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

CLASS: MTECH **SEMESTER: ST**
BRANCH: ECE **SESSION: MO/2024**

SUBJECT: EC505 MICROWAVE THEORY AND ANTENNA

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.

			CO	BL
Q.1(a)	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. Compute input impedance of a transmission line attached to a voltage source and terminated by a load impedance.	[5]	CO2	4
Q.1(b)	State the basic decomposition rules of a signal flow graph (SFG) in analysis of a microwave network. Using SFG model for a sourced and terminated 2-port network with input and output transmission lines, compute the input reflection coefficient (b_1/a_1) and the factor ($a_1/b_{s)}$	[5]	C02	3
Q.2(a)	Compute the values of design parameters of a Wilkinson power divider with 2:3 outputs power division, using Even-odd mode analysis.	[5]	CO2	4
Q.2(b)	Derive the S-matrix of a single section couple line directional coupler. using even-odd mode analysis. Derive the even mode, Z_{oe} and odd mode impedance, Z_{oo} and coupling coefficient, C using even-odd mode analysis.	[5]	CO2	4
Q.3(a)	Derive the Bloch-Floquet's equation for wave propagation through an arbitrary periodic structure. Illustrate dispersion characteristic with an example.	[5]	CO3	3
Q.3(b)	Analyse a periodic capacitively loaded transmission line with Z_0 *=50 Ω, 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. Compute the maximum effective area of a hertzian dipole antenna.	[5]	CO5	4
Q.4(b)	Illustrate the measurement procedure of E-plane, H-plane radiation power pattern of an antenna under testing. Explain through gain transfer method how a radar / communication antenna is tested practically?	[5]	CO5	3
Q.5(a)	Write the following about antennas for ground penetrating radar 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 for medical radar applications: Types of antennas, operation platform, frequency of operation, bandwidth, polarization, radiation efficiency, Range and transmission power.	[5]	CO4	3

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