

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code

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Sixth Semester B.E. Degree Examinations, September/October 2024

MICROWAVES AND ANTENNAS

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions choosing ONE full Question from each Module.

2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>
<u>Module-1</u>			
1.	a. Explain the working of Reflex Klystron oscillator along with its oscillation mechanism.	08	(2 :1: 1.3.1)
	b. What is smith chart and list the characteristics of the smith chart.	06	(2 :1: 1.3.1)
	c. Define Standing Wave Ratio (SWR). Derive the relationship between VSWR and the reflection coefficient.	06	(3 :1: 1.3.1)
(OR)			
2.	a. Derive transmission line equations by the method of distributed circuit theory considering the elementary section of a transmission line.	08	(2 :1: 1.3.1)
	b. Explain the microwave system with the aid of a block diagram.	06	(2 :1: 1.3.1)
	c. The primary constants of a transmission line/m are specified as $R=2\ \Omega$, $L=8\ \text{nH}$, $G=0.5\ \text{mS}$, $C=0.23\ \text{pF}$, Calculate i) characteristics impedance (Z_0) ii) Propagation Constant (γ) if $f=1\ \text{GHz}$	06	(3 :1: 1.4.1)
<u>Module-2</u>			
3.	a. State and explain the properties of S-parameters as applicable to microwave networks.	10	(2 :2: 1.3.1)
	b. Derive the S-matrix representation of a multiport network. Also, define the various losses in terms of S-parameters	10	(2 :2: 1.4.1)
(OR)			
4.	a. Derive the S-matrix for magic tee by considering the characteristics (Properties) of the magic tee and also list the applications of magic tee.	10	(2 :2: 1.3.1)
	b. Illustrate the working of a precision rotary variable attenuator, with the help of a neat diagram and E-field components.	10	(2 :2: 1.3.1)
<u>Module-3</u>			
5.	a. Define the following: (i) Radiation intensity (ii) Aperture of the antenna (iii) Beam Area (iv) Gain (v) Radiation Pattern	10	(2 :3: 1.3.1)
	b. Derive the Friss transmission formula for the radio communication link.	06	(3 :3: 1.4.1)
	c. Define directivity. Obtain the relationship between directivity and beam area to show that smaller the beam area, larger is the directivity.	04	(3 :3: 1.3.1)
(OR)			

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)

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|----|----|---|----|---------------|
| 6. | a. | Derive the radiation resistance of a short dipole. | 10 | (3 :4: 1.4.1) |
| | b. | Show that the directivity of $\lambda/2$ dipole is 1.644. | 06 | (3 :4: 1.4.1) |
| | c. | Write a short note on folded dipole. | 04 | (2 :4: 1.3.1) |

Module-4

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| 7. | a. | Derive array factor for uniformly excited equally spaced linear n element isotropic array with necessary illustrations. | 08 | (3 :4: 1.3.1) |
| | b. | Obtain the expression for the total field in the case of two isotropic point sources with the same amplitude and opposite phase. Plot the expected relative field pattern. | 08 | (2 :4: 1.3.1) |
| | c. | Calculate the exact directivity for the given unidirectional radiation intensity pattern: $U=U_m \sin^2\theta$ (Take: $0<\theta<90^\circ$ and $0<\phi<360^\circ$) | 04 | (3 :4: 2.1.2) |

(OR)

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| 8. | a. | With a neat sketch explain different types of smart antennas. | 10 | (2 :4: 1.3.1) |
| | b. | State and explain the power theorem as applicable to an Isotropic source. | 06 | (2 :4: 1.3.1) |
| | c. | List the applications of smart antennas. | 04 | (1:4: 1.3.1) |

Module-5

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| 9. | a. | Illustrate different feeding methods of micro-strip patch antennas with neat sketches. | 10 | (2:5:1.3.1) |
| | b. | Explain the design aspects of a rectangular micro-strip patch antenna with necessary sketches and equations. | 06 | (3:5:1.4.1) |
| | c. | List the advantages and applications of micro-strip antennas. | 04 | (1:5: 1.3.1) |

(OR)

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| 10 | a. | Describe a helical antenna with the help of a neat diagram. Explain its modes of operations with necessary illustrations. | 10 | (2:5:1.3.1) |
| | b. | Discuss the following:
(i) Log periodic antenna (ii) Parabolic reflector antenna. | 10 | (2:5:1.3.1) |

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