Dayananda Sagar College of Engineering
Department of Electronics & Communication Engineering
Continuous Internal Evaluation – I

Course Name :	Wireless and Mobile Communication	Date :	8/11/2021
Course Code :	17EC7DCWMC	Day :	Monday
Semester & Section :	7 A,B,C,D	Timings :	11.15am-12.45 pm
Max Marks :	50 M	Duration :	1½ Hrs.

No.		Question Description	Mks	CO & Levels
Q1	(a)	The radiation lobe containing the direction of maximum radiation is called as _____ i. Major lobe ii. Minor lobe iii. Side lobe iv. Back lobe	1	
	(b)	__________ is a least directive antenna. i. linear antenna ii. isotropic antenna iii. aperture antenna iv. all of the above.	1	
	(c)	If beam efficiency is 0.87 then the stray factor is ____ i. 1.87 ii. 0.13 iii.1.30 iv.0.87	1	
	(d)	Fresnel zone is also called as ____ i. Near Field ii. Far Field iii. Electrostatic Field iv. Reactive Field	1	
	(e)	For a center fed short antenna, current distribution is _____ at center and ____ at ends. i. Low, high ii. High, high iii. Low, low iv. High, low	1	
	(f)	Find the directivity when the half power beam widths are 45° and 60° in perpendicular planes. i. 12.58 ii. 17.98 iii. 22.91 iv. 15.28	1	
	(g)	How the directivity and effective aperture related to each other? i. Inversely proportional ii. Directly proportional iii. Independent iv. Proportionality depends on input power	1	
	(h)	If BWFN is 6°, then resolution is ____ i. 12° ii. 3° iii.2° iv.6°	1	
	(i)	What is the Beam area for Directivity to be 1 in Steradian? i.4π ii. $1/2\pi$ iii.2π iv. $1/4\pi$	1	
	(j)	If directivity of antenna increases, then the coverage area _____ i. decreases ii. increases iii. increases and then decreases iv. remains unchanged	1	
Q2	(a)	Illustrate the antenna field pattern using i. co-ordinate system ii. Polar co-ordinate system	5	CO1
	(b)	Define the following: i. Half power beam width ii. Radiation Intensity iii. Directivity iv. Antenna Efficiency v. Resolution	5	CO1
Q3	(a)	Derive the relation between Beam area and Directivity of an antenna.	4	CO1
	(b)	A radio link has 150 W of transmitted power Pt connected to an antenna 3 sq. m effective aperture at 4 GHz. The receiving antenna has an aperture of 0.8 sq. m and is located at 12 km line of sight distance from a transmitting antenna. Assume loss less antenna. Find the power delivered to the receiver.	6	CO1
Q4	(a)	Sketch the radiation intensity pattern for the following: i. Unidirectional cosine cubed pattern: $P = P_m \cos^3 \Theta$ ii. Bidirectional sine squared pattern: $U = U_m \sin^2 \Theta$	5	CO1
	(b)	Write a note on: i. Antenna field zones ii. Effective height of antenna	5	CO1
		OR		CO1
Q5	(a)	Define and obtain the relevant equations for the following: i. Effective Aperture ii. Collective Aperture Obtain the relation between apertures of antenna.	5	CO1
	(b)	Find the beam area and directivity for the following pattern $U = U_m \cos \Theta$ for $0 \leq \Theta \leq \pi$.	5	CO1
Q6	(a)	Derive the Friis formula and discuss on the effect of distance on ratio of received power to transmitted power.	5	CO1
	(b)	Illustrate the fields generated from an oscillating dipole with relevant diagrams.	5	CO1
		OR		CO1
Q7	(a)	Give the physical significance of Gain and Directivity of an antenna.	5	CO1
	(b)	Show that the directivity for unidirectional operation is 2 (n+1)	5	CO1

A – Dr. KPS , B-RSK , C- SAS, D- TT

Note : Q2, Q3, Q4, Q5, Q6, Q7 can be 1 question of 10 Marks or it can be split into (a) & (b)

Note : Q2 – module compulsory, Q3 – module compulsory, Q4 & 5 – choice, Q6 & 7 – choice

