K S INSTITUTE OF TECHNOLOGY

Bangalore – 560109

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

CIE Question paper Scrutiny format

Course Name	Microwave & Antennas
Course Code	18EC63
Course Incharge	~~Dr. Chanda V. Reddy~~ Dr. Dinesh Kumar D.S.
Academic year	2022-23
Semester	6th
CIE #	1
Set	A ☑ B ☐
Scrutiny parameters	
Whether questions are according to assessment plan?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions prepared are within the covered syllabus?	Yes ☑ No ☐ ; If No, Suggestions:
Whether all questions are mapped to CO/PO properly?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions framed are according to Blooms level?	Yes ☑ No ☐ ; If No, Suggestions:
Whether marks distribution for each question is correct?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions paper follows the format displayed?	Yes ☑ No ☐ ; If No, Suggestions:
Difficulty level	Very High ☐ High ☑ Moderate ☐ Low ☐
Percentage of Similarity questions in Set A & B	20-1.
Final decision	Accepted without corrections ☐ Accepted with minor corrections ☐ Not accepted ☐

Signature with date
of CIE Question paper setter

Name and Signature with date
of CIE Question paper Scrutiniser

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23EVEN SEMESTER

SET: A

USN										

Degree : B.E
Branch : ECE
Course Title : MICROWAVE AND ANTENNAS
Duration : 90 Minutes

Semester : VI
Course Code : 18EC63
Date : 18-04-2023
Max Marks : 30

Note: Answer ONE full question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Question	Marks	CO	K-Level
	PART-A			
1(a)	**Explain** Reflex Klystron Oscillator with neat diagram.	6	CO1	K2
(b)	**Solve** for VSWR, Reflection coefficient and Transmission Coefficient of a transmission line of Characteristic impedance 75+j10Ω and terminated in a load impedance of 50+j50Ω.	6	CO1	K3
(c)	**Derive** an expression for SWR in terms of reflection coefficient	6	CO1	K3
	OR			
2(a)	**Explain** mechanism of oscillation of Reflex Klystron Oscillator with neat diagram.	6	CO1	K2
(b)	**Solve** for Zo and γ of the lossless transmission line having R=2Ω/m, G=0.5m mho/m, L=8nH/m and C=0.23pf/m find Vp of the signal if frequency is 1GHz	6	CO1	K3
(c)	**Derive** the equation for transmission line with possible solution	6	CO1	K3
	PART -B			
3(a)	**Infer** the losses in two port network interms of S-Parameters.	6	CO2	K2
(c)	**Identify and briefly explain** the properties of S Matrix for lossless junction.	6	CO2	K3
	OR			
4(a)	**Infer** the advantages, common factors and conversion expression ofS parameters with Z parameters	6	CO2	K2
(b)	**Develop** S matrix representation of multiport network.	6	CO2	K3

Dr Chandra V Reddy
Dr- Dinesh Kumar D.S

Name &Signature of Course In charge Name &Signature of Module Coordinator HOD ECE Principal

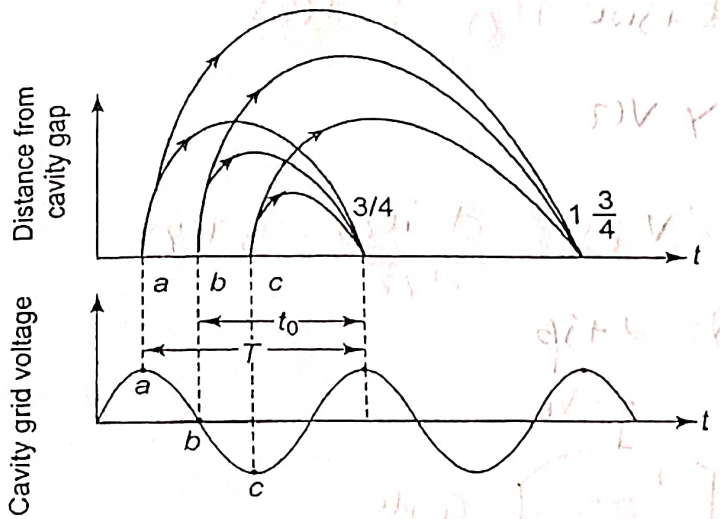
Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

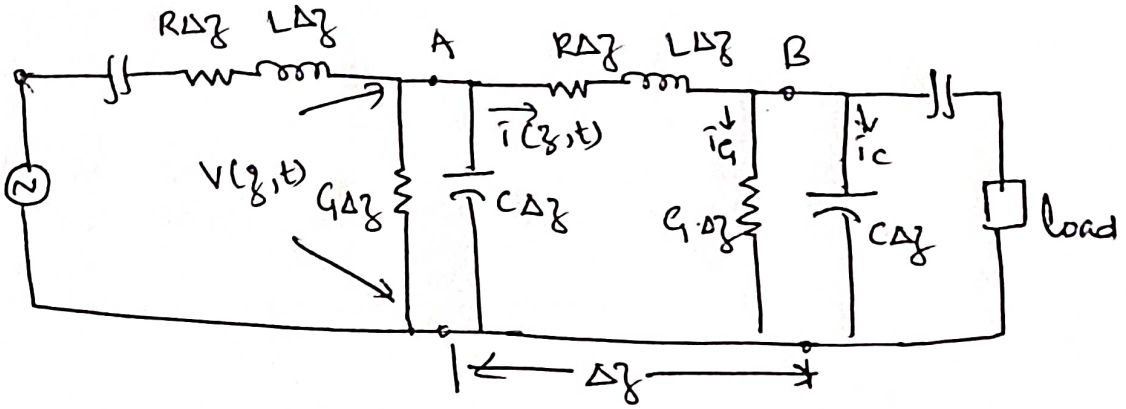
I INTERNAL TEST SCHEME 2022 – 23 EVEN SEMESTER

Set : A

Degree	:	**B.E**	**Semester**	:	**VI**
Branch	:	**Electronics & Communication Engg**	**Subject Code**	:	**18EC63**
Subject Title	:	**MICROWAVE AND ANTENNA**	**Date**	:	**18/04/2023**

Q No.	Answers	Marks
1. a)	Diagram and Explanation 	2+4=6
b.	$\Gamma = \frac{Z_l - Z_0}{Z_l + Z_0} = \frac{(70+j50)-(75+j0)}{(70+j50)+(75+j0)}$ $= 0.075 + j0.38 = 0.326 \angle 76.7^0$ $S = \frac{1+\lvert\Gamma\rvert}{1-\lvert\Gamma\rvert} = 1.967$ $T = \frac{2Z_l}{Z_l+Z_0} = \frac{2(70+j50)}{(70+j50)+75} = 1.075 + j0.38$	2x3 =6M.

c



Dia -2M
Exp -4M

$$\Delta v = \Delta i \Delta z + L\frac{\partial i}{\partial t}\Delta z \quad \& \quad \Delta i = G v \Delta z + C\cdot\frac{\partial v}{\partial t}\cdot\Delta z$$

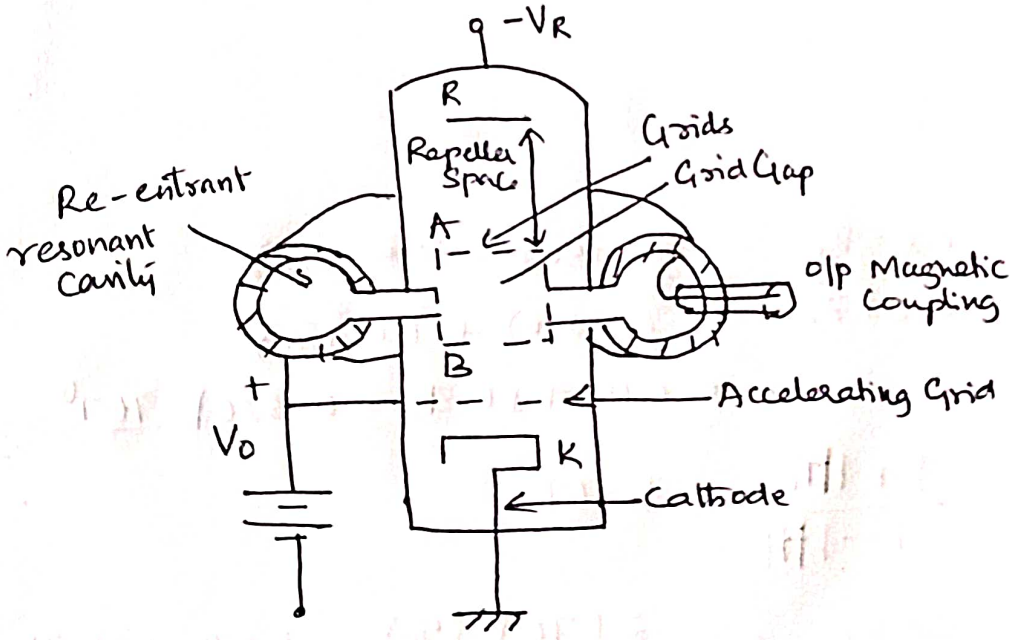
$$\frac{dV(z)}{dz} = (R+j\omega L)\, I(z) = Z\cdot I(z)$$

$$\& \quad \frac{d}{dz} i(z) = Y\cdot V(z)$$

$$\frac{d^2V(z)}{dz^2} = \gamma^2 V(z) \quad \& \quad \frac{d^2 i(z)}{dz^2} = \gamma I(z)$$

$$\gamma = \alpha + j\beta$$

2.a



Dia-2M
Exp-4M

For Lossless $R=0$ $G=0$

2b $Z_0 = \sqrt{\frac{R+j\omega L}{G+j\omega C}}$ or $Z_0 = \sqrt{\frac{L}{C}} = \sqrt{\frac{8\,nH}{0.23p}} = 186.5$

$\gamma = \sqrt{LC} = \sqrt{8\,nH \times 0.23p}$

$= 4.8 \times 10^{-11}$

2X3 =6M

c At Microwave frequencies

$R \leq \omega L$ & $G \leq \omega C$

$\gamma = \sqrt{(R+j\omega L)(G+j\omega C)}$

$\gamma = j\omega\sqrt{LC} + \frac{1}{2}\left(R\sqrt{\frac{C}{L}} + G \cdot \sqrt{\frac{L}{C}}\right)$

