

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

**CLASS: B. TECH
BRANCH: ECE**

**SEMESTER : VII
SESSION : MO/2023**

SUBJECT: EC401R1 MICROWAVE THEORY AND TECHNIQUES

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 hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Q.1(a)	Discuss the characteristics of microwaves. List at least four practical applications of microwave circuits/components.	[5]	CO CO1	BL BL1
Q.1(b)	Consider a lossless two-port network. (a) If the network is reciprocal, show that $ S_{21} ^2 = 1 - S_{11} ^2$. (b) If the network is nonreciprocal, show that it is impossible to have unidirectional transmission, where $S_{12} = 0$ and $S_{21} \neq 0$.	[5]	CO2	BL3
Q.2(a)	Explain the shortcomings of T-junction divider. How they can be overcome?	[5]	CO4, CO5	BL4
Q.2(b)	Design a 50-ohm branch-line quadrature hybrid junction at 3 GHz.	[5]	CO4, CO5	BL6
Q.3(a)	Explain the process of velocity modulation in a two cavity Klystron with the help of suitable diagram. What are the various applications of Reflex Klystron?	[5]	CO3	BL4
Q.3(b)	Explain how oscillations are sustained in the cavity magnetron with the suitable sketches of pi mode operation.	[5]	CO3	BL4
Q.4(a)	Write the 1 st Kuroda's identity and prove the same.	[5]	CO2, CO4, CO5	BL3
Q.4(b)	Design a 3 rd order Chebyshev low-pass filter whose input and output are matched to a 50 Ω impedance and that meets the following specifications: cut-off frequency of 3 GHz; equi-ripple of 0.5 dB. Filter coefficients are given as $g_1 = g_3 = 1.5963$, $g_2 = 1.0967$ and $g_4 = 1.0$.	[5]	CO2, CO4, CO5	BL6
Q.5(a)	With the help of suitable diagram show that the transmission of power takes place in cyclic order in a 4-port ferrite-based circulator.	[5]	CO4, CO5	BL4
Q.5(b)	Write scattering matrix of ideal isolator. In an isolator the isolation is 30dB and insertion loss is 0.4dB. Find its scattering parameter.	[5]	CO4, CO5	BL5

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