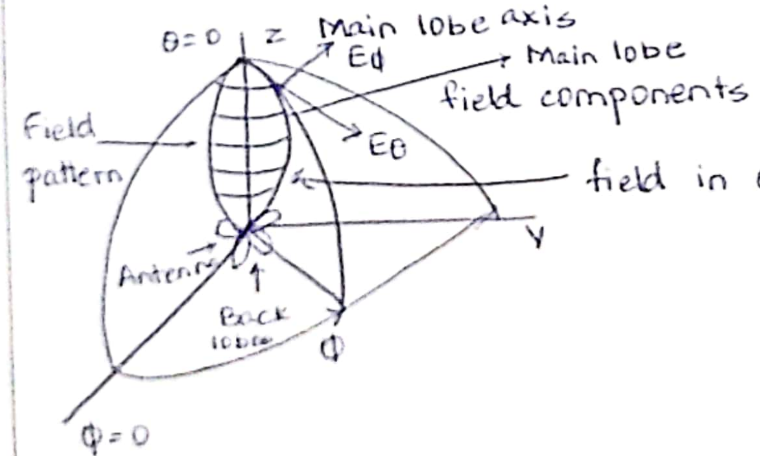
Dayananda Sagar College of Engineering
Shavige Malleshwara Hills, Kumaraswamy Layout, Banashankari, Bangalore-560078, Karnataka
Tel : +91 80 26662226 26661104 Extn : 2731 Fax : +91 80 2666 0789
Web : http://www.dayanandasagar.edu Email : hod-ece@dayanandasagar.edu
(An Autonomous Institute Affiliated to VTU, Approved by AICTE & ISO 9001:2008 Certified)
(Accredited by National Assessment & Accreditation Council (NAAC) with 'A' grade)

Date of test : 08.11.2021	Wireless & Mobile Communications	Max Marks : 50
Day : MONDAY	WMC	Sub Mentor : KPS
Branch : E and C	18EC7DCWMC	Sub Mentor Sign:
Semester : VII	Internal Test	Staff i/c of ser : TT, RSK, SAS
Section : A, B, C, D	CIE- I	Staffs i/c sign :
Timings : 11.15 - 12.45 pm	Test Solutions	HOD Name : Dr. TCM
Test Duration : 1½ Hrs.		HOD's sign :

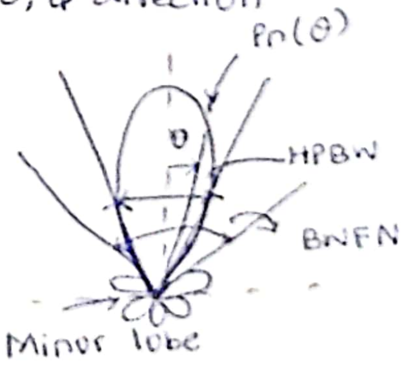
Dr. T. C. Manjunath, HOD ECE, DSCE

Q. No.	Test question paper solutions with steps	Marks Allocation
Q1 a	i. Major lobe	
b	ii. isotropic antenna	
c	ii. 0.13	
d	i. Near field	
e	iv. High, Low	
f	iv. 15.28	
g	ii. Directly proportional	
h	ii. 3°	
i	i. 4π	
j	i. decreases	$1 \times 10 = 10M$

Q2 a



i. coordinate system (2.5M)



ii. Polar co-ordinate (2.5 M)

5M

Q. No.	Test question paper solutions with steps	M. Allo.
b	i HPBW: L'e betw two half power points obtained from a major lobe	
	ii Radiation Intensity: Power radiated from an antenna per unit solid L'e. $P_n(\theta,\phi) = \frac{U(\theta,\phi)}{U(\theta,\phi)_{max}}$ ... W/sr.	
	iii Directivity: Ratio of max. radiation intensity to avg radiation intensity. $D = \frac{U_{max}}{U_0}$	
	iv. Resolution: Equal to half of the Beam width between first nulls. $\frac{BWFN}{2}$.	
	iv. Antenna Efficiency: Ratio of power gain to the directivity of the antenna. $K = \frac{G}{D}$	1x5=5M
Q3 a	Derivation $D = \frac{U_m}{U_0} = \frac{4\pi}{\int_{\theta=0}^{\pi}\int_{\phi=0}^{2\pi} \frac{U}{U_m} \cdot d\Omega} = \frac{4\pi}{\Omega_A}$	4M
b	$\lambda = \frac{c}{f} = \frac{3\times10^8}{4\times10^9} = 0.075\ m$ → 2M	
	$P_r = P_t \cdot \frac{A_{er} \cdot A_{et}}{r^2 \lambda^2}$ → 1M	
	$= \frac{150 \times 0.8 \times 3}{(12\times10^3)^2 \times (0.075)^2}$ → 1M	
	$P_r = 0.000444\ W$ → 2M	6M
Q4 a	i. Unidirectional cosine cubed pattern $P = P_m \cos^3\theta$	