$\gamma = \alpha + j\beta$ where $\beta = \omega\sqrt{LC}$

& $Z_0 = \sqrt{\frac{R+j\omega L}{G+j\omega C}} = \sqrt{\frac{L}{C}}$

3X2 =6M

3.a $V_K = V_K^+ + V_K^-$

& $I_K = V_K^+ Y_0 - V_K^- Y_0$

$[V^+] = \frac{1}{2Y_0}([Y] + Y_0[U])[V]$

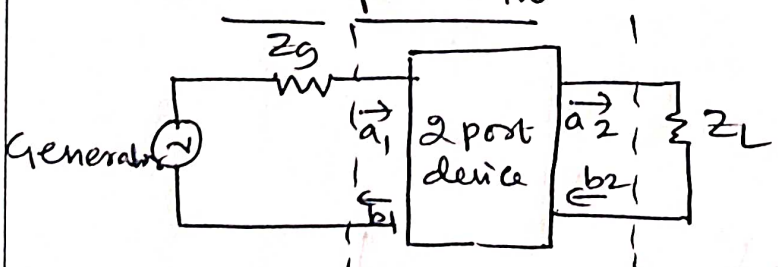
$[V^-] = \frac{-1}{2Y_0}([Y] - Y_0[U][V]$

$[S] = ([U] - [Y]/Y_0)([U] + [Y]/Y_0)^{-1}$

(or) $[\bar{Z}] = (U-S)^{-1}(U+S)$; $\bar{Z} = Z/Z_0$

6M

b. Two port n/w



$b_1 = S_{11}a_1 + S_{12}a_2$

$b_2 = S_{21}a_1 + S_{22}a_2$

Dia-2
Exp-4

$$S_{11} = \frac{b_1}{a_1}\Big|_{a_2=0} \qquad S_{12} = \frac{b_1}{a_2}\Big|_{a_1=0}$$

$$S_{22} = \frac{b_2}{a_2}\Big|_{a_1=0} \qquad S_{21} = \frac{b_2}{a_1}\Big|_{a_2=0}$$

4a **Symmetry property**

$$S_{ij} = S_{ji} \quad i \neq j$$

& $[S] = [S]_T$

$[V] = [Z][I]$

$[b] = \{[z]-[U]\}\{[z]+[U]\}^{-1}[a]$

where $[S] = \{[z]-[U]\}\{[z]+[U]\}^{-1}$

6M

b For Mismatched load $\Gamma_2 = \frac{a_2}{b_2}$

$a_2 = \Gamma_2 b_2$

$$\Gamma_1 = \frac{b_1}{a_1} = S_{11} + \frac{S_{12}S_{21}\Gamma_2}{1-S_{22}\Gamma_2}$$

$\Gamma_1 \neq S_{11}$

6M

For reciprocal n/w $S_{12} = S_{21}$

$$\Gamma_1 = S_{11} + \frac{S_{12}^2\Gamma_2}{1-S_{22}\Gamma_2}$$

Course in charge | Module Coordinator | HOD - ECE

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

CIE Question paper Scrutiny format

Course Name	Microwave & Antennas
Course Code	18EC63
Course Incharge	Dr. Chandan Reddy & Dr. Dinesh Kumar D.S
Academic year	2022-23
Semester	6th
CIE #	1
Set	A☐ B☑
Scrutiny parameters	
Whether questions are according to assessment plan?	Yes ☑ No☐ ; If No, Suggestions:
Whether questions prepared are within the covered syllabus?	Yes ☑ No ☐ ; If No, Suggestions:
Whether all questions are mapped to CO/PO properly?	Yes ☑ No ☐ ; If No, Suggestions:
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Difficulty level	Very High ☐ High ☑ Moderate ☐ Low☐
Percentage of Similarity questions in Set A & B	20-1-
Final decision	Accepted without corrections☐ Accepted with minor corrections☐ Not accepted☐

Signature with date
of CIE Question paper setter

Name and Signature with date
of CIE Question paper Scrutiniser

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
FIRST INTERNAL TEST QUESTION PAPER 2022-23EVEN SEMESTER

SET: B

USN										

Degree : B.E
Branch : ECE
Course Title : MICROWAVE AND ANTENNAS
Duration : 90 Minutes

Semester : VI
Course Code : 18EC63
Date : 18-04-2023
Max Marks : 30

Note: Answer ONE full question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Question	Marks	CO	K-Level
	PART-A			
1(a)	**Explain** Velocity modulation process in Mechanism of mechanism of oscillation of Reflex Klystron.	6	CO1	K2
(b)	**Solve** for Reflection coefficient, Transmission Coefficient and of a transmission line of Characteristic impedance 75Ω and terminated in a load impedance of 70+j50Ω.	6	CO1	K3
(c)	**Derive** the equation for transmission line with possible solution	6	CO1	K3
	OR			
2(a)	**Explain** Operation ofReflex klystron Oscillator with neat diagram.	6	CO1	K2
(b)	**Solve** for Zo and γ of the lossless transmission line having R=.02Ω/m, G=0.005mho/m, L=8nH/m and C=0.23pf/m find Vp of the signal if frequency is 2GHz.	6	CO1	K3
(c)	**Derive an expression for** Zo and γ for a transmission line with relevant expressions	6	CO1	K3
	PART -B			
3(a)	**Infer** the advantages, common factors and conversion expressionS matrix properties with Y parameters.	6	CO2	K2
(c)	**Develop** S matrix representation of two port network.	6	CO2	K3
	OR			
4(a)	**State and prove** symmetry property for a reciprocal network	6	CO2	K2
(b)	**Developthe** expression for S matrix representation of two port mismatched network.	6	CO2	K3

Dr Chandra V Reddy
Dr. Dinesh Kumar D.S

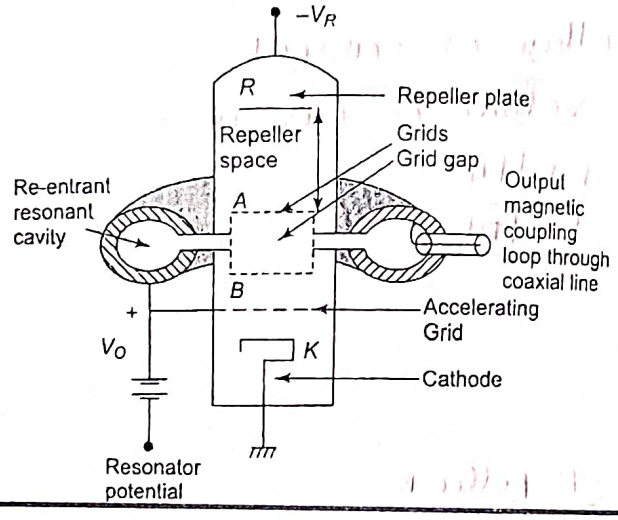
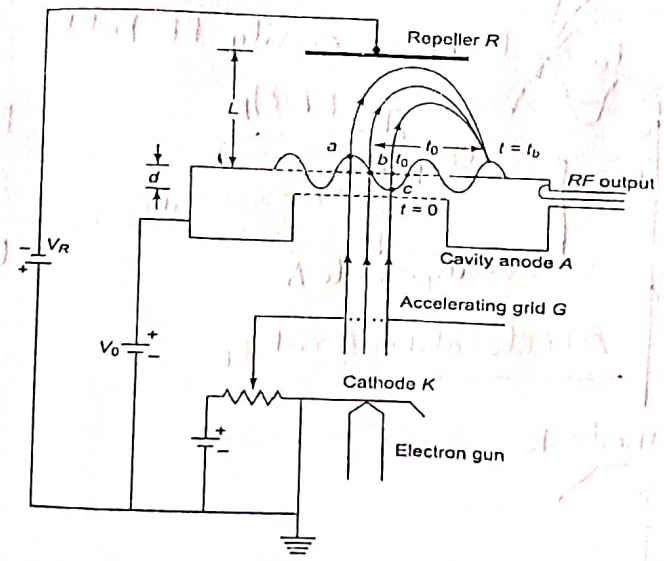
Name &Signature of Course In charge Name &Signature of Module Coordinator HOD ECE Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

I INTERNAL TEST SCHEME 2022 – 23 EVEN SEMESTER

Set : A

Degree	:	**B.E**	**Semester**	:	**VI**
Branch	:	**Electronics & Communication Engg**	**Subject Code**	:	**18EC63**
Subject Title	:	**MICROWAVE AND ANTENNA**	**Date**	:	**18/04/2023**

Q No.	Answers	Marks
	Diagram and explanation 	Dia 3M
		EXP 3M

b $\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{(50+j50) - (75+j10)}{(50+j50)+(75+j10)}$

$= -0.03 - j0.335 = 0.339 \angle -95.07^\circ$

$S = \frac{1+|\Gamma|}{1-|\Gamma|} = \frac{1+0.339}{1-0.339} = 2.02$

$T = \frac{2Z_L}{Z_L+Z_0} = \frac{2(50+j50)}{(50+j50)+(75+j10)} = 0.96 + j0.34$

2X3 = 6

c. SWR = $\frac{\text{Maximum voltage or current}}{\text{minimum voltage or current}}$

