AMIETE - ET (OLD SCHEME)

Code: AE20 Time: 3 Hours Subject: MICROWAVE THEORY & TECHNIQ

& TECHNIQU Max. Marks: 10

JUNE 2011

NOTE: There are 9 Questions in all.

- 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:

 (2×10)

a. The semiconductor diode which can be used in switching circuits at microwave range is

(A) PIN diode	(B)	Varactor diode
(C) Tunnel diode	(D)	Gunn diode

b. Which one of the following modes of transmission will not be supported by a rectangular waveguide?

(A)	TE_{10}	(B)	TE_{11}
(C)	TM_{11}	(D)	TM_{10}

c. The skin depth at 1000 MHz, in comparison with that at 500 MHz is

(A) 2	(B)	$\sqrt{2}$
(C) $1/\sqrt{2}$	(D)	1/2

- d. In a TWT, the tube velocity of the axial component of the RF field on the slow-wave structure is kept
 - (A) Equal to the velocity of the electrons.

(C) Pump energy

- (B) Slightly less than the velocity of electrons.
- (C) Slightly more than the velocity of electrons.
- (D) Equal to the velocity of light in free space.
- e. In parametric amplifiers used in microwave communication systems, the amplification is limited by

(D) Frequency of operation

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(A) 45° (B)	90°
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- Which of the following is the correct angular aperture for a parabolic reflector antenna for which the aperture number is 0.25? (B) 90° $^{\circ}0^{\circ}$ $^{\circ}$ that the the the the parabolic reflector antenna for which the aperture number is 0.25? g. A disadvantage of microstrips with respect to stripline circuits is that the
 - (A) Do not lend themselves to printed circuits techniques
 - (**B**) Are more likely to radiate
 - (C) Are bulkier
 - (D) Are more expensive and complex to manufacture
- h. Which one of the following is a transferred electron device?

(A) BARITT diode	(B) IMPATT diode
(C) Gunn diode	(D) Step recovery diode

i. A 75 ohm transmission line is first short terminated and minima locations are noted. When the short is replaced by a resistive load R_L, the minima locations are not altered and the VSWR is measured to be 3. What is the value of R_L ?

(A) 25 ohms	(B)	50 ohms
(C) 225 ohms	(D)	250 ohms

- i. In microwave power measurement using bolometers the principle of working is the variation of
 - (A) Inductance with absorption of power
 - (B) Resistance with absorption of power
 - (C) Capacitance with absorption of power
 - (D) Cavity dimensions with heat generated by the power

Answer any FIVE Questions out of EIGHT Questions. Each question carries 16 marks.

Q.2	a.	Derive the transmission lir	e equations.	(8)
	b.	The diameter of the inner the outer conductor is 6 n 1.60. Calculate the charac	conductor of a coaxial cable is 2 mm a nm and the dielectric constant of the in teristic impedance. If the nominal capa	and that of sulation is acitance is
		$60\mathrm{pF/m}$. Find the value of	f inductance per meter at RF.	(8)
Q.3				
Q.3	a.	Define the following terr matrix for the same.	ns related to directional coupler. Als	o write S
Q.3	a.	Define the following terr matrix for the same. (i) Directivity	ns related to directional coupler. Als (ii) Coupling factor	o write S

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	b.	A rectangular waveguide has dimensions 5 cm \times 2.5 cm (international Determine the critical frequency for TE ₁₀ modes. This waveguide is fed a 10 GHz carrier from a coaxial cable. If TE ₁₀ wave is propagate determine (i) free space wave length (ii) guide wavelength (iii) phase a group velocities.	al). by ed, and (8)
Q.4	a.	Explain the operation of a Faraday rotation isolator with the help of n sketch. List the applications of Ferrite isolator.	eat (8)
	b.	Derive an expression for resonant frequency F_0 in a rectangular cav resonator.	rity (8)
Q.5	a.	A two cavity Klystron amplifier has the following parameters: Beavoltage $V_0=900$ V, Beam current $I_0=30$ mA, Frequency F=8 GHz, a spacing in either cavity d=1 mm, spacing between centres of cavities L=cm, effective shunt impedance $R_{sh}=40$ k Ω . Determine: (i) electron velocity (ii) dc transit time of electrons. (iii) input voltage maximum output voltage (iv) voltage gain in dB.	am gap = 4 for (8)
	b.	Explain how amplification is achieved in a magnetron with neat sketch.	(8)
Q.6	a.	Obtain the scattering matrix of H plane Tee.	(8)
	b.	Differentiate amongst TE, TM, TEM & HE waves.	(4)
	c.	Enumerate the advantages and disadvantages of MICS.	(4)
Q.7	a.	Describe the method for microwave frequency and noise fac measurement.	tor (8)
	b.	Explain working of TWT with neat sketch.	(8)
Q.8	a.	Explain in detail the operation of Gunn diode with neat sketch.	(8)
	b.	Derive the radar range equation. Explain the factors that affects maximum range of RADAR.	the (8)
Q.9		Write short notes on any <u>TWO</u> of the following:	
		 (i) Measurement of high VSWR (ii) Microwave antennas (iii) Reflex Klystron (iv) Impedance matching in RF Transmission line. 	(2×8)