◦ maxima

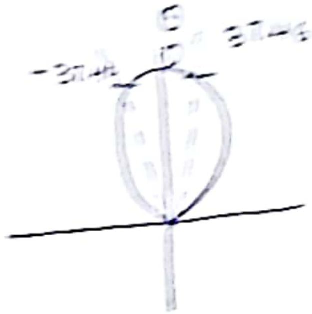
$$P = P_m$$

$$P_m = P_m \cos^3\theta$$

$$\cos^3\theta = 1$$

$$\theta = \cos^{-1}(1)$$

$$\theta = 0$$



◦ Half power points

$$P = \frac{P_m}{2}$$

$$\frac{P_m}{2} = P_m \cos^3\theta$$

$$\theta = \pm\cos^{-1}\left(\frac{1}{2}\right)^{1/3}$$

$$\theta = \pm 37.46^\circ$$

ii. Bidirectional sine squared pattern

$$U = U_m \sin^2\theta$$

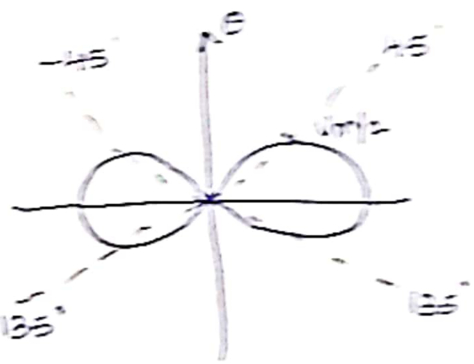
◦ maxima

$$U = U_m$$

$$\sin\theta = 1$$

$$\theta = \pm\sin^{-1}(\pm 1)$$

$$\theta = 90^\circ \text{ or } 270^\circ$$



◦ half power points

$$U = \frac{U_m}{2}$$

$$\frac{U_m}{2} = U_m \sin^2\theta$$

$$\theta = \pm\sin^{-1}\left(\pm\frac{1}{2}\right)^{1/2}$$

$$= \pm\sin^{-1}(\pm 0.707)$$

$$= \pm 45^\circ, \pm 135^\circ.$$

b. i. Antenna field zones - 2.5M

ii Effective height of antenna - 2.5M 5M

Q5

a i. Effective Aperture - It is defined as the ratio of effective power W_e & power density S.

$$A_e = \frac{W_e}{S} = \frac{I^2 R_T}{S}$$

→ 2M

$$\text{Max. } A_{em} = \frac{V^2}{4 R_r S}$$

ii Collective Aperture : Ratio of total power receiver & power density

$$A_C = \frac{W_c}{S}$$

→ 2M

Relation :

$$A_C = A_e + A_L + A_S$$

→ 1M

5M.

b. $$\Omega_A = \int_{\theta=0}^{\pi} \int_{\phi=0}^{2\pi} \cos\theta .\ \sin\theta .\ d\theta .\ d\phi$$ → 1M

→ 2M

$$= 2.\pi$$

$$D = \frac{4\pi}{\Omega_A}$$ → 1M

$$= 2$$ → 1M

5M

Q.6.

a. Friis formula Derivation

$$P_r/P_t = (A_{em} .\ A_{et})/(r\lambda)^2$$ → 4M

Effect of distance on P_r

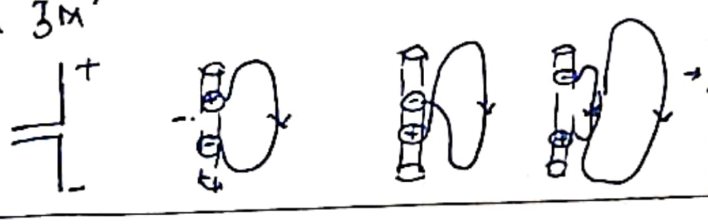
as $r \uparrow$ $P_r \downarrow$ → 1M

5M

b. Fields generated from oscillating dipole

Explanation → 3M

Diagrams



→ 2M

5M

Q7. a.	Physical significance of Gain & Directivity Explanation → 3M Diagram → 2M	5M.
b.	$D = 2(n+1)$ proof. Consider $U = U_m \cos^n \theta$ → 2M find Ω_A → 2M $D = \frac{4\pi}{\Omega_A} = 2(n+1)$ → 1M	5M.