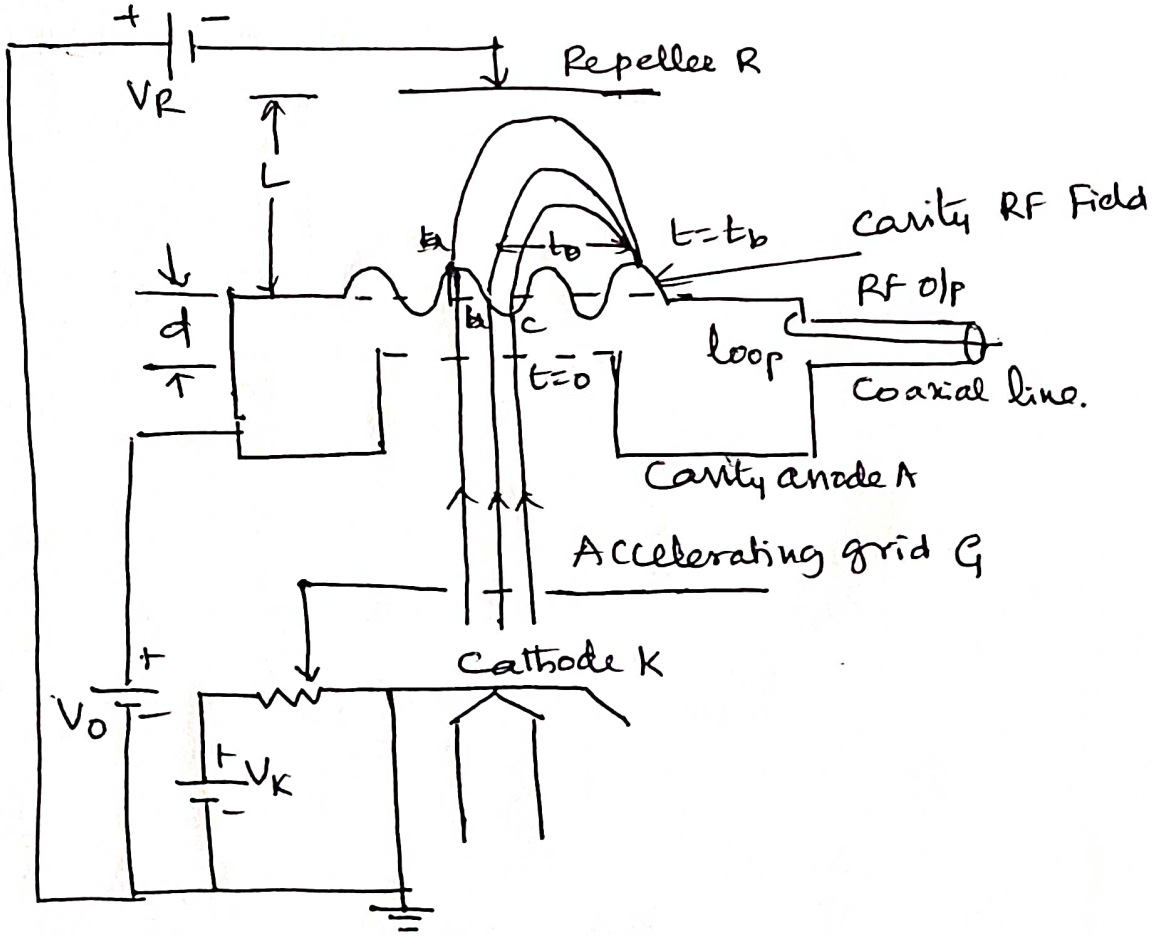
$S = \frac{|V_{max}|}{|V_{min}|} = \frac{1+|\Gamma|}{1-|\Gamma|}$

& $|\Gamma| = \frac{S-1}{S+1}$

Definition 2M

Expression 4M.

2.a



Dia 3M

Exp 3M

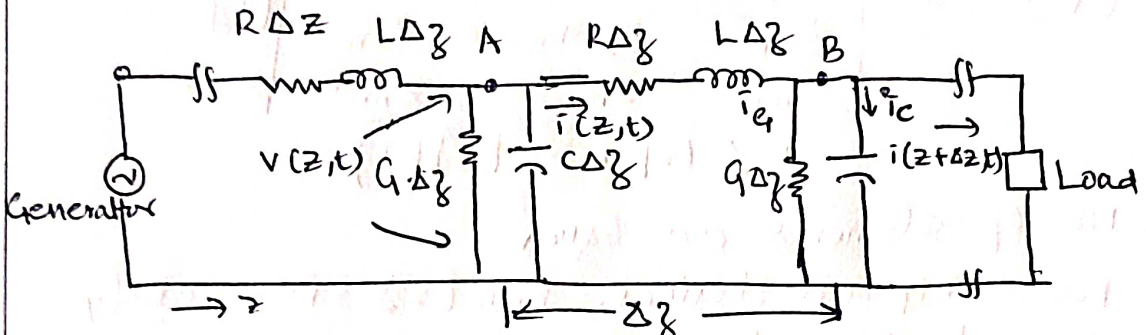
b $Z_0 = \sqrt{\frac{R+j\omega L}{G+j\omega C}} = 181.59 \angle -8.40^0 = 179.44 + j26.50$

$\gamma = \sqrt{(R+j\omega L)(G+j\omega C)} = 0.2774 \angle 79.31^0$

$= 0.051 + j0.273$

2×3 = 6M

c.



Dia 2M

$\Delta v = Ri\Delta z + L\frac{\partial i}{\partial t}\Delta z$ & $\Delta i = GV\Delta z + C\frac{\partial v}{\partial t}\Delta z$ Exp 4M

$\frac{dV(z)}{dz} = (R+j\omega L)I(z) = Z \cdot I(z)$

& $\frac{d}{dz}I(z) = Y \cdot V(z)$

$\frac{d^2V(z)}{dz^2} = \gamma^2 V(z)$ & $\frac{d^2I(z)}{dz^2} = \gamma^2 I(z)$

$\gamma = \alpha + j\beta$

3.a Insertion loss $= 20\log\frac{1}{S_{12}}$

Transmission loss $= 10\log_{10}\frac{1-|S_{11}|^2}{|S_{12}|^2}$

Reflection loss $= 10\log_{10}\frac{1}{1-|S_{11}|^2}$ 6M

& Return loss $= 10\log_{10}\frac{P_i}{P_r} = 20\log_{10}\frac{1}{|S_{11}|}$

b. Property 1: The diagonal elements of a perfectly matched n/w is zero.

Symmetry property :- $S_{ij} = S_{ji}$ $i \neq 0$ i.e $[S] = [S]^T$

Unitary property $[S][S^*] = [U]$ 6M

Phase shift property $[S'] = \begin{bmatrix} e^{-j\phi_1} & 0 \\ 0 & e^{-j\phi_2} \end{bmatrix}[S]\begin{bmatrix} e^{-j\phi_1} & 0 \\ 0 & e^{-j\phi_2} \end{bmatrix}$

4a

$$V_K = V_K^+ + V_K^- = \sum_{j=1}^{n} Z_{kj} I_j$$

$$V_K^- = \frac{1}{2}\left(\sum_{j=1}^{n} Z_{kj} I_j - Z_0 I_k\right)$$

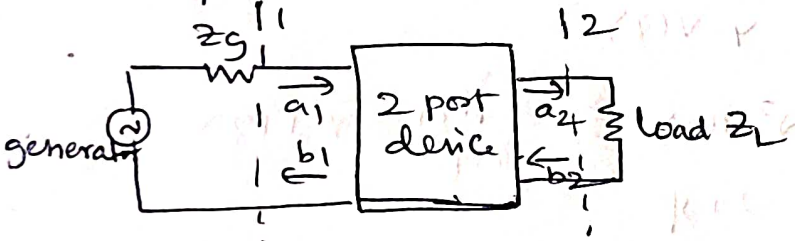
$$[V^+] = \frac{1}{2}\begin{bmatrix} Z_{11}+Z_0 & Z_{12} & \cdots & Z_{1n} \\ Z_{21} & Z_{22}+Z_0 & \cdots & Z_{2n} \\ Z_{n1} & Z_{n2} & \cdots & Z_{nn}+Z_0 \end{bmatrix}[I]$$

$$= \frac{1}{2}\left([Z] + Z_0[U]\right)[I]$$

1. No of elements are Equal
2. For reciprocal devices, both [Z] & [S] satisfy reciprocity properties $Z_{ij} = Z_{ji}$ & $S_{ij} = S_{ji}$

B
Exp-4
Adv-2

4b Multi port n/w.



Dia-2M
Exp 4M.

For a 2 port n/w.

$b = S \cdot a$

$$b_1 = S_{11}a_1 + S_{12}a_2 \quad -(1)$$

$$b_2 = S_{21}a_1 + S_{22}a_2 \quad -(2)$$

For a Multiport n/w.

$$\begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} & \cdots & S_{1n} \\ S_{21} & S_{22} & \cdots & S_{2n} \\ \vdots & & & \\ S_{n1} & S_{n2} & \cdots & S_{nn} \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{bmatrix}$$

Course in charge | Module Coordinator | HOD - ECE

K S INSTITUTE OF TECHNOLOGY Bangalore – 560109

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

CIE Question paper Scrutiny format

Course Name	Microwave and Antennas
Course Code	18EC63
Course Incharge	Dr. Chanda V reddy Dr. Dinesh Kumar
Academic year	2022-23
Semester	VI
CIE #	2nd
Set	A ☑ B ☐
Scrutiny parameters	
Whether questions are according to assessment plan?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions prepared are within the covered syllabus?	Yes ☑ No ☐ ; If No, Suggestions:
Whether all questions are mapped to CO/PO properly?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions framed are according to Blooms level?	Yes ☑ No ☐ ; If No, Suggestions:
Whether marks distribution for each question is correct?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions paper follows the format displayed?	Yes ☑ No ☐ ; If No, Suggestions:
Difficulty level	Very High ☐ High ☑ Moderate ☐ Low ☐
Percentage of Similarity questions in Set A & B	zero %
Final decision	Accepted without corrections ☑ Accepted with minor corrections ☐ Not accepted ☐

31/5/23

31/5/23

Signature with date
of CIE Question paper setter

31/5

Name and Signature with date
of CIE Question paper Scrutiniser

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
SECOND SESSIONAL TEST QUESTION PAPER 2022 – 23 EVEN SEMESTER

SET – A

USN										

Degree	:	B.E	Semester	:	VI
Branch	:	ECE	Course Code	:	18EC63
Course Title	:	MICROWAVE AND ANTENNAS	Date	:	6-06-2023
Duration	:	90 Minutes	Max Marks	:	30

Note: Answer ONE full question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	**Outline** the following with respect to antennas 1. Beam Efficiency 2. Radiation Intensity 3. HPBW	6	CO3	K2
(b)	**Make use of** A lossless parallel strip line having a conducting strip width 'w', substrate dielectric separating the two conducting strips has a relative dielectric constant ε_{rd} of '6' and a thickness 'd' of 4mm. to calculate: i) The required widths 'w' of the conducting strip in order to have a Characteristic impedance of 50Ω. ii) The Strip line Capacitance 'C'. iii) The strip line Inductance 'L'.	6	CO3	K3
(C)	**Solve** for the maximum power received at a distance of 0.5km over a free space of 1GHz circuit. Consisting of transmitting Antenna and receiving Antenna are 25dB and 20dB gain respectively. The transmitting antenna input is 150w.	6	CO3	K3
	OR			
2(a)	**Relate** the transmitted power and received Power of antenna by obtaining Friss Transmission Formula.	6	CO3	K2
(b)	**Make use of** shielded strip line parameters of εr =2.256, w=2mm, t=0.5mm and d=4mm to calculate i) The K factor ii) Cf iii) Zo	6	CO3	K3
(C)	**Solve** for Beam area and Directivity i) $E = \text{Cos}\theta$ for $0 \leq \theta \leq \pi$ ii) $U = \text{UmSin}^2\theta\ \text{Sin}^3\varphi$ for $0 \leq \theta \leq \pi$ and for $0 \leq \varphi \leq \pi$	6	CO3	K3
	PART-B			
3(a)	**Explain** variable Attenuator with a neat diagram.	6	CO2	K2
(b)	**Explain** different types of Point sources.	6	CO4	K2
	OR			
4(a)	**Explain** rotary precision phase shifter with a neat diagram.	6	CO2	K2
(b)	**Explain** different types of Array patterns.	6	CO4	K2

