

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH.
BRANCH: ECE

SUBJECT: EC505 MICROWAVE THEORY AND ANTENNA

SEMESTER: 1ST
SESSION: MO/2025

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.
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		CO	BL
Q.1(a)	Compute input impedance of a transmission line attached to a voltage source and terminated by a load impedance. Obtain the modified generalised S-matrix representation of a 2-port network when a transmission line of characteristic Impedance Z_{01} and length l_1 is introduced between the source impedance and the network and another transmission line of characteristic Impedance Z_{02} and length l_2 is introduced between the network and the load impedance.	[5] CO2	4
Q.1(b)	Using signal flow graph model compute the input reflection coefficient (b_1/a_1) and the factor (a_1/b_s) for a sourced and terminated 2-port network with input and output transmission lines	[5] CO2	3
Q.2(a)	Prove that three-port network cannot be lossless, reciprocal and matched at all ports. Obtain the S-matrix of matched resistive (lossy) divider and power losses at the other two ports.	[5] CO2	4
Q.2(b)	Derive the S-matrix of a single section coupled-line directional coupler. Derive the even mode impedance, Z_{oe} and odd mode impedance, Z_{oo} and coupling coefficient, C using even-odd mode analysis.	[5] CO2	4
Q.3(a)	Obtain the Bloch-Floquet's equation for wave propagation through an arbitrary periodic structure. Illustrate dispersion characteristics with an example.	[5] CO3	3
Q.3(b)	Analyse a periodic capacitively loaded transmission line with $Z_0 = 50 \Omega$, d (distance of separation between the short capacitive stubs) = 1.0 cm and $C_0 = 2.666$ pF. Compute propagation constant, phase velocity and Bloch impedance at $f = 3.0$ GHz. Assume $k = k_0$	[5] CO3	4
Q.4(a)	State the principle of radiation mechanism encompassing the basic laws of electromagnetism. Using polar plot draw the E-Plane and H-plane radiation pattern of hertzian dipole antenna.	[5] CO5	4
Q.4(b)	Draw the 3-D radiation power pattern of a dipole antenna using pattern multiplication method.	[5] CO5	3
Q.5(a)	Write the following about antennas LEO Satellite Link applications: Types of antennas, operation platform, frequency of operation, available bandwidth, polarization, radiation efficiency, range and transmission power.	[5] CO4	3
Q.5(b)	Write the following about antennas Base Station Antennas applications: Types of antennas, operation platform, frequency of operation, bandwidth, polarization, radiation efficiency, range and transmission power.	[5] CO4	3

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