



Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech(ECE-N)/SEM-1/MCE-104/2011-12

2011

**ADVANCED MICROWAVE COMMUNICATION
ENGINEERING**

Time Allotted : 3 Hours

Full Marks : 70

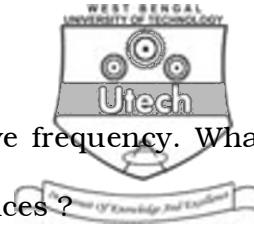
The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

Answer any *five* of the following. $5 \times 2 = 10$

1. Explain how the limitations of conventional vacuum tubes are taken care in microwave vacuum tubes.
2. In a Gunn diode the drift velocity of electrons is $2 * 10^7$ cm/s through the active region of length $2 * 10^{-4}$ cm. Calculate the natural frequency of the diode and the critical voltage.
3. Write down the scattering matrix of a hybrid rat-race ring.
4. What is meant by non-reciprocal device ? Explain with a four port device.



5. State some applications of millimeter wave frequency. What are the special design criteria for such devices ?
6. Explain Babinet principle using neat diagram. Give an application.
7. Explain how Duct propagation is used in Terrestrial communication.

GROUP – B

Answer any *five* of the following. $5 \times 12 = 60$

8. a) Write the stability conditions of microwave amplifiers in terms of impedances, reflection coefficients and S-parameters.
b) Design a GaAs MESFET amplifier at 6GHz for 50 ohm termination. Given parameters are $\Gamma_{sin} = 0.76 \angle 180^\circ$, $\Gamma_{L0} = 0.72 \angle 104^\circ$, $G_{max} = 12\text{dB}$. Design input and output matching circuits. $4 + 8$
9. Explain with diagram, construction and operating principle of IMPATT oscillator. What are their limitations ? $10 + 2$
10. a) Draw a neat diagram of a Gunn diode oscillator circuit and explain its operation.
b) Describe strip line three-port circulator and give its applications. $6 + 6$



11. A linear uniform array of N isotropic elements are uniformly excited along x -axis with inter-element phase shift α . Establish the following :
- Condition of no grating lobes
 - Beam broadening from broad side to end fire directions
 - Beam asymmetry while scanning. 4 + 4 + 4
12. a) Derive the equation of the surface geometry of a parabolic reflector antenna. Explain how cross-polarization occur in such reflectors.
- b) A parabolic reflector has diameter 10 m, $f/d = 0.5$ and excited at 10 GHz with aperture efficiency 80%. Find the directivity. 6 + 2 + 4
13. What do you understand by Butterworth and Equal ripple filters. Design a microstrip LP Tchebyshev filter with $f_c = 2$ GHz, 30 dB attenuation at 3 GHz, ripple = 0.2 dB. Outline the microstrip simulation of this filter. Table of prototype parameters is given below : 4 + 8

0.2 dB ripple

k	n						
	1	2	3	4	5	6	7
1	0.4342	1.0378	1.2275	1.3028	1.3394	1.3598	1.3722
2	1.0000	0.6745	1.1525	1.2844	1.3370	1.3632	1.3781
3		1.5386	1.2275	2.9761	2.1660	2.2934	2.2756
4			1.0000	0.8468	1.3370	1.4555	1.5001
5				1.5386	1.3394	2.0974	2.2756
6					1.0000	0.8838	1.3761
7						1.5386	1.3722

CS/M.Tech(ECE-N)/SEM-1/MCE-104/2011-12



14. a) Explain how fading occurs in microwave propagation. Using neat diagrams describe two important techniques how fading is minimized.
- b) The maximum electron density in the ionosphere layer is $10^6 / \text{cc}$. Find the lowest frequency that will penetrate the ionosphere to reach a satellite. 8 + 4