1) Dr Chonda V Reddy
2) Dr Dinesh Kumar D.S

Name & Signature of Course In charge:	Name & Signature of Module Coordinator:	HOD ECE	Principal

Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
SECOND INTERNAL TEST SCHEME 2021 – 22 EVEN SEMESTER

Set : A

Degree	:	**B.E**	**Semester**	:	**VI**
Branch	:	**Electronics & Communication Engg**	**Subject Code**	:	**18EC63**
Subject Title	:	**MICROWAVE AND ANTENNA**	**Date**	:	**6/06/2023**

Q No.	Answers	Marks
1a	Each Definitions 2marks 1. Beam Efficiency 2. Radiation Intensity 3. HPBW	2×3 = 6
b	i) $Z_0 = \frac{377}{\sqrt{\varepsilon_{rd}}}\left(\frac{d}{w}\right)$ $w = \frac{377}{\sqrt{\varepsilon_{rd}}} \cdot \frac{d}{Z_0}$ $w = \frac{377}{\sqrt{6}} \times \frac{4\times10^{-3}}{50}$ $w = 0.012312 = 12.31\times10^{-3}$ m ii) $C = ?$ $C = \frac{\varepsilon_d w}{d} = \frac{8.854\times10^{-12}\times6\times12.31\times10^{-3}}{4\times10^{-3}}$ $C = 163.48$ pF/m iii) $L = \frac{\mu_c d}{w} = \frac{4\pi\times10^{-4}\times4\times10^{-3}}{12.31}$ $= 408\times10^{-9}$ H/m $L = .408\ \mu$H/m	2×3 = 6
c	$A_{el} = \frac{\lambda^2}{4\pi} G_{11} = \frac{(0.3)^2\times G_{11}}{4\pi} = \frac{(0.3)^2\times100}{4\pi} = 0.716$ m² (2) $\lambda = \frac{c}{f} = 0.3$ (2) $P_r = \frac{P_t A_{et} A_{er}}{\lambda^2 r^2} = \frac{150\times2.264\times0.716}{(0.3)^2\times(0.5\times10^3)^2}$ (2) $A_{er} = 2.264$ m² (2) $P_r = 10.8$ mW	2+2+2 = 6
2 a	$\frac{P_r}{P_t} = \frac{A_{et} A_{er}}{\lambda^2 r^2}$ derivation	6

b

(i) $K = \frac{1}{1 - \tau/d}$ ≥1.14

(ii) $C_f = \frac{8.854\,\epsilon_r}{\pi}\left[2K\ln(K+1) - (K-1)\ln(K^2-1)\right]$

$C_f = 1\mp.06$ pF

2×3 = 6

(iii) $Z_0 = \frac{94.15}{\sqrt{\epsilon_r}}\left(\frac{w}{d}K + \frac{C_f}{8.854\,\epsilon_r}\right)^{-1}$

$Z_0 = 53.5\ \Omega$

C

$\Omega_A = \int_\theta \int_\phi P_n(\theta, \phi)\, d\Omega$ $\qquad D = \frac{4\pi}{\Omega_A}$

i) $P_n = E_n^2 = \cos^2\theta$.

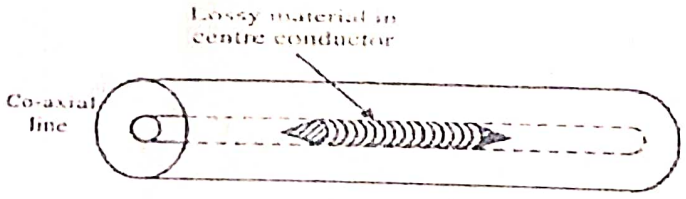
(2) (1)

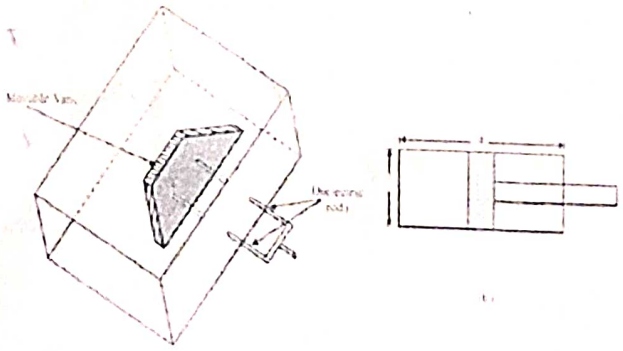
$\Omega_A = \frac{4\pi}{3} S_0$. $\qquad D = \frac{4\pi}{\Omega_A} = \frac{4\pi}{4\pi/3} = 3$

ii) $\Omega_A = \frac{16}{9}$ (3) $\qquad D = \frac{4\pi}{\Omega_A} = \frac{4\pi}{16/9} = \frac{9\pi}{4} = 7.068$ (1)

3+3 = 6

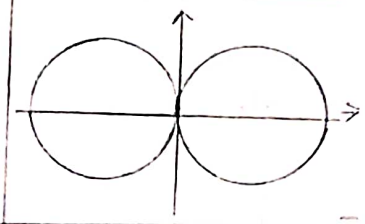
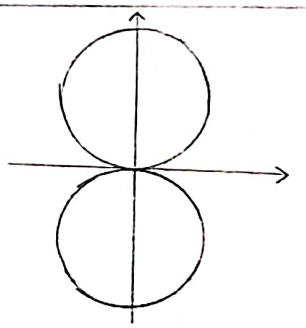
3a Explanation with diagram





2+4 = 6

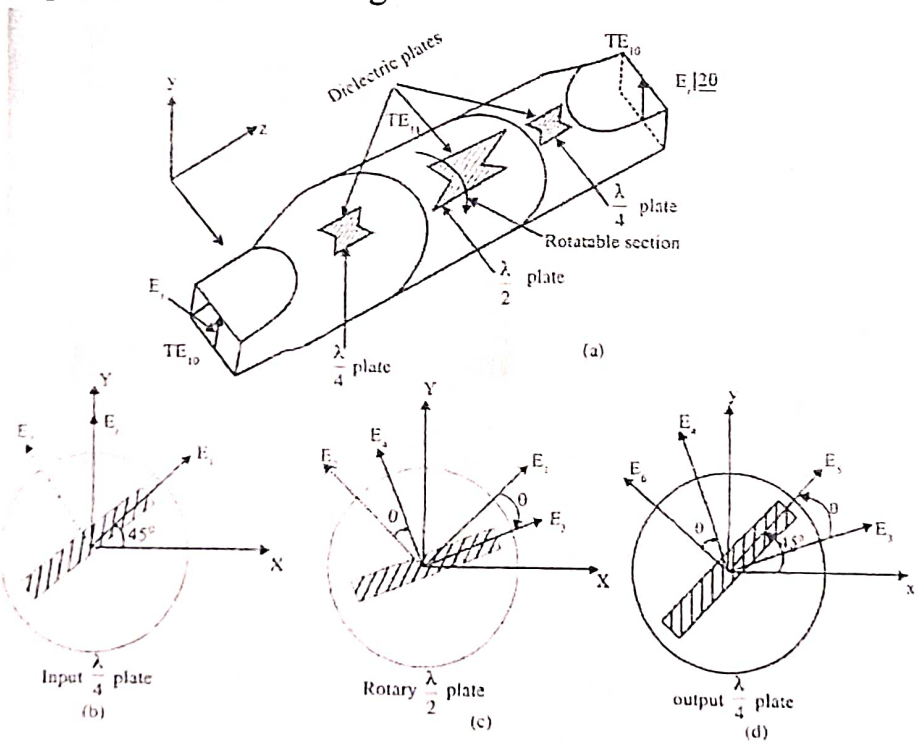
b

1. Isotropic point Source	D = 1	
2. Hemisphere point Source	D = 2	
3. Dough Nut point Source (Lin^2 Source)	D = 1.5	
4. Cosine point Source	D = 2(n+1) Ex: 1) $\cos^1\theta$, D = 4 2) $\cos^2\theta$, D = 6	

6.

Explanation with neat diagram

4a



6

b

a) Broad - Side array

b) End - fire array

3+3 =6

Course in charge

HOD - ECE

K S INSTITUTE OF TECHNOLOGY Bangalore – 560109

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

CIE Question paper Scrutiny format

Course Name	Microwave and Antennas
Course Code	18EC63
Course Incharge	Dr. Chanda V reddy Dr. Dinesh Kumar
Academic year	2022-23
Semester	VI
CIE #	2nd
Set	A☐ B☑
Scrutiny parameters	
Whether questions are according to assessment plan?	Yes☑ No☐ ; If No, Suggestions:
Whether questions prepared are within the covered syllabus?	Yes☑ No ☐ ; If No, Suggestions:
Whether all questions are mapped to CO/PO properly?	Yes☑ No ☐ ; If No, Suggestions:
Whether questions framed are according to Blooms level?	Yes☑ No ☐ ; If No, Suggestions:
Whether marks distribution for each question is correct?	Yes☑ No ☐ ; If No, Suggestions:
Whether questions paper follows the format displayed?	Yes☑ No ☐ ; If No, Suggestions:
Difficulty level	Very High ☐ High ☑ Moderate ☐ Low☐
Percentage of Similarity questions in Set A & B	zero %
Final decision	Accepted without corrections☑ Accepted with minor corrections☐ Not accepted☐

31/5/23

31/5/23

Signature with date
of CIE Question paper setter

31/5

Name and Signature with date
of CIE Question paper Scrutiniser

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
SECOND SESSIONAL TEST QUESTION PAPER 2022 – 23 EVEN SEMESTER

SET – B

USN										

Degree : B.E
Branch : ECE
Course Title : MICROWAVE AND ANTENNAS
Duration : 90 Minutes

