CS/B.Tech/ECE/Odd/Sem-7th/EC-703A/2015-16

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# CS/B.Tech/ECE/Odd/Sem-7th/EC-703A/2015-16



# MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

	EC-703A
RF AN	MICROWAVE ENGINEERING
Time Allotted: 3 Hours	Full Marks: 70
The figu Candidates are required to go	questions are of equal value. es in the margin indicate full marks. e their answers in their own words as far as practicable. mbols are of usual significance.
(M	GROUP A Itiple Choice Type Questions)
<ol> <li>Answer any ten questions.</li> </ol>	$10 \times 1 = 10$
(i) Distance between successi	e maxima and minima of standing wave is
(A) λ/2	(B) 3λ∕2
(C) \(\lambda\)	LATV4
(ii) Any two-port network hav	ng a 6 dB loss will give an output power which is
(A) 0.25	(B) 0.75
(C) 0.50	(D) none of these
(iii) Cavity is a filter	
(A) low pass	(B) band pass
(C) high pass	(D) band reject

(iv)	The dominant mode in a waveguide	The dominant mode in a waveguide is characterized by					
	(A) shortest cut-off wavelength	(B) longest cut-off wavelength					
	(C) zero attenuation	(D) infinite attenuation					
(v)	Microwave components are generally characterized by						
	(A) h-parameter	(B) Z-parameter					
	(C) s-parameter	(D) Y-parameter					
(vi)	In transmission through a waveguide, the maximum and minimum values of VSWR obtained under loaded conditions are						
	(A) one and zero	(B) infinity and one					
	(C) infinity and zero	(D) - 1 and $+ 1$					
(vii)	The broad wall dimension of rectangular when the cut-off frequency for dominant mode is 3 GHz is						
	(A) 6 cm	(B) 4 cm					
	(C) 5 em	(D) none of these					
viii)	In a two hole directional coupler the distance between two holes in terms of guided wavelength $\lambda_g$ is						
	$(A) \lambda_g$	(B) 7 4					
	(C) λ <sub>g</sub> /2	(B) χ <sub>g</sub> 4 (D) 2λ <sub>g</sub>					
(ix)	To overcome difficulties with strapping high frequencies the type of cavity structure desired for magnetron is						
	(A) hole and slot	(B) vane					
	(C) slot	(D) rising sun					
(x)	In a VSWR measurement a square law detector is used to detect the signal level. The current meter connected to the circuit read 64 mA and 16 mA as maximum and minimum currents respectively, the VSWR is						
	(A) 4	(B) 2					

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(C) 9.25

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(D) zero

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(xi)	TWT is sometimes	preferred to	magnetron	for	use	in	RADAR	transmitte	1
	because it								
	(A) has been don hom		(D) in i						

- (A) has broader band
- (B) is less noisy
- (C) is more efficient amplifier
- (D) is capable of large duty cycle
- (xii) The dominant mode of propagation in circular waveguide is
  - (A) TE<sub>11</sub>
- (B) TE<sub>10</sub>
- (C)  $PM_{11}$
- (D) TM<sub>10</sub>
- (xiii) Large microwave power can be measured by
  - (A) VSWR meter

- (B) Bolometer
- (C) Calorimeter-wattmeter
- (D) Thermister

# **GROUP B** (Short Answer Type Questions)

Answer any three questions.

 $3 \times 5 = 15$ 

4+1

5

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- VSWR of a bilateral passive two port microwave component is 2 with the 2. other port matched terminated. If the input power to port 1 is 1 mW then, the output power at port 2 is 0.5 mW. Determine the s-matrix for the component.
- 3. What is the wave impedance of a TE mode in a rectangular waveguide? Express the impedance in terms of the free-space intrinsic impedance and the cut-off wavelength of the mode. Consider a 22.86 mm × 10.16 mm rectangular waveguide. Calculate the wave impedance of the TE10 mode at 10 GHz.
- Find out the [S] matrix of a H-plane TEE.
- 5. How do you use a three port circulator as two port isolator? Why the 2.5 + 2.5isolators are used just after the oscillator?
- 6. What do you mean by crystal diode? Why Schottky diodes are suitable for 2+3 microwave region?

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GROUP C (Long Answer Type Questions)

Answer any three questions.

3×15 == 45

- 7. (a) Explain the working principle of a Magnetron. Also derive the expression for cut-off magnetic field B.
  - (b) A helix Travelling wave Tube (TWT) has the following characteristics: Beam voltage V = 2 kV, Beam current I = 4 mA, frequency f = 8 GHzCircuit Length of interaction N = 50 in wavelength, Characteristic impedance Z = 20 ohm.

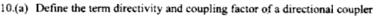
Determine: (i) The gain parameter. (ii) The power gain in dB.



3×5

8+7

- 8. (a) Describe the construction of a reflex klystron and explain how it works as an oscillator.
  - (b) The input power in a two hole directional coupler is 1 mW. The coupler has a coupling factor of 15 dB and a directivity of 30 dB. Calculate the power in all the ports.
- (a) Describe the operation of a four-port microwave circulator.
  - (b) What is microwave Isolator?
- (c) Describe the operating principle of H-plane tee.
- (d) Derive the scattering matrix of Magic tee.



- (b) The input power in a two hole directional coupler is 1 mW. The coupler has a coupling factor of 15 dB and a directivity of 30 dB. Calculate the power in all the ports.
- (c) What is phase shifter? Give its applications.
- (d) Explain the principle of operation of VSWR measurement; low, medium and
- Write short notes on any three of the following:

(a) Industrial application of microwave

- (b) RF amplifier
- \*(c) Tunnel diode
- (d) Magic Tee
- (e) VSWR meter

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