical frequency and MUF with necessary derivations. [4+4]
4. What is the main difference between standing wave antenna and travelling wave antenna? Explain with a neat sketch the construction, working principle and characteristics of Rhombic antenna. [2+6]
5. What are the advantages of aperture antenna? List out the type of horn antenna and explain rectangular horn briefly. [2+6]
6. Why antenna radiation pattern lobes are important during antenna design? Derive the relation for the field intensity of linear array of 2 isotropic radiators with equal potential and 180° out of phase. [3+3]
7. What is travelling wave antenna? Explain the construction, working principle and characteristics of a V-antenna. [1+7]
8. Derive the expression for free space path loss propagation. Calculate free space path loss for 6 GHz frequency, if transmitter and receiver are 10,500 km line of sight apart. [5+3]
9. Explain the block diagram of optical communication and list out the advantages and disadvantages of it over cable communication. [3+5]
10. Describe the following terms: Numerical Aperture and Dispersion in Optical Fiber. [6]
11. Explain fresnel zone and knife edge diffraction. [4]

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. Define antenna. Describe the operation of infinitesimal dipole with the help of mathematical relations and the field pattern. [2+8]
2. Explain the following antenna parameters: [2+2]
 - a) Half Power Beamwidth
 - b) Directivity
3. State the principle of pattern multiplication. Use the principle to obtain a wave pattern for array of two short dipoles for following cases where (d) = dipole separation and (α) = current phase difference. [2+3+3]
 - a) Dipoles aligned perpendicular to the array axis with $d = \lambda/2$, $\alpha = 0$
 - b) Dipoles aligned perpendicular to the array axis with $d = \lambda/2$, $\alpha = \pi$
4. Explain the working principle of Rhombic antenna. [4]
5. Derive the relation for flare angle and length of a pyramidal horn antenna. [5]
6. Explain the construction, working principle and design feature of Log Periodic Antenna. [10]
7. With a neat diagram, explain the designation of radio waves according to the path they follow during propagation. Also, compare the propagation characteristics for different radio bands. [4+6]
8. a) Describe knife edge diffraction phenomenon. [5]
 - b) Explain the effect of space wave propagation on the ground of plane and actual earth. [5]
9. Where are optical fibres most widely used? Explain the various advantages and disadvantages of optical fibers over metal wire communication. [10]
10. What is an acceptance angle? Derive an expression to calculate the acceptance angle. [2+7]

New Back (2066 & Later Batch)			
Exam.	BE	Full Marks	80
Level	BEX	Pass Marks	32
Programme	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates ~~are~~ required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. How does a single wire act as an antenna? During the transmission mode, explain the mechanism involved by which the electric lines of force are detached from the dipole antenna to form free space waves. [2+4]
2. Differentiate between: $\frac{\lambda}{2}$, λ and $3\frac{\lambda}{2}$ length dipoles in terms of their individual radiation pattern, self impedance and directivity; where λ is the wavelength of operation frequency. [6]
3. Explain the following antenna parameters: [2+2]
 - i) Radiation Pattern Lobes
 - ii) Polarization
4. Derive a mathematical relation to calculate the field intensity of an array for two element isotropic radiators. Draw the Resultant pattern for an End Fire Array with dipoles perpendicular to the axis of array with $d = \frac{\lambda}{2}$ & $\alpha = \pi$. Where, λ is the wavelength of the operating frequency? [4+4]
5. Explain the construction, working principle and characteristics of a V antenna with necessary diagrams. [7]
6. Explain the construction and working principle of a log periodic antenna. [8]
7. Define for ionospheric region: [2+2]
 - i) Critical frequency
 - ii) Virtual height of a layer
8. Assume that reflection take place at a height of 400 km and that the maximum density in the ionosphere corresponds to a 0.8 refractive index at 15 MHz. What will be the range (assume flat earth) for which the MUF is 20 MHz. [5]
9. Explain the phenomenon of Duct propagation. [4]
10. Describe Knife edge diffraction. [2]
11. Explain the effect of space wave propagation on the ground of plane and actual earth. [10]
12. What are advantages and disadvantages of multimode fiber over single mode fiber? Derive Expression of Numerical Aperture of a stepped index optical fiber. [3+7]
13. Briefly explain the advantage of optical fiber over metallised wire. [6]

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
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Year / Part	III / II	Time	3 hrs.

Subject: - Propagation and Antenna (EX653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. Explain the characteristics of $\lambda/2$, λ and 1.28λ length dipoles where λ is the wavelength of operating frequency. [6]
2. Explain the mechanism by which the electric line of forces are detached from the dipole antenna to form the free space waves. [4]
3. Explain the following antenna parameters; (a) Antenna efficiency (b) Polarization. [4]
4. Define antenna arrays and also derive a mathematical expression for the array of two element isotropic radiators. [6]
5. Explain the construction, working principle and design of an Yagi antenna. [10]
6. Explain the fundamentals as well as importance of ground and ground system construction in vertical monopole antenna. [8]
7. In case of radio wave propagation define surface, ground reflected, direct and sky waves. Also, compare the propagation characteristics of different bands of radio frequencies. [4+8]
8. Derive an expression for the path loss in case of radio wave propagation. [12]
9. Explain the advantages and disadvantages of optical fibre communication over the metallic wire communication system. [12]
10. Explain the dispersion and attenuation properties of an optical fibre. [6]