Semester : VI
Course Code : 18EC63
Date : 6-06-2022
Max Marks : 30

Note: Answer ONE full question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	**Explain** various types of Radiation Patterns with the definition of Radiation Pattern.	6	CO3	K2
(b)	**Make use of** shielded strip line parameters of ε_r =2.56, w=25mils, t=14mils and d=70mils to calculate i) The K factor ii) C_f iii) Zo	6	CO3	K3
(C)	**Solve** for the input to the transmitting Antenna if gain of transmitting Antenna and receiving Antenna are 25dB and 35dB respectively. The Power received by the receiving Antenna at a distance of 1kM over a free space at a frequency of 1GHz is 12mW.	6	CO3	K3
	OR			
2(a)	**Explain** the working of Microstrip line with neat diagram and list the various losses that occur in it.	6	CO3	K2
(b)	**Make use of** a lossless gold parallel strip line having a conducting strip width 'w'of 25mm, substrate dielectric separating the two conducting strips has a relative dielectric constant ε_{rd} of '2.25' and a thickness 'd' of 5mm. to calculate: i) Characteristic impedance 'Z_0' ii) The Strip line Capacitance 'C'. iii) The strip line Inductance 'L'.	6	CO3	K3
(C)	**Solve** for Beam area and Directivity i) E = Sinθ for $0 \leq \theta \leq \pi$ ii) U = UmSinθSinφ for $0 \leq \theta \leq \pi$ and for $0 \leq \varphi \leq \pi$	6	CO3	K3
	PART-B			
3(a)	**Build** S-matrix of E-plane and H-plane stating the characteristic features.	6	CO2	K3
(b)	**Develop** an equation for total electric field intensity of two point sources in far field with same magnitude and in phase.	6	CO4	K3
	OR			
4(a)	**Build** S-matrix and explain the working principle of Magic TEE with neat diagrams.	6	CO2	K3
(b)	**Develop** an equation for total electric field intensity of two point sources in far field with same magnitude and out off phase.	6	CO4	K3

Dr Chanda V Reddy
Dr Dinesh Kumar D-S

Name & Signature of Course In charge:

Name & Signature of Module Coordinator:

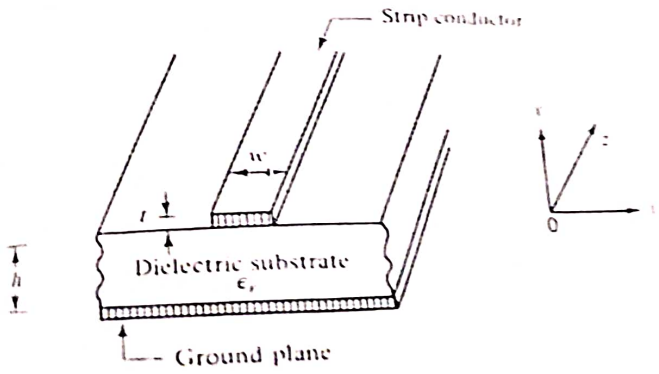
HOD ECE

Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
SECOND INTERNAL TEST SCHEME 2021 – 22 EVEN SEMESTER

Set : B

Degree	:	**B.E**	**Semester**	:	**VI**
Branch	:	**Electronics & Communication Engg**	**Subject Code**	:	**18EC63**
Subject Title	:	**MICROWAVE AND ANTENNA**	**Date**	:	**6/06/2023**

Q No.	Answers	Marks
1 a	Definition of Radiation Patterns 1. Field pattern 2. Power pattern	3+3=6
b	$K = \left(1 - \frac{t}{d}\right)^{-1} = \left(\frac{1 - 14}{70}\right)^{-1} = 1.25$ $C_f = \frac{8.854 \times 2.56}{3.1416}[2 \times 1.25 \ln(1.25 + 1) - (1.25 - 1)\ln(1.25^2 - 1)]$ $= 15.61$ pF/m. $Z_0 = \frac{94.15}{\sqrt{2.56}}\left[\frac{25}{70}(1.25) + \frac{15.61}{8.854 \times 2.56}\right]^{-1}$ $= 50.29\ \Omega$	2x3 =6
c	$G_t = 10^{(25/10)} = 316.22$ $G_0 = 10^{(20/10)} = 100$ $\eta = 1$ $\therefore D_t = 316.22$ $D_0 = 100$ $A_{et} = \frac{D_t \lambda^2}{4\pi} = 2.26\ m^2$ —(1) $A_{e0} = 0.716\ m^2$ —(2) $P_t = \frac{P_0 \lambda^2 g^2}{A_{et} A_{e0}} = 666.24\ W$ —(3)	6
2 a	Working with neat diagram  The losses are Dielectric losses, - Ohmic skin losses and Radiation loss	2+4 =6

b

i) $Z_0 = \frac{377}{\sqrt{\varepsilon_{rd}}}\left(\frac{d}{w}\right)$

$w = \frac{377}{\sqrt{\varepsilon_{rd}}} \cdot \frac{d}{Z_0} = 50.266$

ii) $C = ?$

$C = \frac{\varepsilon_d w}{d} = 0.996pF$

iii) $L = \frac{\mu_c d}{w}$ 25micro H

2+3=6

c

$\Omega_A = \int_\theta \int_\phi P_n(\theta, \phi)\, d\Omega$ $\quad D = \frac{4\pi}{\Omega_A}$

i)

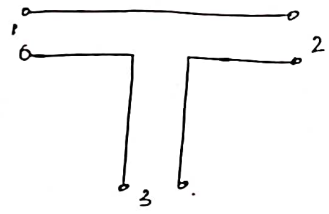
$Pn = En^2 = \sin^2\theta$

$\Omega_A = \frac{8\pi}{3}$ — (2) $\quad D = \frac{4\pi}{\Omega_A} = \frac{4\pi}{8\pi/3} = \frac{3\pi}{2}$ — (1)

ii) $\Omega_A = \pi$ — (2) $\quad D = \frac{4\pi}{\pi} = 4$ — (1)

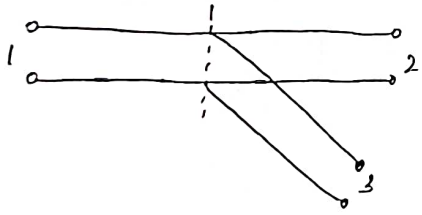
3+3 =6

3 a E-plane Tee:



$[S] = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & \frac{1}{\sqrt{2}} \\ \frac{1}{2} & \frac{1}{2} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 \end{bmatrix}$

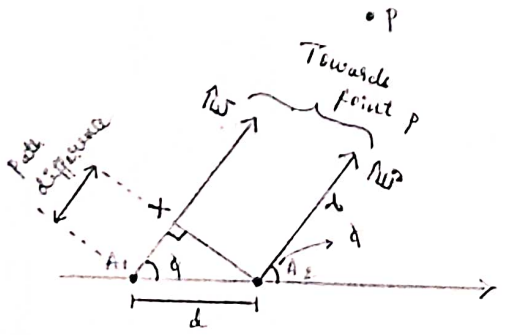
H-plane Tee:



$[S] = \begin{bmatrix} \frac{1}{2} & -\frac{1}{2} & \frac{1}{\sqrt{2}} \\ -\frac{1}{2} & \frac{1}{2} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 \end{bmatrix}$

3+3=6

b Explanation — (2)

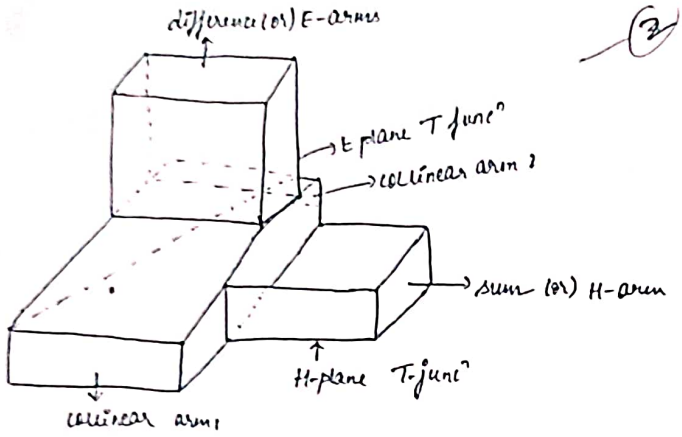


— (2)

$E_{Tn} = \frac{\vec{E_T}}{|\vec{E_T}|_{max}} = \cos\psi/2$ — (2)

2×3 =6

4 a



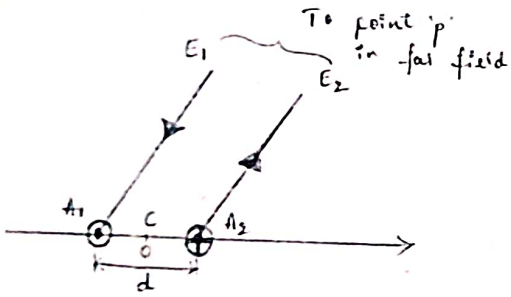
(2)

(4)

$$[S]_{\text{magic-T}} = \begin{bmatrix} 0 & 0 & 1/\sqrt{2} & 1/\sqrt{2} \\ 0 & 0 & -1/\sqrt{2} & 1/\sqrt{2} \\ 1/\sqrt{2} & -1/\sqrt{2} & 0 & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 & 0 \end{bmatrix}$$

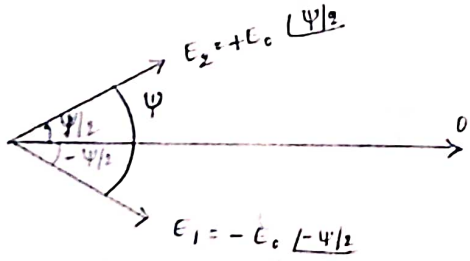
2+4 = 6

b



3+3 = 6

2 - point Sources supplied with Currents of same magnitude but opposite in phase



Vector diagram of $\vec{E_1}$ and $\vec{E_2}$ taking reference 17 as Centre

$$|\vec{E_1}| = 2E_c \sin \psi/2$$

Course in charge

HOD - ECE

K S INSTITUTE OF TECHNOLOGY
Bangalore – 560109

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

CIE Question paper Scrutiny format

Course Name	Microwave and Antennae
Course Code	18EC63
Course Incharge	Dr. Chanda V Reddy/Dr-Dinesh Kumar D S
Academic year	2022-23
Semester	6
CIE #	3
Set	A ☑ B ☐
Scrutiny parameters	
Whether questions are according to assessment plan?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions prepared are within the covered syllabus?	Yes ☑ No ☐ ; If No, Suggestions:
Whether all questions are mapped to CO/PO properly?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions framed are according to Blooms level?	Yes ☑ No ☐ ; If No, Suggestions:
Whether marks distribution for each question is correct?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions paper follows the format displayed?	Yes ☑ No ☐ ; If No, Suggestions:
Difficulty level	Very High ☐ High ☑ Moderate ☐ Low ☐
Percentage of Similarity questions in Set A & B	20%
Final decision	Accepted without corrections ☐ Accepted with minor corrections ☐ Not accepted ☐

