R22 Regulation *Subject code: 4E7DA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech VII Semester Regular Examinations, November 2025

MICROWAVE ENGINEERING

(ECE)

Maximum Marks: 60 Date: 24.11.2025 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X1M=10 Marks)		Marks	CO	BloomTx
1.a)	Define the phase and group velocities.	1M	1	1
b)	Draw the field pattern of TE_{10} mode in rectangular waveguide.	1M	1	2
c)	What is the need of Attenuator?	1M	2	3
d)	Name the three types of coupling devices	1M	2	1
e)	What are slow wave structures? Why are they used	1M	3	2
f)	Draw apple-gate diagram for two-cavity Klystron?	1M	3	1
g)	What is the condition for phase angle of the Magnetron.	1M	4	2
h)	How to separate a pi-mode in Magnetron?	1M	4	3
i)	State the various methods for measuring attenuation?	1M	5	1
j)	What is a bolometer?	1M	5	1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	Bloom Tx
2	Derive all the field equations of waveguide in both TE and TM modes.	10M	1	3
	OR			
3	A rectangular waveguide has the following characteristics: b =1.5cm, a = 3.0cm, μ_r =1, and ε_r=2.25 a) Calculate the cutoff wavelength and frequency for the TE_{10}, TE_{20} and TM_{11} modes. b) Calculate λ_g and Z_o at 4.0GHz. c) Calculate the attenuation constant (in dB/cm) at 3.0GHz for the dielectric-filled guide. What is the total attenuation (in dB) if the guide is 12cm long? d) What is the total attenuation at frequencies much less than the TE_{10} cutoff frequency	10M	1	4
4	a) What are ferrites? Explain the composition and characteristics of ferrites. b) Explain the operation of Isolator in the Waveguide.	4M 6M	2 2	2 2
	OR			

5	a) Derive an expression for Q-factor of a cavity resonator. Also discuss different types of coupling based on coupling coefficients. b) What are the different waveguide attenuators? Explain one of them in detail.	5M 5M	2 2	4 2
6	a) Explain the amplification process of TWT with neat diagrams. b) A two-cavity klystron operates at 4.5 GHz. The Dc beam load voltage is 8 KV, Cavity gap spacing is 2 mm for a given input, the magnitude of gap voltage is 100V.Calculate the time of the electrons in the gap, gap transit angle and range of velocity of electrons as they leave the gap region.	7M 3M	3 3	2 3
	OR			
7	a) Draw the mode characteristics of reflex klystron and explain the operation with applegate diagram. b) Discuss the Effect of repeller voltage on output power with the help of neat diagrams.	5M 5M	3 3	3 2
8	Draw the basic structure of 8- cavity magnetron and explain how cross-field is used to generate oscillations and derive the equation for oscillations	10M	4	4
	OR			
9	a) Explain how Gunn oscillator produces oscillations. b) What are the advantages of Transit time devices?	6M 4M	4 4	2 1
10	a) Discuss the significance of scattering matrix. Also give its properties. b) What are the various precautions that has to be take care while measuring microwave parameters	5M 5M	5 5	2 2
	OR			
11	Derive the S-matrix of H-plane tee and prove all the properties of S-matrix.	10M	5	4