## **AMIETE - ET (NEW SCHEME)**

Time: 3 Hours

## **DECEMBER 2011**

Max. Marks: 100

**NOTE:** There are 9 Questions in all.

- Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.
- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

#### **Q.1** Choose the correct or the best alternative in the following:

 $(2\times10)$ 

- a. The free space wave length for a 9 GHz signal is
  - (A) 10 cms

**(B)** 20 cms

(**C**) 3.33 cms

- **(D)** 5 cms
- b. A directional coupler is \_\_\_\_\_ port junction.
  - (A) 5 port junction

**(B)** 3 port junction

(C) 2 port junction

- (**D**) 4 port junction
- c. The cutoff wave length for TE<sub>m,o</sub> mode is given by \_\_\_\_\_

**(A)** 
$$\lambda_{o} = \frac{2}{\sqrt{(m_{a})^{2} + (n_{b})^{2}}}$$
 **(B)**  $\lambda_{o} = \frac{4a}{m^{2} + n^{2}}$ 

$$\mathbf{(B)} \ \lambda_{\mathrm{o}} = \frac{4\mathrm{a}}{\mathrm{m}^2 + \mathrm{n}^2}$$

(C) 
$$\lambda_o = \frac{2a}{m}$$

**(D)** 
$$\lambda_{0} = \frac{2a}{\sqrt{m^{2} + n^{2}}}$$

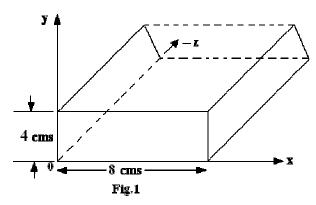
- d. Wave guides have advantages over coaxial line because \_\_\_\_\_
  - (A) mechanical simplicity and much higher operating frequency
  - **(B)** power losses in wave guide is more
  - (C) wall reflections
  - (**D**) it does not require matching
- e. In a microstrip line the propagating mode is \_\_\_\_\_
  - (A) a pure TM mode
- (B) a quasi TEM mode
- (C) the same as waveguide mode
- (D) a TE mode only

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# Code: AE72 Subject: MICROWAVE THEORY AND TECHNIQUES

	f.	A uniline or isolator is a dev	vice	
		<ul><li>(A) a ferrite loaded 2 port device</li><li>(C) 4 port device</li></ul>	<ul><li>(B) A 3 port device</li><li>(D) None of them</li></ul>	
	g.	When a transmission line is terminimpedance represents	nated by an impedance, called charac	eteristic
		<ul><li>(A) short circuit</li><li>(C) infinite line</li></ul>	<ul><li>(B) open circuit</li><li>(D) finite line</li></ul>	
	h.	An X band reflex klystron operates	in the frequency range	
		(A) 8 to 12 GHz (C) 4 to 6 GHz	( <b>B</b> ) 20 to 50 GHz ( <b>D</b> ) 100 MHz – 200 MHz	
	i.	A klystron oscillator		
		<ul> <li>(A) act as a signal source in microw</li> <li>(B) used in optical fiber communica</li> <li>(C) not suitable for microwave appl</li> <li>(D) not suitable for frequency modula</li> </ul>	tion ications	
	j.	A device which exhibits negative re	sistance it is possible to used as	
		<ul><li>(A) an oscillator</li><li>(C) mixer</li></ul>	<ul><li>(B) an amplifier</li><li>(D) All of them</li></ul>	
		Answer any FIVE Question Each question ca		
Q.2	a.	What are the different types of tranfigures.	smission lines used? Explain them w	ith neat (4)
	b.	Derive transmission line equations	for voltage and current.	(6)
	c.	Explain Smith Chart and explain h from it.	ow a normalized impedance can be o	obtained (6)
Q.3	a.	Arrive at the solution of wave equathree distinct cases of propagation	tions in a rectangular co-ordinates. D constant in the waveguide.	iscuss the (10)
	b.	An air filled rectangular waveguid in Fig.1. Its inside dimensions are (i) Cut off frequency (ii) Find the phase velocity of the (iii) Determine the guide wave length	wave at 4 GHz	shown (6)

**Subject: MICROWAVE THEORY AND TECHNIQUES** 



- **Q.4** a. Derive S parameters for two port microwave junction. **(8)** 
  - b. Draw a neat diagram of directional coupler and derive S matrix for it. **(8)**
- Q.5 a. What are microwave solid state devices? Write a note on their applications and advantages.
  - b. Explain what is differential negative resistance. Explain the two valley model theory of Gunn diode.
- a. What do you understand by Apple gate diagram? With a neat diagram explain **Q.6** the operation of Reflex klystron.
  - b. Write short notes on Helix travelling wave tube. **(6)**
- **Q.7** a. Explain linear magnetron, derive the expressions for Hull cut off voltage and Hull cut off magnetic flux density.
  - b. A linear magnetron has the following operating parameters

Anode voltage  $V_0 = 10 \text{ kV}$ 

Cathode current  $I_0 = 1A$ 

Magnetic flux density  $B_o = 0.01 \text{ wb/m}^2$ 

Distance between Cathode and Anode d = 5 cms

Compute the Hull cut off voltage for a fixed B<sub>0</sub>. **(6)** 

- **Q.8** a. Explain microstrip line with neat diagram. What are the feeding mechanisms? Explain with neat diagrams.
  - b. A lossless parallel stripline has a conducting strip width w. The substrate dielectric separating the two conducting strips has a relative dielectric constant  $\in_{rd}$  of 6 and thickness d = 4 mm. Calculate the required width w of the conducting strip in order to have a characteristic impedance of  $50\Omega$ . **(6)**
  - c. Write explanatory note on coplanar strip lines. **(4)**
- 0.9 a. What are the fabrication techniques involved in MMIC? **(6)**

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- b. What are planar capacitor film? Explain with neat figures. (6)
- c. An integrated capacitor fabricated on a GaAs substrate has the following parameters

No of fingers N = 8Relative dielectric  $\epsilon_r = 13.10$ 

Const of GaAs

 $\begin{array}{lll} \text{Substrate height} & & h = 0.254 \text{ cm} \\ \text{Finger length} & & \ell = 0.00254 \text{cms} \\ \text{Finger base width} & & w = 0.051 \text{ cms} \\ \text{A}_1 = 0.089 \, \text{pF/cm} & & \text{A}_2 = 0.10 \, \text{pF/cm} \end{array}$ 

Is the contribution of is the contribution of 2 external

Interior finger for fingers for h > w

h > w

Compute the capacitance of the interior finger.