Signature with date
of CIE Question paper setter

Name and Signature with date
of CIE Question paper Scrutiniser

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
THIRD SESSIONAL TEST QUESTION PAPER 2022 – 23 EVEN SEMESTER

KSIT **SET – A**

USN | | | | | | | | | | |

Degree	: B.E	Semester	: VI
Branch	: ECE	Course Code	: 18EC63
Course Title	: MICROWAVE AND ANTENNAS	Date	: 7-07-2023
Duration	: 90 Minutes	Max Marks	: 30

Note: Answer ONE full question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	**Explain** a Parabolic antenna with neat diagram and supporting equations	6	CO5	K2
(b)	**Develop** expressions for field patterns of small loop antenna.	6	CO5	K3
(C)	**Solve** for length, H – plane aperture, directivity and gain of a pyramadical horn antenna for which E plain aperture is 10λ. Assume $\delta_E = 0.2\lambda$ and $\delta_H = 0.375\lambda$.	6	CO5	K3
	OR			
2(a)	**Explain** Yagi Uda antenna with neat diagram, supporting equations and its radiation pattern.	6	CO5	K2
(b)	**Develop** an expression for radiation resistance of small loop antenna	6	CO5	K3
(C)	**Solve** for HPBW,BWFN, Axial ratio and gain of a right handed monofliar helical antenna which has 10 turns, 100mm diameter and 70mm of turn spacing. Also sketch far field pattern at frequency of 1GHz.	6	CO5	K3
	PART-B			
3(a)	**Develop** an expression for total electric field for an array of point sources (n point sources).	6	CO4	K3
(b)	**Explain** radiation of short electric dipole and obtain an expression for radiation resistance.	6	CO4	K2
	OR			
4(a)	**Develop** normalized equation of Two point sources which are supplied with currents of equal magnitude, in phase quadrature and separated by distance of $\frac{\lambda}{2}$ m and mention the equations required to obtain radiation pattern.	6	CO4	K3
(b)	**Explain** thin linear arrays mention the expressions for field intensity.	6	CO4	K2

Dr Chandra V Reddy

Dr. Dinesh Kumar D.S

Name & Signature of Course In charge:

Name & Signature of Module Coordinator:

HOD ECE

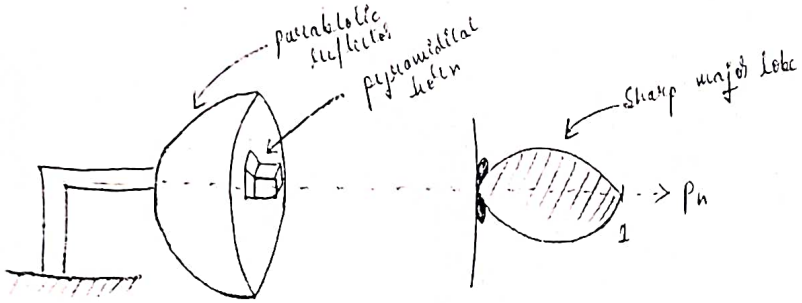
Principal

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
THIRD INTERNAL TEST SCHEME 2022 – 23 EVEN SEMESTER

Set : A

Degree	:	**B.E**	**Semester**	:	**VI**
Branch	:	**Electronics & Communication Engg**	**Subject Code**	:	**18EC63**
Subject Title	:	**MICROWAVE AND ANTENNA**	**Date**	:	**7/07/2023**

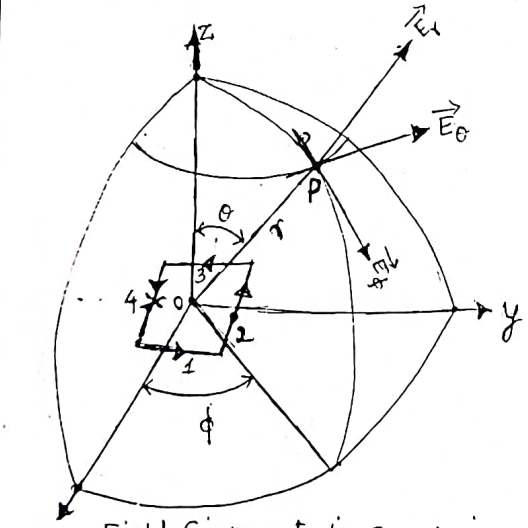
Q No.	Answers	Marks
1a)	Explanation with diagram.	



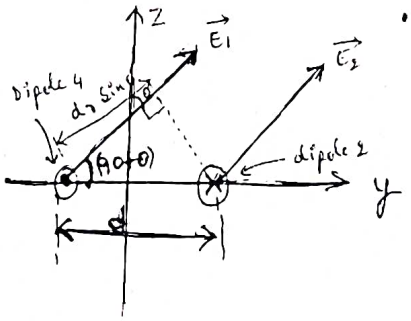
$$A_e = 0.65 A_p$$

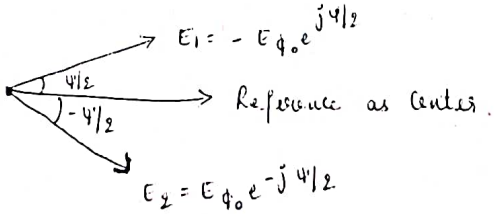
$$A_p = \pi \left(\frac{dl}{2}\right)^2 \qquad D = \frac{4\pi}{\lambda^2} \times A_e$$

b)



Field Components of a Small loop





$$H_\theta = \frac{\pi [I] \sin\theta}{r} \cdot \frac{A}{\lambda^2}$$

$$E_\phi = \frac{120\pi^2 [I]}{r} \sin\theta \cdot \frac{A}{\lambda^2}$$

c)

$L = \frac{a^2}{8\delta}$ $\qquad L = \frac{a_H^2}{8\delta_H} \Rightarrow a_H^2 = 8L\delta_H$

E-plane $\quad a_E = 10\lambda$; $\delta_E = 0.2\lambda$ $\qquad a_H^2 = 8 \times 62.5\lambda \times 0.375\lambda$

$L = \frac{a_E^2}{8\delta_E} = \frac{(10\lambda)^2}{8(0.2\lambda)} = 62.5\lambda$ $\qquad a_H^2 = 187.5\lambda^2$

$\boxed{a_H = 13.693\lambda}$

$\theta_E = 2\tan^{-1}\left(\frac{a_E}{2L}\right)$ $\qquad D = \frac{7.5A_p}{\lambda^2}$; $A_p = a_E a_H$

$\theta_E = 2(4.574)$ $\qquad D = \frac{7.5(10\lambda)(13.693\lambda)}{\lambda^2}$

$\boxed{\theta_E = 9.148^\circ}$ $\qquad \boxed{D = 1026.975}$

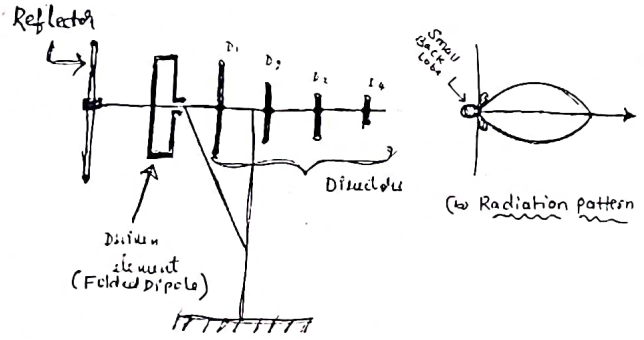
$\theta_H = 2\tan^{-1}\left(\frac{a_H}{2L}\right)$

$\theta_H = 2\tan^{-1}\left(\frac{13.693\lambda}{2 \times 62.5\lambda}\right) = 12.5^\circ$

$G_p = 0.6D = \frac{4.5A_p}{\lambda^2} = \underline{616.185}$

↑ 60% efficiency for horn

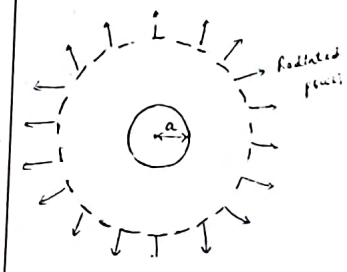
2a)



$L_R = \frac{152}{f(MHz)}$

$S_{RD} = \frac{75}{f(MHz)}$ $\qquad S_{\text{Driven - director}} = \frac{93}{f(MHz)}$ $\qquad L_D = \frac{143}{f(MHz)}$

b)



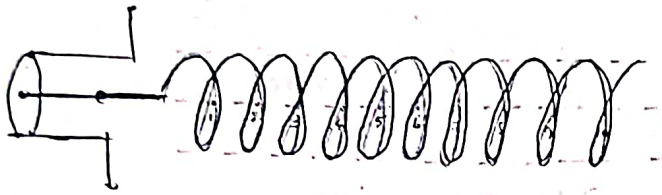
$R_\gamma \approx 31200\left[\frac{AN}{\lambda^2}\right]^2$

c)

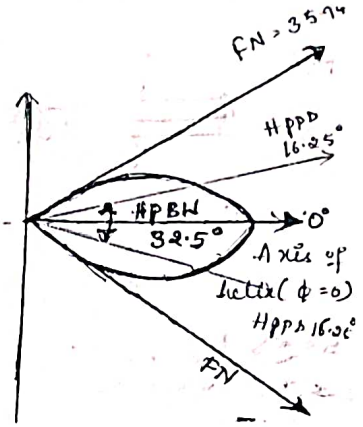
i) Gain, $G_{D_{max}} = D = \frac{15 N S c^2}{\lambda^3}$ ii) $HPBW = \frac{52}{c}\sqrt{\frac{\lambda^3}{NS}}$

iii) $BWFN = \frac{115}{c}\sqrt{\frac{\lambda^3}{NS}} = 71.57°$ iv) Axial ratio $= 1 + \frac{1}{2N}$

