Hall Ticket No | | | | | | | | | | | Question Paper Code: AEC015

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

B.Tech VII Semester End Examinations, November - 2019
Regulation: IARE-R16
MICROWAVE ENGINEERING
(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 70**

Answer any ONE question from each Unit
All questions carry equal marks
All parts of the question must be answered in one place only

UNIT – I

1	a)	Name the microwave frequency bands and spectrums and Summarize the advantages of microwaves.	[7M]
	b)	The dimensions of a rectangular waveguide are a = 2.5 cm and b = 1 cm. The signal frequency is 8.6 GHz. The determine the following: (a) Possible modes (b) Cut-off frequencies.	[7M]
	a)	Derive the TMmn mode field equation in rectangular waveguide.	[7M]
	b)	A rectangular waveguide operating in dominant mode having breath 10 cm for 2.5 GHz signal propagated in this waveguide. Determine the group, phase velocities and guide wavelength	[7M]

UNIT – II

3	a)	What is the instrumentation amplifier? What are the required parameters of an instrumentation amplifier? Explain the working of instrumentation amplifier with neat circuit diagram.	[7M]
	b)	Show that H-plane acts as a 3 dB splitter	[7M]
4	a)	Describe about various types of Attenuators and phase shifters?	[7M]
	b)	An attenuator of 20dB is fed with 100w input. Find the output power of the attenuator.	[7M]

UNIT – III

5	a)	Explain in detail bunching process & obtain expression for bunching parameter in a two cavity klystron amplifier..	[7M]
	b)	A reflex klystron operates at the peak mode n = 2 with Beam voltage V0 = 300 V Beam current I0 = 20 mA Signal voltage V1 = 40 V Determine: (a) The input power (b) The output power (c) The efficiency.	[7M]
6	a)	Explain the principle of operation of a reflex Klystron oscillator and derive an expression for the bunching parameter.	[7M]

b) A helix travelling wave tube operates at 4 GHz under a beam voltage V0 = 6 kV and beam current I0 = 30 mA. If the helix impedance Z0 is 100 ohm and circuit length N = 30, find the output power gain. [7M]

UNIT – IV

7 a) What is meant by Avalanche Transit Time Devices? Explain theoperation, construction and Applications of IMPATT. [7M]

b) An IMPATT diode has a drift length of 2μm. Determine the operating frequency of the IMPATT diode, if the drift velocity for Si is 107 cms/sec. [7M]

8 a) Explain Gunn effect using the two valley theory. [7M]

b) An n-type GaAs Gunn diode has Electron velocity vd = 3 105 m/s Negative electron mobility |μn| = 0.16 m2 /Vs Relative dielectric constant εr = 12.9 Determine the criterion for classifying the modes of operation. [7M]

UNIT – V

9 a) Write a short notes on [7M]
i)power ratio method
ii)Rf substitution method

b) Two identical 20 dB directional couplers are used in a waveguide to sample the incident and reflected powers. The output of the forward and reverse directional coupler are 3.5 mW and 0.25 mW respectively. Find the VSWR in the waveguide. [7M]

10 a) Define Voltage standing wave ratio and explain the method for measuring VSWR<10? [7M]

b) Calculate the VSWR of a transmission line operating at 10 GHz. Assume TE10 wave propagating inside of a waveguide of dimensions a = 4 cm, b = 3 cm. The distance between twice minimum power point is 2 mm on a slotted line. [7M]

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COURSE OBJECTIVES

I	Develop the knowledge on transmission lines for microwaves, cavity resonators and Wave guide components and applications.
II	Enable the students to understand and analyze the operation of microwave tubes like klystron, magnetron, travelling wave tube, etc.,
III	Familiarize with microwave solid state devices
IV	Introduce the student the microwave test bench for measure different parameters like attenuation, VSWR, impedance etc.

