



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## ELECTRONICS AND COMMUNICATION ENGINEERING

### ASSIGNMENT QUESTIONS

Course Name	:	MICROWAVE ENGINEERING
Course Code	:	A70442-R15
Class	:	IV B. Tech I Semester
Branch	:	ECE
Year	:	2018 – 2019
Course Coordinator	:	Dr. V Siva Nagaraju, Professor, Dept of ECE
Course Faculty	:	Dr. S Pedda Krishna, Professor, Dept of ECE Mr. V Naresh Kumar, Asst. Prof, Dept of ECE

### OBJECTIVES

The subject microwave engineering may be also referred to as applied electromagnetic. The importance of microwaves started way back in World War II period and later expanded its ways out to domestic (microwave oven), military, commercial, satellite and etc. This subject starts with the definition of microwave frequency range, its applications and its importance in modern era. The microwave transmission lines like waveguides (rectangular, circular), micro-strips etc. and the various microwave components like T-junctions, circulator, isolator etc. are discussed in detail to enable the student to design microwave systems and sub- systems.

ASSIGNMENT-I			
UNIT-I			
MICROWAVE TRANSMISSION LINES-I			
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What are the dominated and degenerate modes? What is the significance of dominant modes? Indicate the dominant mode in rectangular wave guide and calculate $f_c$ for the same.	Remember	1
2.	A rectangular waveguide has dimensions 2.5 X 5 cms. Determine the guide wavelength, phase constant and phase velocity at a wavelength of 4.5 cms for dominant mode.	Understand	1
3.	What is a Microwave spectrum bands? Explain briefly the applications of microwaves at various frequency bands.	Remember	1
4.	A Rectangular wave guide is filled by dielectric material of $\epsilon_r = 9$ and has dimensions of $7 \times 3.5$ cm. It operates in the dominant TE mode. i. Determine the cut off frequency. ii. Find the phase velocity in the guide at a frequency of 2 GHz iii. Find the guided wave length at 2GHz.	Understand	1
5.	Derive the expression for cutoff frequency of $TE_{mn}$ mode in rectangular wave guide.	Remember	1

6.	Obtain the wave equations for TE mode.	Understand	1
7.	Derive the wave equations for TM mode.	Understand	1
8.	Obtain an expression for microwave impedance for TE waves in rectangular wave guide.	Understand	1
9.	Derive an expression for microwave impedance for TM waves in rectangular wave guide.	Understand	1
10.	Obtain the expression for power transmission in waveguide	Remember	1
<b>UNIT-II</b> <b>CAVITY RESONATORS &amp; WAVEGUIDE</b> <b>COMPONENTS AND APPLICATIONS</b>			
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Derive the expression for Rectangular cavity resonator.	Understand	2
2.	Prove that a cavity resonator is nothing but an LC circuit.	Understand	2
3.	Discuss about E-H plane Tee junction. Why a hybrid E-H plane Tee referred to as Magic Tee. Derive the scattering matrix for E-H plane Tee junction.	Understand	2
4.	Explain the applications of Directional Couplers and obtain scattering matrix.	Understand	2
5.	Write about quality factor of a cavity resonator.	Understand	2
6.	Explain the principle of working a Magic Tee junction with neat schematics?	Understand	2
7.	Discuss the principle of working of E-H plane Tee junction with neat schematics?	Understand	2
8.	Write the principle of working of two-hole Directional coupler with neat schematics?	Understand	2
9.	Explain the two-hole Directional coupler and write applications of directional couplers?	Understand	2
10.	Discuss the following characteristics related to Directional coupler i)Coupling factor ii)Directivity iii) Isolation	Remember	2
<b>UNIT-III</b> <b>MICROWAVE TUBES</b>			
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What is Gunn effect? Explain the operation of Gunn diode.	Remember	3
2.	Explain is the principle of working for Two – Cavity Klystron with velocity diagram.	Understand	3
3.	Derive the expression for output power & Efficiency of a 2 cavity klystron.	Understand	3
4.	Explain in detail bunching process & obtain expression for bunching parameter in a two cavity klystron amplifier.	Understand	3
5.	What are the limitations of conventional tubes at microwave frequencies? Explain how these limitations can be overcome.	Understand	3
<b>ASSIGNMENT-II</b>			
6.	Name different methods of generating microwave power. Describe the necessary theory & Working of reflex klystron.	Understand	3

7.	Explain in detail bunching process & obtain expression for bunching parameter in a two cavity klystron amplifier.	Understand	3
8.	Write the principle of operation of a reflex Klystron oscillator and derive an expression for the bunching parameter.	Understand	3
9.	Explain the construction & working of two cavity klystron amplifier.	Remember	3
10.	Write the operation of a reflex klystron By means of applegate diagram?	Understand	3
<b>UNIT-IV</b>			
<b>M-TYPE TUBES &amp; MICROWAVE SOLID STATE DEVICES</b>			
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain the working Magnetron with $\pi$ mode oscillation.	Understand	4
2.	List out the differences in performances and applications of Klystrons and TWTs.	Remember	4
3.	What is meant by Avalanche Transit Time Devices? Explain the operation, construction and Applications of IMPATT.	Remember	4
4.	How is bunching achieved in a cavity magnetron? Explain the phase focusing effect.	Understand	4
5.	Determined the Gunn effect using the two valley theory.	Understand	4
6.	Derive the criterion for classifying the modes of operation for Gunn effect diodes.	Understand	4
7.	Explain the physical structure and construction of IMPATT diodes.	Remember	4
8.	Write short notes on "LSA mode in GUNN diode".	Understand	4
9.	Describe the operation of TRAPATT diode.	Remember	4
10.	Describe the operation of BARITT diode.	Remember	4
<b>UNIT-V</b>			
<b>MICROWAVE MEASUREMENTS</b>			
1.	Explain the measurement of attenuation using power ratio method	Understand	5
2.	Write about the Slotted line method for impedance measurement.	Understand	5
3.	Draw a neat diagram of microwave test bench and explain about each block along with its features.	Understand	5
4.	Explain the measurement of microwave power using bolometer method.	Remember	5
5.	Discuss the measurement of phase shift.	Remember	5
6.	Determined the method of measurement of high VSWR.	Understand	5
7.	Explain the RF substitution method of measurement of Attenuation.	Understand	5
8.	Write about the measurement of Q of a cavity resonator.	Understand	5
9.	Discuss the measurement of frequency using wave meter method.	Understand	5
10.	Explain the high power measurements using calorimetric method.	Understand	5

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