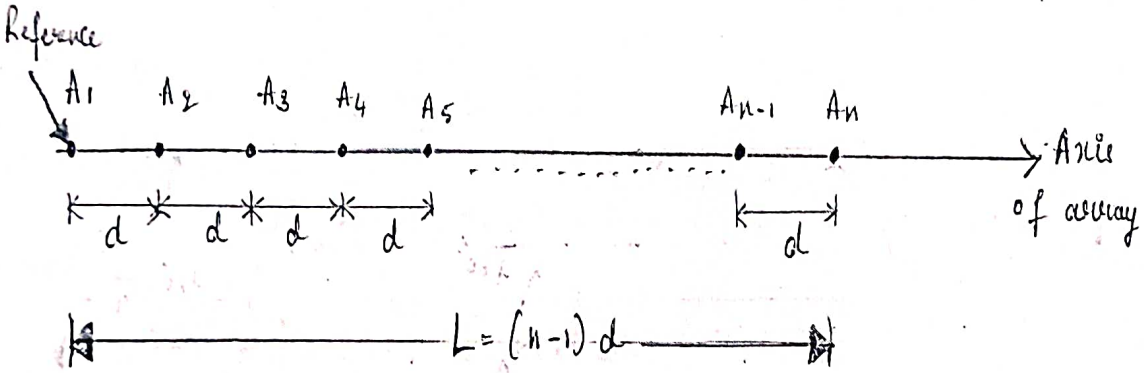
Far field patterns:

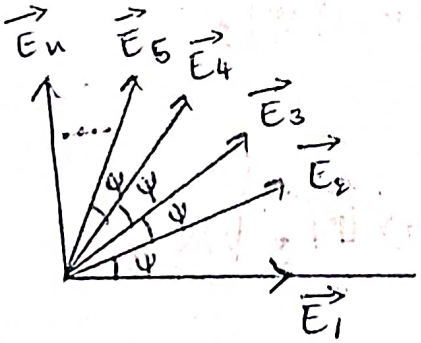


Right Handed Monofilar Antenna :- Helical



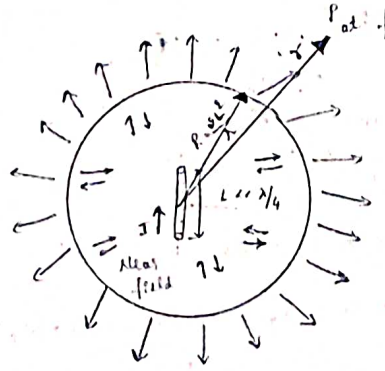
3a)





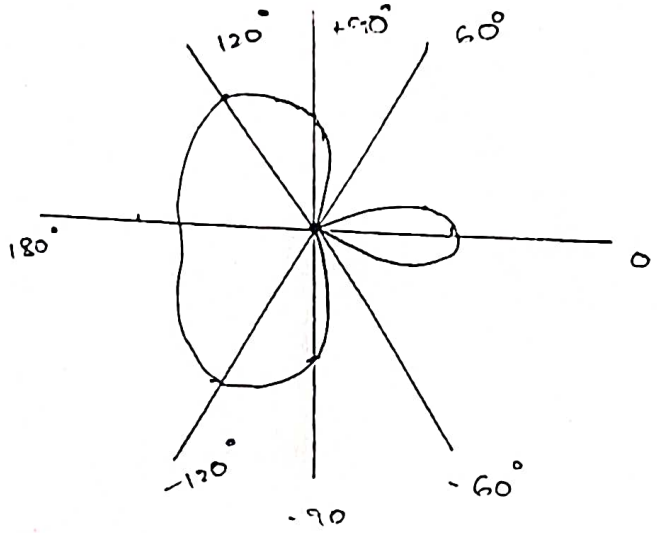
$$|\vec{E_T}| = E_0 \frac{\sin(n\psi/2)}{\sin\psi/2}$$

b)



$$R_r = 80\pi^2\left(\frac{L}{\lambda}\right)^2$$

4a)

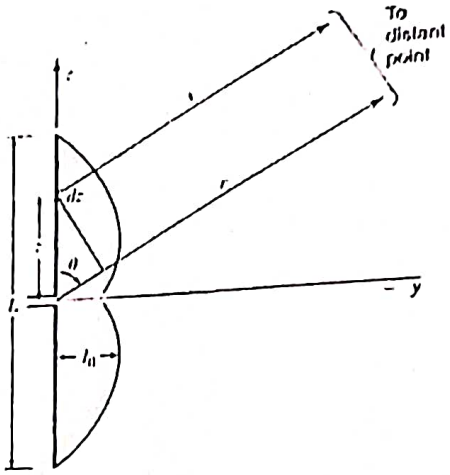


Major
$\pm 120°$

Null.
$\pm 60°$

HP
$\pm 90°$
$0, 180°$

b)



$$H_\phi = \frac{I_0}{2\pi r}\left[\frac{\cos\left(\frac{\beta L\cos\theta}{2}\right) - \cos\theta\left(\beta\frac{L}{2}\right)}{\sin\theta}\right]$$

$$E_\theta = \frac{2\eta}{2\pi}\frac{60 I_0}{r}\left[\frac{\cos\left(\frac{\beta L\cos\theta}{2}\right) - \cos\left(\beta\frac{L}{2}\right)}{\sin\theta}\right]$$

Course in charge

HOD - ECE

K S INSTITUTE OF TECHNOLOGY

Bangalore – 560109

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

CIE Question paper Scrutiny format

Course Name	Microwave and Antennas
Course Code	18EC63
Course Incharge	Dr-Chanda V reddy / Dr Dinesh Kumar D.S
Academic year	2022-23
Semester	6
CIE #	3
Set	A☐ B☐
Scrutiny parameters	
Whether questions are according to assessment plan?	Yes ☑ No☐ ; If No, Suggestions:
Whether questions prepared are within the covered syllabus?	Yes ☑ No ☐ ; If No, Suggestions:
Whether all questions are mapped to CO/PO properly?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions framed are according to Blooms level?	Yes ☑ No ☐ ; If No, Suggestions:
Whether marks distribution for each question is correct?	Yes ☑ No ☐ ; If No, Suggestions:
Whether questions paper follows the format displayed?	Yes ☑ No ☐ ; If No, Suggestions:
Difficulty level	Very High ☐ High ☑ Moderate ☐ Low☐
Percentage of Similarity questions in Set A & B	20%.
Final decision	Accepted without corrections☐ Accepted with minor corrections☐ Not accepted☐

Signature with date
of CIE Question paper setter

Name and Signature with date
of CIE Question paper Scrutiniser

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109

THIRD SESSIONAL TEST QUESTION PAPER 2022 – 23 EVEN SEMESTER

KSIT **SET – B**

USN | | | | | | | | | | |

Degree : B.E
Branch : ECE
Course Title : MICROWAVE AND ANTENNAS
Duration : 90 Minutes

Semester : VI
Course Code : 18EC63
Date : 7-07-2023
Max Marks : 30

Note: Answer ONE full question from each part.

K-Levels: K1-Remebering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

Q No.	Question	Marks	CO mapping	K-Level
	PART-A			
1(a)	**Explain** Horn antenna with supporting equations and neat diagram.	6	CO5	K2
(b)	**Make use of** given data of Yagi Uda antenna to sketch its radiation pattern, having 6 elements to provide a gain of 12dB. If operating frequency is 200MHz.	6	CO5	K3
(C)	**Develop** an expression for radiation resistance of small loop antenna	6	CO5	K3
	OR			
2(a)	**Explain** with neat diagram modes of Helix Antenna	6	CO5	K2
(b)	**Make use of** given data of Parabolic dish antenna to calculate Directivity, HPBW and BWFN. Its frequency is 1.45 GHz, and uses $\lambda/2$ dipole with even illumination.	6	CO5	K3
(C)	**Develop** an expression for radiation resistance of large loop antenna	6	CO5	K3
	PART-B			
3(a)	**Construct** Radiation pattern of 6 point sources which are supplied with currents of equal magnitude, in phase and separated by distance of $\frac{\lambda}{2}$ m	6	CO4	K3
(b)	**Develop** an expression far fields of a Short Dipole	6	CO4	K3
	OR			
4(a)	**Construct** Radiation pattern of 4 point sources which are supplied with currents of equal magnitude, in phase and separated by distance of $\frac{\lambda}{2}$ m	6	CO4	K3
(b)	**Develop** an expression for radiation resistance of short electric dipole.	6	CO4	K3

Dr Chanda V Reddy

Dr. Dinesh Kumar DS

Name & Signature of Course In charge:

Name & Signature of Module Coordinator:

HOD ECE

Principal

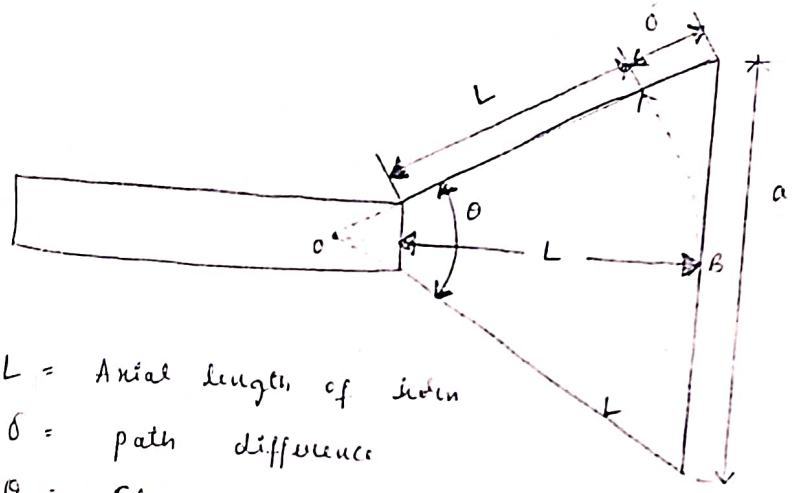
Selected

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE - 560109
THIRD INTERNAL TEST SCHEME 2022 – 23 EVEN SEMESTER

Set : B

Degree	:	B.E	Semester	:	VI
Branch	:	Electronics & Communication Engg	Subject Code	:	18EC63
Subject Title	:	MICROWAVE AND ANTENNA	Date	:	7/07/2023

