



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.Tech(ECE)(O)/SEM-1/MCE-104/2012-13**

**2012**

**ADVANCED MICROWAVE 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**

**( Short Answer Type Questions )**

1. Answer any *seven* of the following :  $7 \times 2 = 10$
- i) State the limitations of conventional vacuum tubes to be used at millimeter wave.
  - ii) Write the full names of BARITT, TRAPATT and IMPATT
  - iii) Why Transferred Electron Device is related to Gunn Diode ?
  - iv) What is HEMT ? Write the difference between HEMT and MESFET.



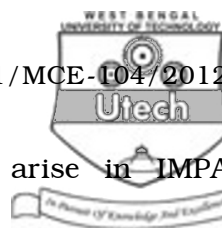
- v) Give one example of frequency independent antenna. Why is the antenna termed as frequency independent antenna ?
- vi) What Hertzian dipole ? What is isotropic antenna ?
- vii) What is scattering matrix ? What is its significance in microwaves ?
- viii) What is antenna aperture and effective height of an antenna ?
- ix) Give the relation between directivity and gain of an antenna.
- x) Define radiation resistance of a folded dipole antenna.
- xi) Define isotropic antenna and beam width.
- xii) Explain the concept of near field and far field.

**GROUP – B**

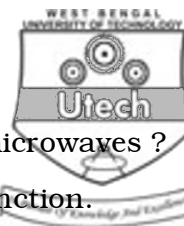
**( Long Answer Type Questions )**

Answer any *four* of the following.  $4 \times 14 = 56$

- 2. a) Draw and explain the equivalent circuit of PIN diode used as a switch. 7
- b) Describe the modes of operation of Gunn diode with suitable diagram. 7



3. a) How does the negative resistance arise in IMPATT diode ? Draw its equivalent circuit. 7  
 b) Discuss the operation of TRAPATT and explain why the operating frequency is only of the order of a few GHz. 5 + 2
4. a) What is the slow wave structure ? Draw and explain the operation of Magnetron. 2 + 5  
 b) Define array factor and phase pattern. 3  
 c) Explain how Gunn diode can be used as an oscillator. 4
5. a) Describe the various important layers of the ionosphere and their effects on wave propagation. 4  
 b) Explain Duct propagation and find out the modified refractive index for it. 2 + 5  
 c) A radio link has a 20 watt transmitter connected to an antenna of  $3 \text{ m}^2$  effective aperture at 10 GHz. The receiving antenna has an effective aperture of  $0.6 \text{ m}^2$  and is located at a 20 km line of sight distance from the transmitting antenna. Assuming lossless, matched antennas, find the power delivered to the receiver. 3
6. a) Give the classification of horn antennas. List the applications of horn antennas. 3 + 2  
 b) Describe the polarization characteristics of Yagi-Uda antenna. 4  
 c) Explain the working principle and operation of parabolic reflector antenna. 5



7. a) What is the significance of S-matrix in microwaves ? 3  
b) Compute the S-matrix for a magic tee junction. 8  
c) Explain how Gunn diode can be used to generate microwave frequency. 3
8. a) Define the following :  $2 \times 2 \frac{1}{2}$   
(i) Ground wave propagation  
(ii) Space wave propagation.  
b) Explain how the log periodic antenna works. Write its applications. 4 + 2  
c) Explain what is HPBW and FNBW. 3
9. a) What do you mean by antenna array ? Explain broadside array and end-fire array. 2 + 4  
b) Explain the following terms : 4 × 2  
(i) Antenna Gain  
(ii) Radiation pattern  
(iii) Directivity  
(iv) Effective aperture.
10. Write short notes on any *two* of the following : 2 × 7  
a) Gyrotron  
b) Tunnel diode  
c) Microstrip antenna  
d) Friis Transmission formula  
e) Babinet's principle.
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