

BRAINWARE UNIVERSITY

Course - BSc(CS)

Electromagnetism & Electronic Communication (EC401)

(Semester – 4)

Time	e allotted: 3 Hours	Full Marks: '	Full Marks: 70		
[The		arks. Candidates are required to give their answers rds as far as practicable.]	in		
		Group –A			
	(Multiple C	hoice Type Questions) 10 x 1 =	: 10		
1. (i)	Choose the correct alternative from Gaussian surface is	the following			
	a. an open surface	b. a closed surface			
	c. a semi closed surface	d. any surface			
(ii)	Direction of propagation of EM way	ve is in the direction of			
	a. $\vec{E} \times \vec{H}$	b. \vec{E}			
	c. \overrightarrow{H}	d. anything			
(iii)	The dominant mode of a rectangula	r waveguide (a=2b) is			
	a. TE ₁₁	b. TE ₁₀			
	c. TM_{01}	d. none of these			
(iv)	A lossless transmission line when shorted has input impedance given by				
	a. $jZ_0 \tan \beta l$	b. $-jZ_0 \tan \beta l$			
	c. $jZ_0 \cot \beta l$	d. $-jZ_0 \cot \beta l$			
(v)	An open circuited $(\frac{\lambda}{4})$ lossless transmission line has input impedance				
	a. infinity	b. zero			
	c. Z ₀	d. none of these			
(vi)	The frequency range of microwave	e			
	a. 300 MHz to 300 GHz	b. 3 to 30 MHz			
	c. 30 to 300 MHz	d. 0.3 to 30 MHz			
(vii)	With increase in modulation index of	of an FM wave, the number of sidebands having			

b. decrease

significant amplitude will

a. increase

[5]

c. remain same d. none of these (viii) The value of a resistor creating thermal noise is doubled. The noise power gentherefore a. halved b. quadrupled c. doubled d. unchanged (ix) An antenna located in a city is a source of radio waves. How much time does the waves to reach a town 18000 km away? a. 30 sec b. 60 ms c. 400 µs d. None of these (x) A carrier of 100 W is amplitude modulated to the depth of 40%. The total transpower is a. 112 W b. 125 W c. 108 W d. 118 W	nerator is					
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power is a. 112 W b. 125 W						
a. 112 W b. 125 W	nsmitted					
c. 108 W d. 118 W						
Group – B (Short Answer Type Questions)	3 x 5 = 15					
Answer any <i>three</i> from the following 2. Find the electric potential and electric field at an external point due to an						
electric dipole.	[5]					
3. Deduce the relation $\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$ in dielectric medium. Here, the notations						
bear their usual meanings	[5]					
4. The equation of a frequency modulated voltage is						
$E = 10 \sin (10^8 t + 3 \sin 10^4 t)$ volts. Determine (i) r. m. s. value of						
modulated voltage (ii) carrier frequency, (iii) modulating frequency, (iv) modulation index and (v) frequency deviation.	[5]					
5. Illustrate half power beam width and beam width between first nulls.	[-1					
Define effective aperture of an antenna.						
6. An air filled rectangular wave guide of inside dimensions 7 cm × 3.5 cm	[3+2]					
operates in the dominant TE_{10} mode (a) Find the cut-off frequency (b) Determine the guided wavelength at	[3+2]					

3.5 GHz.

Group - C

(Long Answer Type Questions) $3 \times 15 = 45$

		ny three from the following	
7.	(a)	Establish wave equations in lossy dielectric medium.	[6]
	(b)	What do you mean by a perfect conductor? Explain the concept of	[-]
		skin depth and find out an expression for it.	[1+1+3]
	(c)	Calculate the skin depth for radio wave of 3 m wavelength (free	
		space) in copper. (Given $\sigma = 6 \times 10^7$ S/m; $\mu_0 = 4\pi \times 10^{-7}$ H/m)	[4]
8.	(a)	What is secant law in connection with ionospheric reflection of	
		radio waves? Obtain a relation between the maximum radio	
		frequency reflected from an ionospheric layer and the corresponding	[10]
	(b)	critical frequency. Write short notes on flicker noise and shot noise.	[10]
9.	(b) (a)	Explain amplitude modulation, derive the expression for modulation	[5]
7.	(a)	index and also obtain the frequency spectrum.	[5]
	(b)	In case of amplitude modulation, derive the expression for total	[2]
	(0)	transmitted power P_t in terms of P_c and m , where P_c and m have	
		their usual meanings.	[5]
	(c)	Compare and contrast AM and FM system.	[5]
10.	(a)	Develop the transmission line equations.	[5]
	(b)	Find out solutions of the equations.	[5]
	(c)	Define characteristic impedance of transmission line and obtain	
		expression for it.	[5]
11.	(a)	Establish the relation $\nabla \times \overrightarrow{H} = \overrightarrow{J} + \frac{\partial \overrightarrow{D}}{\partial t}$. The notations have their usual	
		∂t	
		meanings.	[5]
	(b)	State Poynting theorem in electromagnetic field theory. Derive it.	[5]
	(c)	Define the terms (i) VSWR and (ii) reflection coefficient of	
		transmission line and establish the relation between them.	[1+4]