K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

May – June 2025
PhD Program: Academic Year 2024-25
Course Work Examination
Course Code: **PhD102** and Course Name: **Electromagnetic Waves in Guided and Wireless Media**
Date: 21-05-2025 Duration: 2.00 PM to 4.30 PM Max. Marks: 70

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

	Question	Max. Marks	CO	BT Level
Qu-1	Solve any **Six** questions out of **Eight.**	**30**		
i)	Define the characteristic impedance of a transmission line and explain its significance.	5	CO1	U
ii)	What is the reflection coefficient? How does it affect signal transmission?	5	CO1	U
iii)	Explain how the Smith Chart helps in impedance matching.	5	CO2	U
iv)	Explain the concept of a uniform plane wave in free space.	5	CO3	U
v)	Describe the effect of lossy media on the propagation of electromagnetic waves.	5	C04	U
vi)	Differentiate between near field and far field in antenna theory.	5	CO6	U
vii)	List the types of wave guides and one application of each.	5	CO5	U
viii)	Define diffraction and explain its significance in wireless communication.	5	CO6	U
Qu-2	Solve any **TWO** questions out of **THREE.**	**20**		
i)	Derive the expressions for voltage and current on a transmission line with sinusoidal excitation. Explain the role of the propagation constant.	10	CO1	An
ii)	Describe the modes of propagation in rectangular wave guides. Derive the cutoff frequency for TE and TM modes.	10	CO3	U
iii)	A 50 Ω transmission line is terminated with a load of Z_L=25−j50 Ω. The operating frequency is 1 GHz. 1) Normalize the load impedance. 2) Plot on the Smith Chart and determine the reflection coefficient. 3) Find the location of the first voltage minimum. 4) Design a single-stub matching network (using short-circuited stub) to match the load.	10	CO2	Ap

Qu-3	Solve any **TWO** questions out of **THREE**.	**20**		
i)	A rectangular waveguide has dimensions a=3 cm, b=1.5 cm, operating at 10 GHz. 1) Calculate the cutoff frequencies of TE10, TE01, and TE11 modes. 2) Identify which modes can propagate. 3) Compute the wavelength and phase velocity of the TE10 mode.	10	CO4	Ap
ii)	Describe how electromagnetic wave energy propagates in optical fibers and compare with slab wave guides.	10	CO5	
iii)	Discuss wireless channel modeling in detail. Explain the role of diffraction, interference, and multipath fading.	10	CO6	

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