

Program: BE Electronics & Telecommunication Engineering

Curriculum Scheme: Revised 2016

Examination: Final Year Semester VII

Course Code: ECC701 and Course Name: Microwave Engineering

Time: 2hour

Max. Marks: 80

Q. No. 1: All MCQs are Compulsory. Each carry 2 Marks.

Marks[40]

1	S parameters are expressed as a ratio of: a) Power b) Impedance at different ports c) Incident and the reflected voltage waves d) Frequency
2	$S_{12}=0.67 \angle -45^\circ$ and $S_{21}= 0.67 \angle 45^\circ$ for a two-port network. Then the two-port network is: a) Non-reciprocal b) Lossless c) Reciprocal d) Lossy
3	If the reflection coefficient of a 2 port network is 0.45 then the return loss in the network is: a) 6.5 dB b) 0.45 dB c) 6.935 dB d) 69.35 dB
4	For FR4 substrate ($\epsilon_r = 4.4$ of height (h) = 1.6 mm) the value of microstrip line width (W) for characteristic impedance (Z ₀) of 50 Ω is approximately: a) 3mm b) 2mm c) 1mm d) 0.5mm
5	The two adjustable parameters in single stub matching are distance 'd' from the load to the stub position, and _____ a) Susceptance or reactance provided by the stub b) Length of the stub c) Distance of the stub from the generator d) None of the mentioned
6	The modes of propagation supported by a rectangular wave guide is: a) TM, TEM, TE modes b) TM, TE

	<p>c) TM, TEM d) TE, TEM</p>
7	<p>Dominant mode is defined as: a) Mode with the lowest cut off frequency b) Mode with the highest cut off frequency c) Any TEM mode is called a dominant mode d) Any TM mode</p>
8	<p>The cut off frequency of rectangular waveguide with the dimension $a = 5.842$ cm, operating in dominant mode is :</p> <p>a) 2.57 GHz b) 1.28 GHz c) 257GHz d) 128GHz</p>
9	<p>The intrinsic impedance of the waveguide at $f = 1.5f_c$ in TM and TE modes is, respectively:</p> <p>a) 140Ω, 253Ω b) 218Ω, 652Ω c) 281Ω, 506Ω d) 109Ω, 326Ω</p>
10	<p>What is the cutoff frequency for TE_{11} mode in a circular waveguide of radius 2 cm with $P'_{11} = 1.841$?</p> <p>a) 5.5 GHz b) 4.3 GHz c) 7.7 GHz d) 8.1 GHz</p>
11	<p>A normal circular magnetron has the following parameters. Inner radius $a = 0.15$m, outer radius = 0.45m, $B = 1.2$ mWb/m. Determine the Hull Cut-off voltage.</p> <p>a) 59.78 kV b) 50.66 kV c) 100.66 kV d) 150.66kV</p>
12	<p>A two cavity Klystron amplifier has the following parameters: $V_0 = 300$V, $d = 1$mm, $L = 4$cm, $R_{sh} = 40$KΩ, Frequency $f = 8$GHz. Determine electron velocity and electron transit time.</p> <p>a) 1.8×10^7 m/s, electron velocity will increase b) 2.8×10^7 m/s, 0.55×10^{10} S c) 1.8×10^7 m/s, 2.55×10^{10} S d) 1.8×10^7 m/s, 0.55×10^{10} S</p>
13	<p>A reflex Klystron operates at 8 GHz at the peak of $n = 2$ mode with $V_0 = 300$V, $R_{sh} = 20$KΩ and $L = 1$mm. If the gap transit time and beam loading are neglected, find the repeller voltage.</p> <p>a) 415.6V</p>

	b) 833.98 V c) 450.9V d) 950.36V
14	A If the length of the intrinsic region in IMPATT diode is $2\ \mu\text{m}$ and the carrier drift velocity are $10^7\ \text{cm/s}$, then the nominal frequency of the diode is: a) 12 GHz b) 23 GHz c) 30 GHz d) 25 GHz
15	If the length of the intrinsic region in IMPATT diode is $2\ \mu\text{m}$ and the carrier drift velocity are $10^7\ \text{cm/s}$, then the drift time of the carrier is: a) 10^{-11} seconds b) 2×10^{-11} seconds c) 2.5×10^{-11} seconds d) 5.5×10^{-11} seconds
16	If the length of the intrinsic region in IMPATT diode is $2\ \mu\text{m}$ and the carrier drift velocity are $10^7\ \text{cm/s}$, then the nominal frequency of the diode is: a) 12 GHz b) 23 GHz c) 30 GHz d) 25 GHz
17	If the critical field in a Gunn diode oscillator is $2.2\ \text{KV/cm}$ and effective length is 40 microns, then the critical voltage is: a) 2.2 V b) 8.8 V c) 2.4 V d) 6.4 V
18	_____ is the most popularly used device for the measurement of high microwave power. a) VSWR meter b) Frequency Meter c) Calorimetric watt meter d) DSO
19	_____ is an important consideration for a hybrid integrated circuit. a) material selection b) processing units c) design complexity d) active sources
20	The substrate of an MMIC must be a _____ to accommodate the fabrication of all the type of devices. a) Semiconductor b) Insulator c) Partial conductors d) Metals operable at high frequencies

Q. 2 Answer any two of the following

Marks [20]

- i) Match a load impedance $Z_L = 200 + j300\Omega$ to a 100Ω line using a single short-circuited shunt stub.
- ii) Design L-section matching network to match an impedance at 500 MHz to transform $Z_L = 200 - j100\Omega$ to a 50Ω line.
- ii) Derive the expression for the field in TE Modes of the Rectangular Waveguide.

Q.3 Answer any two of the following.

Marks [20]

- i) With a neat functional diagram explain the working principle of Travelling Wave Tube (TWT) and why its slow wave structure is used in TWT.
- ii) Explain working principle of Gunn Diode with neat functional diagram and its operating modes in detail.
- iii) Explain Hybrid Microwave Integrated Circuit.