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MAR_APR 2026 SUMMER EXAMINATION

1154 B.Tech. CBCS

Sub. Name: Antenna and Wave Propagation

Sub. Code: 66314/81859/81649

Day and Date: Saturday ,30-05-2026 **Total Marks: 70**

Time: 10:30 AM To 01:00 PM

Instructions:
1. **All questions are compulsory**
2. **Assume suitable data wherever necessary and mention it boldly**
3. **Figures to the right indicate full marks**
4. **Use of Scientific calculator is allowed**

Q1) Solve following MCQ. **[14]**

i. Which ionization layer exists during daytime & usually vanishes at night due to highest recombination rate?
- A. D-region
- B. Normal E-region
- C. Sporadic E-region
- D. Appleton region

ii. In broadside array, all the elements in the array should have similar excitation along with similar amplitude excitation for maximum radiation.
- A. Phase
- B. Frequency
- C. Current
- D. Voltage

iii. The biggest disadvantage of CW Doppler radar is that
- A. It does not give the target velocity
- B. It does not give the target range
- C. A transponder is required at the target
- D. It does not give the target position

iv. In a non-isotropic directional antenna, which radiating lobe axis makes an angle of 180° w.r.t. major beam of an antenna?
- A. Minor lobe
- B. Side lobe
- C. Back lobe
- D. None of the above

v. If an antenna draws 12 A current and radiates 4 kW, then what will be its radiation resistance?
- A. 22.22 ohm

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B. 27.77 ohm
C. 33.33 ohm
D. 39.77 ohm

vi. One of the advantages of the Microstrip antenna compared to a conventional microwave antenna is _____
A. Small size
B. Low gain
C. No surface wave excitation
D. High gain

vii. The minimum value of the directivity of an antenna is.....
A. Infinite
B. Zero
C. Unity
D. None of these

Q2) Answer any two **[14]**

a. Explain with suitable example antenna pattern synthesis by pattern multiplication. **[7]**

b. Two spacecraft are separated by 3 Mm. Each has an antenna with D = 200 operating at 2 GHz. If craft A's receiver requires 20 dB over 1 pW, what transmitter power is required on craft B to achieve this signal level? **[7]**

c. Explain transmission line model of rectangular microstrip antenna.

Q3) Answer any two **[14]**

a. Derive equation for normalised value of total electrical field due to linear array of n-isotropic point sources of equal amplitude and spacing **[7]**

b. . **[7]**

Calculate the approximate directivities from the half-power beam widths of the three unidirectional antennas having power patterns as follows:

$$P(\theta,\phi) = P_m \sin\theta \sin^2\phi$$

$$P(\theta,\phi) = P_m \sin\theta \sin^3\phi$$

$$P(\theta,\phi) = P_m \sin^2\theta \sin^3\phi$$

$P(\theta,\phi)$ has a value only for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and is zero elsewhere.

c. With neat diagram, explain the different feeding methods of the microstrip antenna. **[7]**

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Q4) Answer any two **[14]**

a. With the help of geometry of direct and ground reflected waves, obtain the equation for reflection factor for horizontal and vertical polarization **[7]**

b. Explain ionosphere and its regular & irregular variations. **[7]**

c. Derive RADAR range equation. **[7]**

Q5) Answer any two **[14]**

a. Explain the space wave and the surface wave propagation. **[7]**

b. Calculate maximum range of deep space radar operating at 2.5GHz and using peak pulse power of and using peak pulse power of 25MW. The antenna diameter is 64 m, the target cross section is 1 m2 and the receiver noise figure is 1.1.The receiver BW is 5KHz. **[7]**

c. Find the relative permittivity of D, E & F layers of the ionosphere for EM waves of frequency 50 MHz. The electronics density of D layer 400e-/cm3 , E layer 5 x 10^5 e-/cm3 and F layer 2 x 10^6 e-/cm3 **[7]**

End Of Question Paper

Important Note for Chief Exam Officer / SRPD Coordinator / Sr Supervisor/ Student -
This Question Paper may be distributed for following Subjects as common code.
सदरची प्रश्नपत्रिका खालील विषयांकरिता वितरित करता येईल.

1] (101) Bachelor of Engineering (81859) Antenna and Wave Propagation Part 3 SEM 6
2] (1154) B.Tech. CBCS (81649) Antenna and Wave Propagation Part 3 SEM 6
3] (101) Bachelor of Engineering (66314) Antenna and Wave Propagation Part 3 SEM 5

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