Q No.	Answers	Marks
1a)	Horn antenna	2+4=6



L = Axial length of horn

δ = path difference

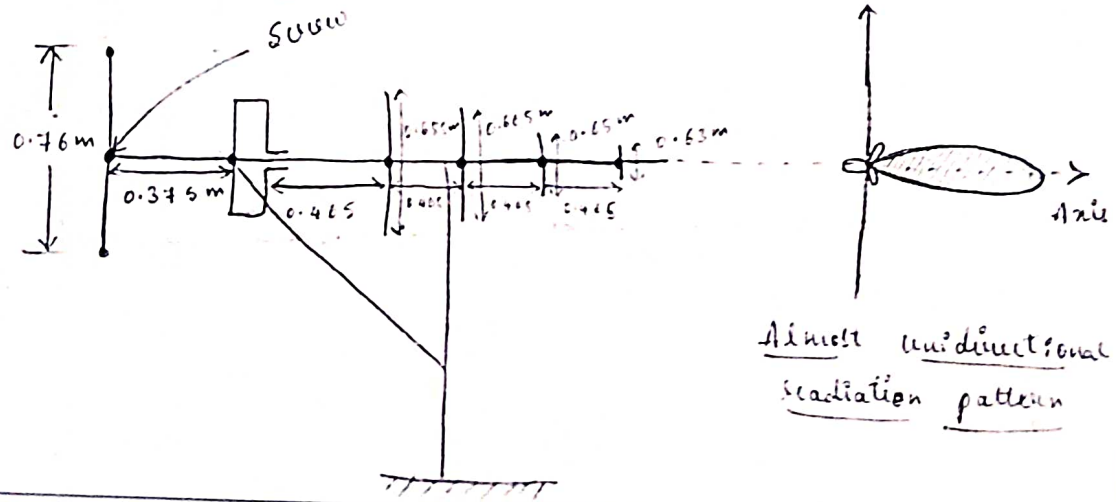
θ = Flare angle

a = Aperture dimension in 'm'

Flare angle θ, is

$$\theta = 2\cos^{-1}\left(\frac{L}{L+\delta}\right) = 2\tan^{-1}\left(\frac{a}{2L}\right) \qquad L = \frac{a^2}{8\delta}$$

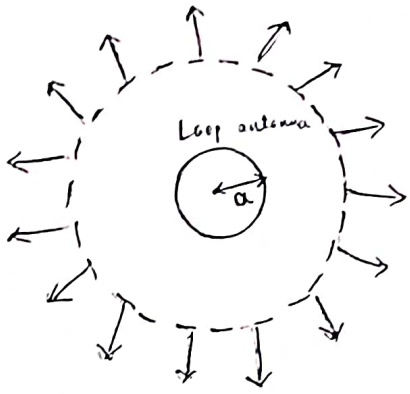
b)



Almost unidirectional radiation pattern

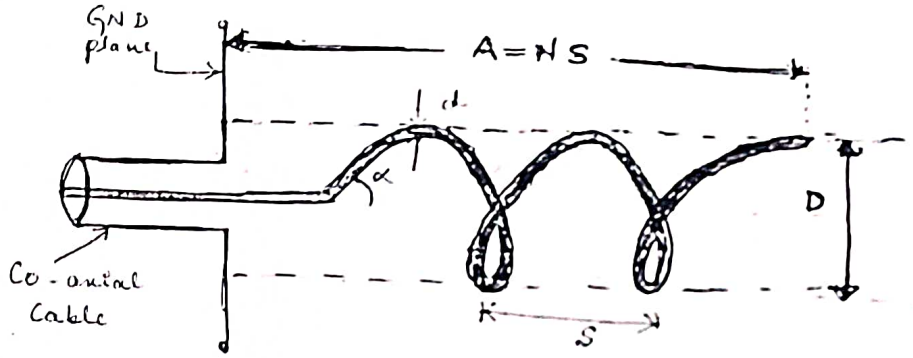
2+4=6

c)



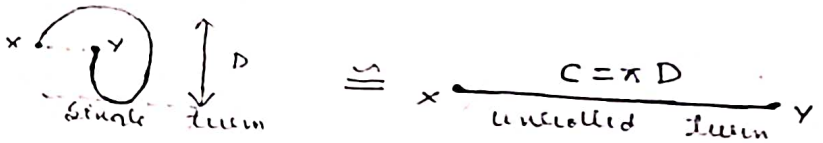
$$R_r \simeq 31200 \left[\frac{A}{\lambda^2}\right]^2 \cdot N^2$$

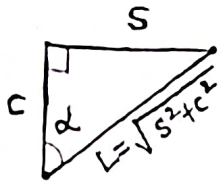
2a)



Right handed monofilar helical antenna

Let S = Spacing between neighbouring turns
N = Number of turns
D = Diameter of circular turn
C = Circumference of single turn, $C = \pi D$
A = be the axial length of helical antenna
α = pitch angle





$$\alpha = \tan^{-1}\left(\frac{S}{C}\right) \qquad L = \sqrt{S^2 + C^2}$$

b)

$$D = 6\left(\frac{d}{\lambda}\right)^2$$

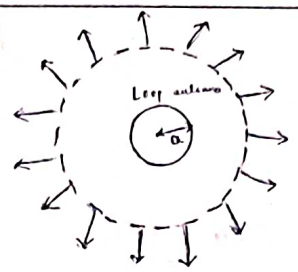
$$= 6\left(\frac{64}{0.206}\right)^2$$

$$D = 579.13 \times 10^3.$$

$$HPBW = \frac{70}{(64/0.206)} = 0.225$$

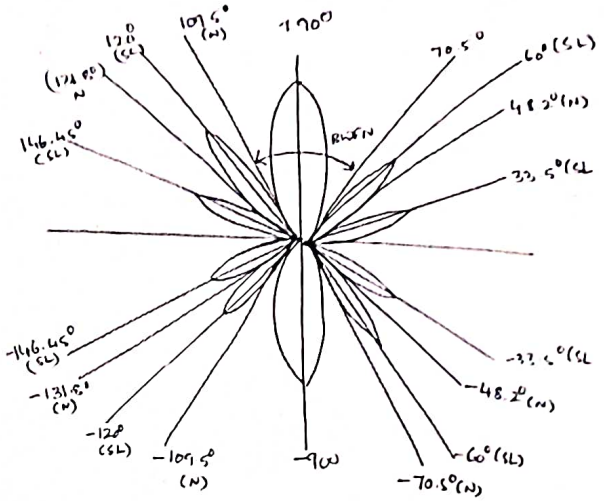
$$BWFN = \frac{140}{(64/0.206)} = 0.450$$

c)



$$R_r = 3720.75\,(a/\lambda)$$

3a)

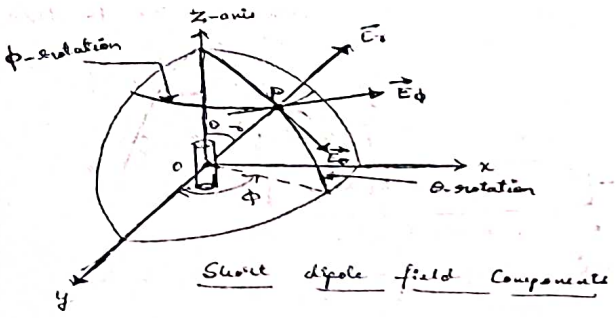


$$BWFN = 109.5^0 - 70.5^0$$
$$= 39^0$$

$$\text{OR} \quad BWFN = 2(90 - 70.5)$$
$$= 2(19.5^0)$$
$$= 39^0$$

$$HPBW = \frac{BWFN}{2} = 19.5^0$$

b)



Source dipole field Components

Electrical field Components : $\vec{E}_r$, $\vec{E}_\theta$, $\vec{E}_\phi$

Magnetic field Components : $\vec{H}_r$, $\vec{H}_\theta$, $\vec{H}_\phi$

4a)

The far field components of short electric dipole are

$\vec{E}_r = 0$

$\vec{E}_\theta = 0$

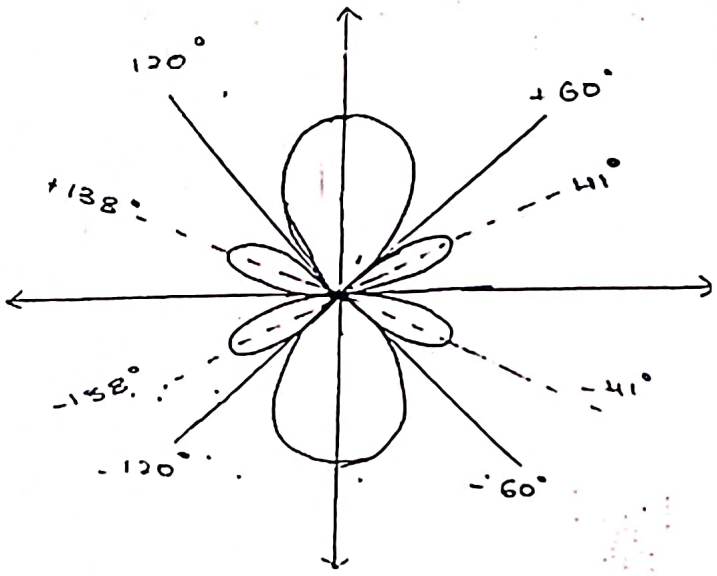
$|\vec{E}_\theta| = |\vec{H}_\phi| \times 120\pi$

Since $\frac{|E_\theta|}{|H_\phi|} = Z_0 = 120\pi$

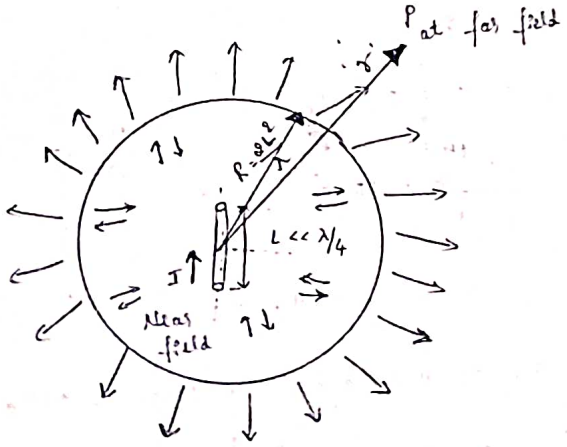
$\vec{H}_r = 0$

$|\vec{H}_\phi| = \frac{|I|\beta L}{4\pi r} \sin\theta \ A\,m^{-1}$

$|\vec{H}_\theta| = 0$



b)



$$R_r = 80\pi^2 \left(\frac{L}{\lambda}\right)^2$$

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