HIGH HIGH CALL AND CLOCK	
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Table of Contents

15EC71 : MICROWAVE AND ANTENNAS	.2
A. COURSE INFORMATION	. 2
1. Course Overview	. 2
2. Course Content	. 2
3. Course Material	. 3
4. Course Prerequisites	. 3
B. OBE PARAMETERS	.4
1. Course Outcomes	.4
2. Course Applications	.4
3. Articulation Matrix	. 5
4. Mapping Justification	. 5
5. Curricular Gap and Content	.6
6. Content Beyond Syllabus	. 7
C. COURSE ASSESSMENT	. 7
1. Course Coverage	. 7
2. Continuous Internal Assessment (CIA)	. 8
D1. TEACHING PLAN – 1	. 8
Module – 1	. 8
Module – 2	. 9
E1. CIA EXAM – 1	10
a. Model Question Paper – 1	10
b. Assignment –1	10
D2. TEACHING PLAN – 2	15
Module – 3	15
Module – 4	16
E2. CIA EXAM – 2	17
a. Model Question Paper – 2	17
b. Assignment – 2	18
D3. TEACHING PLAN – 3	21
Module – 5	21
E3. CIA EXAM – 3	23
a. Model Question Paper – 3	23
b. Assignment – 3	23
F. EXAM PREPARATION	26
1. University Model Question Paper	26
2. SEE Important Questions	27

	SKIT	Teaching Process	Rev No.: 1.0
San Krass	Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
ANGALORE*	Title:	Course Plan	Page: 2 / 36

Note : Remove "Table of Content" before including in CP Book

Each Course Plan shall be printed and made into a book with cover page

Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

15EC71 : MICROWAVE AND ANTENNAS

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	EC
Year / Semester :	4/7	Academic Year:	2019-20
Course Title:	MICROWAVES AND ANTENNAS	Course Code:	15EC71
Credit / L-T-P:	4-1-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	80 Marks
CIA Marks:	20 Marks	Assignment	1 / Module
Course Plan Author:	N S MYTHREYE	Sign	Dt:
Checked By:		Sign	Dt:

2. Course Content

Mod	Module Content	Teachin	Module	Bloom
ule		g Hours	Concepts	s Level
1	Microwave tubes: Introduction, Reflex Klystron Oscillator,	12	Klystron	L2, L4
	Mechanism of Oscillations, Modes of Oscillations, Mode curve.		oscillator,	
	Microwave transmission lines: Microwave frequencies, devices,		Microwave	
	systems, Transmission line equation and solution, Reflection		transmission	
	and transmission co-efficient, standing wave and standing		lines	
	wave ratio, Smith chart, Single stub matching			
2	Microwave network theory: Symmetrical Z and Y parameters	7	Multiport	L3,L2
	for reciprocal networks, S matrix representation of multiport		networks,	
	networks. Microwave passive devices: coaxial connectors,		Microwave	
	adapters, attenuators, phase shifters, waveguides tees, magic		passive	
	tees		devices	
3	Striplines: Introduction, Microstriplines, parallel strip lines,	12	Striplines,	L3,L3
	shielded striplines. Antenna Basics: Introduction, Basic		Antenna	
	Antenna Parameters, Patterns, Beam Area, Radiation Intensity,		parameters	
	Beam Efficiency, Directivity and Gain, Antenna Apertures,			

	SKIT	Teaching Process		Rev No.: 1.0	
19010W	Doc Code:	SKIT.Ph5b1.F02		Date: 25–08	-2019
BANGALORE	Title:	Course Plan		Page: 3 / 36	
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	Effective			
	Height, Bandwidth, Radio Communication Link, Antenna Field			
	Zones & Polarization.			
4	Point Sources and Arrays: Introduction, Point Sources, Power	13	Array of point	L3,L4
	Patterns, Power Theorem, Radiation Intensity, Field Patterns,		sources,	
	Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern		electric dipole	
	Multiplication, Linear Arrays of n Isotropic Point Sources of		antennas	
	equal Amplitude and Spacing.			
	Electric Dipoles: Introduction, Short Electric Dipole, Fields of a			
	Short Dipole (General and Far Field Analyses), Radiation			
	Resistance of a Short Dipole, Thin Linear Antenna (Field			
	Analyses), Radiation Resistances of Lambda/2 Antenna.			
5	Loop and Horn Antenna: Introduction, Small loop, Comparison	10	Loop and	L2,L2
	of Far fields of Small Loop and Short Dipole, The Loop Antenna		horn	
	General Case, Far field Patterns of Circular Loop Antenna with		antennas,	
	Uniform Current, Radiation Resistance of Loops, Directivity of		Other antenna	
	Circular Loop Antennas with Uniform Current, Horn antennas		types	
	Rectangular Horn Antennas.			
	Antenna Types: Helical Antenna, Helical Geometry, Practical			
	Design Considerations of Helical Antenna, Yagi-Uda array,			
	Parabola General Properties, Log Periodic Antenna.			

