

ANDHRA LOYOLA INSTITUTE OF ENGINEERING AND TECHNOLOGY**VIJAYAWADA-8****ACADEMIC YEAR: 2020-2021****YEAR: III ECE****SEMESTER: II****SUBJECT NAME: MICROWAVE ENGINEERING****Cognitive levels****L1– Remember, L2-Understanding, L3- Applying /Analyzing****Question – Bank for unit-1 to unit-3****Unit-1**

Q.No	Question	Marks	Cognitive level
1	What are microwaves? Explain the advantages of microwaves.	5M	L1
2	An air filled rectangular waveguide of inside dimensions 7 x 3.5 cm operates in the dominant TE ₁₀ mode. (i) Find the cut off frequency. (ii) Determine the phase velocity of the wave in the guide at a frequency of 3.5 GHz.	5M	L1
3	Derive the field expressions for TM wave propagation in rectangular waveguide.	10M	L2
4	Derive the wave equation for a TE wave and obtain all the field components in a rectangular waveguides.	10M	L2
5	Derive expressions for cut off wavelength and cut off frequency for TM waves propagating through rectangular waveguides.	5M	L2
6	Derive the expressions for phase velocity and group velocity.	6M	L2
7	Calculate the guide wavelength (in cm) at 7 and 12GHz for an air filled waveguide with $a=2.54$ cm , $b=1.5$ cm.	4M	L2
8	Discuss about the impossibility of TEM mode in Waveguides.	3M	L2
9	Explain about dominant and degenerate modes in a rectangular waveguides.	3M	L2
10	Calculate the cutoff frequencies of air-filled wave guide with $a=3.24$ cm and $b=2.2$ cm, for the TE ₁₀ , TE ₂₀ , TE ₀₁ , and TM ₁₁ modes.	7M	L2
11	A TE ₁₀ Wave at 10.0 GHz propagates in a rectangular Wave guide ($a=2.5$ cm and $b=1.25$ cm) filled with Teflon having $\epsilon_r=2.1$. Determine the wave Impedance.	3M	L2
12	An air-filled rectangular wave guide has dimensions of $a=6$ cm and $b=4$ cm. The signal frequency is 3 GHz.		

	Compute cutoff frequency, Guide wavelength, Phase constant and group velocity for the following modes i) TE ₁₀ ii) TE ₀₁ iii) TE ₁₁ iv) TM ₁₁	10M	L3
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Unit-2

Q.No	Question	Marks	Cognitive level
1	What is a cavity resonator? Derive the expression for resonant frequency of rectangular & circular cavity resonator?	7M	L1
2	Explain about Dielectric losses in Micro strip lines.	3M	L1
3	Derive the characteristic equation of a Circular waveguide.	10M	L2
4	Derive the field equation for rectangular cavity resonator in TE _{mnp} mode, starting from wave equation.	10M	L2
5	Derive the field equation for rectangular cavity resonator in TM _{mnp} mode, starting from wave equation.	10M	L2
6	Compare rectangular and circular waveguides.	4M	L2
7	Derive the expressions for Q- factor and coupling co-efficients in cavity resonators.	7M	L2
8	Explain about dominant modes in circular waveguide.	3M	L2
9	Explain the different excitations techniques used in rectangular and circular wave guides.	5M	L3

Unit-3

Q.No	Question	Marks	Cognitive level
1	What are the limitations of conventional tubes at microwave frequencies? Explain.	10M	L1
2	With necessary equations, explain the velocity modulation process with Applegate diagram in two cavity klystron amplifier.	10M	L1
3	Explain the operation of Two Cavity klystron with neat sketches and derive its output power and efficiency?	10M	L2
4	A 2-cavity klystron is operated at 10GHz with $V_0=1200V$, $I_0=30mA$, $d=1mm$, $L=4cm$, $R_{sh}=40K\Omega$, neglecting the beam loading. Calculate a) input RF voltage V_1 for maximum output voltage, b) voltage gain, c) Efficiency.	10M	L2

5	Derive the expression for bunching process and voltage gain of Two-cavity klystron.	10M	L2
6	Explain the operation of Reflex klystron with neat sketches and derive its bunching parameter?	10M	L2
7	Klystron having following parameters: operating frequency 9GHZ with $V_0=1200V$, $I_0=25mA$, $d=1mm$, $L=4cm$, $R_{sh}=30K\Omega$, neglecting the beam loading. Calculate a) input RF voltage V_1 for maximum output voltage, b) voltage gain, c) Efficiency.	10M	L3

Unit-4

Q.No	Question	Marks	Cognitive level
1	Explain about different types of magnetrons.	4M	L1
2	Draw the diagram of helix travelling-wave tube and explain its operation.	6M	L1
3	Derive the expression for Axial Electric field in helix type travelling wave tube.	5M	L2
4	Derive the Hull cut-off voltage equation.	10M	L2
5	Explain the nature of four propagation constants in helix travelling-wave tube.	10M	L2
6	Explain the operation of 8-cavity cylindrical magnetron?	5M	L2
7	What is Hartree condition in Magnetron? Derive the equation for Hartree voltage.	6M	L2
8	Derive the equation for gain of TWT amplifier.	5M	L2
9	b) An X-band pulsed cylindrical magnetron has $V_0=30KV$, $I_0 = 30A$, $B_0= 0.34Wb/Sq.m$, $a=5cm$, $b=10cm$. Calculate a) cyclotron angular frequency b) Cut-off voltage c) Cut-off magnetic flux density?	10M	L3

Unit-5

Q.No	Question	Marks	Cognitive level
1	Explain the different types of Microwave attenuators.	3M	L1
2	What are the various applications of Magic Tee? Explain.	4M	L1
3	Explain in detail about waveguide irises, tuning screws and posts neat diagram?	7M	L1
4	Derive the S-Matrix of H-Plane Tee.	7M	L2
5	Derive the S-matrix of E plane Tee and also write its characteristics.	10M	L2
6	What is magic tee? Derive the S matrix of a Magic Tee.	10M	L2
7	Find the Hybrid ring S-parameters and explain with neat sketch.	6M	L2
8	Explain the design & Working principle of a Gyrator?	5M	L2
9	Explain briefly about circulators and isolators.	10M	L2

10	Explain different types of directional couplers with neat sketches and derive the S- matrix for directional coupler?	10M	L2
11	Derive the S-parameters for 10dB directional coupler, Directivity D=30dB. Assume that it is lossless and VSWR at each port is 1.0 under matched conditions.	10M	L3

Unit-6

Q.No	Question	Marks	Cognitive level
1	Draw a neat diagram of a microwave bench setup and explain in detail about all the components.	5M	L1
2	What are the different precautions have to be made while measuring parameters at Microwave range?	3M	L1
3	Draw and explain in detail about IMPATT diode.	5M	L2
4	Discuss about construction and operation of TRAPATT diode.	5M	L2
5	Define VSWR and explain the procedure for measurement of Low and High VSWR.	5M	L2
6	Explain the concept of Gunn effect with necessary figures.	7M	L2
7	Explain the procedure for measurement of Attenuation.	5M	L2
8	Explain the process of Frequency measurement using microwave bench?	5M	L2
9	What is bolometer? How it is used for microwave measurements?	5M	L2
10	Explain the method of measurement of impedance at microwave frequencies with suitable block diagram.	5M	L2
11	Explain the procedure for measurement of Phase shift.	5M	L2

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