COURSE OUTCOMES (COs):

CO 1	Describe the types of waveguides, rectangular waveguides and field equations
CO 2	Understand the coupling mechanisms in waveguides and analyze the waveguide multiport junctions
CO 3	Explore the microwave linear tubes and analyze with microwave cross field tubes
CO 4	Understand the microwave solid state devices and avalanche transit time devices
CO 5	Demonstrate the microwave bench set up and conducting measurements of differentparameters

COURSE LEARNING OUTCOMES:

AEC015.01	Understand the microwave spectrum and applications of microwaves
AEC015.02	Analyze the types of waveguides, rectangular waveguides and field equations in rectangularwaveguide.
AEC015.03	Determine the wave impedance for a TM and TE wave in rectangular waveguide
AEC015.04	Understand the types of cavity resonators and determine the dominant mode.
AEC015.05	Explore the coupling mechanisms for a cavity resonator.
AEC015.06	Understand the waveguide discontinuities: waveguide irises, tuning screws, posts and matched loads
AEC015.07	Understand the operation of multiport junctions and its applications
AEC015.08	Understand the Faraday rotation principle and analyze the different ferrite devices.
AEC015.09	Understand the limitations of conventional vacuum tubes at microwave frequencies and Understand the velocity modulation process and bunching process in microwave linear beam tubes
AEC015.10	Determine the beam current density in Multi cavity Klystron amplifiers
AEC015.11	Understand the velocity modulation process and power output in Reflex Klystron
AEC015.12	Determine the amplification process in helix Traveling wave tube (TWT)
AEC015.13	Describe the 8-cavity cylindrical travelling wave Magnetron
AEC015.14	Analyze the Hull cut-off and Hartree conditions in Magnetron.
AEC015.15	Illustrate the microwave solid-state devices: microwave tunnel diode and transferred electron devices

MAPPING OF SEMESTER END EXAMINATION TO COURSE LEARNING OUTCOMES:

SEE Question No.		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AEC015.1	Understand the microwave spectrum and applications of microwaves	CO 1	Understand
	b	AEC015.02	Analyze the types of waveguides, rectangular waveguides and field equations in rectangular waveguide.	CO 1	Understand
2	a	AEC015.03	Determine the wave impedance for a TM and TE wave inrectangular waveguide	CO 1	Understand
	b	AEC015.03	Determine the wave impedance for a TM and TE wave inrectangular waveguide	CO 1	Understand
3	a	AEC015.07	Understand the operation of multiport junctions and itsapplications	CO 2	Understand
	b	AEC015.07	Understand the operation of multiport junctions and its applications	CO 2	Understand
4	a	AEC015.07	Understand the operation of multiport junctions and itsapplications	CO 2	Understand
	b	AEC015.08	Understand the Faraday rotation principle and analyze thedifferent ferrite devices.	CO 2	Remember
5	b	AEC015.08	Understand the Faraday rotation principle and analyze thedifferent ferrite devices.	CO 3	Understand
	a	AEC015.09	Understand the limitations of conventional vacuum tubes at micro wave frequencies and Understand the velocity modulation process and bunc hing process in microwavelinear beam tubes	CO 3	Remember
6	b	AEC015.11	Understand the velocity modulation process and power outputin Reflex Klystron	CO 3	Understand
	a	AEC015.12	Determine the amplification process in helix Traveling wave tube (TWT)	CO 3	Understand
7	b	AEC015.13	Describe the 8-cavity cylindrical travelling wave Magnetron	CO 4	Understand
	a	AEC015.16	Determine the RWH theory and modes of operations in Gunndiodes	CO 4	Understand
8	b	AEC015.16	Determine the RWH theory and modes of operations inGunn diodes	CO 4	Understand
	a	AEC015.17	Understand the Avalanche transit time devices: IMPATTdiode, TRAPATT diode and BARITT diode	CO 4	Understand
9	b	AEC015.17	Understand the Avalanche transit time devices: IMPATTdiode, TRAPATT diode and BARITT diode	CO5	Understand
	a	AEC015.18	Describe the microwave bench set-up with different blocksand their features attenuation, frequency, VSWR and impedance	CO5	Remember
10	a	AEC015.19	Determine the measurements of microwave power,attenuation, frequency, VSWR and impedance	CO5	Understand
	b	AEC015.19	Determine the measurements of microwave power,attenuation, frequency, VSWR and impedance	CO5	Remember

Signature of Course Coordinator **HOD, ECE**