3. Course Material

Mod	Details	Available
ule		
	Text books	
1	Microwave Engineering - Annapurna Das, Sisir K Das TMH Publication,	In Lib/ In dept
	2nd, 2010.	
1	Microwave Devices and circuits- Liao, Pearson Education.	In Lib/ In dept
2	Microwave Engineering - Annapurna Das, Sisir K Das TMH Publication,	In Lib/ In dept
	2nd, 2010.	
3	Microwave Devices and circuits- Liao, Pearson Education.	In Lib/ In dept
3	Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and	In Lib/ In dept
	Ahmad S Khan,4thSpecial Indian Edition , McGraw- Hill Education Pvt.	
	Ltd., 2010.	
4	Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and	In Lib/ In dept
	Ahmad S Khan,4thSpecial Indian Edition , McGraw- Hill Education Pvt.	
	Ltd., 2010.	
5	Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and	In Lib/ In dept
	Ahmad S Khan,4thSpecial Indian Edition , McGraw- Hill Education Pvt.	
	Ltd., 2010.	

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SKIT	Teaching Process	Rev No.: 1.0
Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
Title:	Course Plan	Page: 4 / 36
	and the second	

2	Reference books	
	Microwave Engineering - David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.	In lib
	Microwave Engineering - Sushrut Das, Oxford Higher Education, 2 nd Edn, 2015.	Not Available
	Antennas and Wave Propagation- Harish and Sachidananda: Oxford University Press, 2007.	In lib
3	Others (Web, Video, Simulation, Notes etc.)	
		Not Available

4. Course Prerequisites

SNo	Course	Course Name	Module / Topic / Description	Sem	Remarks	Blooms
	Code					Level
1	15MAT	Mathematics-III	5/ Vector integration/Knowledge	3		L2
	31		of vector analysis			
2	15IT35	Electronics	3/Oscilloscopes/ Knowledge of	3		L2
		Instrumentation	oscillators			
3	15EC36	Engineering	3/ Steady Magnetic Fields/	3		L2
		ELectromagnetic	Knowledge of fields			
		s				

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

B. OBE PARAMETERS

1. Course Outcomes

#	COs	Teach.	Concept	Instr	Assessmen	Blooms'
		Hours		Method	t Method	Level
15EC71.1	Comprehend the working of	5	Klystron	Lecture	Slip Test	L2
	Klystron oscillator		oscillator			
15EC71.2	Examine the transmission lines	7	Microwave	Lecture/	Assignmen	L4
	using graphical methods		transmissio	Tutorial	t	
			n lines			
15EC71.3	Implement the Z, Y and S	5	Multiport	Lecture	Assignmen	L3
	parameters to Multiport networks		networks		t	

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San KHIS	Doc Code:	SKIT.Ph5b1.F02				Date: 2	5-08-2019		
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15EC71.4	Understand	the working of	f 2	Microwave	Lecture	Slip Test	L2		
	microwave pas	ssive devices		passive					
				devices					
15EC71.5	Have knowled	lge of micro, paralle	I 3	Striplines	Lecture	Slip test	L3		
	and shielded s	striplines							
15EC71.6	Compute th	ie antenna desigr	n 9	Antenna	Lecture/	Assignmen	L3		
	characteristics	using the parameters		parameters	Tutorial	t			
15EC71.7	Extend the a	ntenna parameters to	9	Array of	Lecture/	Assignmen	L3		
	the array of po	pint sources		point	Tutorial	t			
				sources					
15EC71.8	Examine the	field parameters of	f 4	Electric	Lecture/	Assignmen	L4		
	electric dipole	antennas		dipole	Tutorial	t			
				antennas					
15EC71.9	Explain the v	working of horn and	15	Loop and	Lecture	Assignmen	L2		
	loop antennas			horn		t			
				antennas					
15EC71.1	Compare the	working of helical	, 5	Helical,	Lecture	Assignmen	L2		
0	parabola, Y	agi-Uda and log-	-	Parabola,		t			
	periodic anten	inas		Yagi-Uda					
				and Log-					
				periodic					
				antennas					
-		Total	62	-	-	-	-		

Note: Identify a max of 2 Concepts per Module. Write 1 CO per concept.

2. Course Applications

CNIC	Application Area	<u> </u>	Loval	
2110	Application Area	CO	Level	
1	Local oscillators in radar receivers and modulators in microwave transmitters	CO1	L2	
2	Propagation and transmission of high microwave frequency signals	CO2	L4	
3	Conventional Radio Resources for phase control	CO3	L3	
4	Services medical, security, home, entertainment, and communication industries	CO4	L2	
5	Printed circuit boards of radio receivers, mother boards	CO5	L2	
6	Transmission and reception of signals of any frequency			
7	Mathematical modeling of light, electromagnetic radiation, sound, heat, fluid			
	pollution			
8	A driven element used in feeding the elaborate directional antennas like horn,	CO8	L4	
	yagi-uda antennas			
9	Horn-Transmission in wider bandwidth, increasing the directivity and reduces	CO9	L2	
	the spurious responses of the parabolic reflector, short range radar			
	system(speed enforcement cameras), Loop- Finding directions in radars,			
	aircraft and radio receivers			
10	Helical-Circularly polarized radio waves for satellite communication, Parabolic-	CO10	L2	

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direct the radio waves in radio telescopes, Yagi-Uda-high directivity for log							
c	distance communication, Log-Periodic-Wide bandwidth UHF terrestrial TV						

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

-	Course Outcomes	Program Outcomes												
#	COs	PO	PO2	PO	PO	PO	PO6	PO	PO	PO9	PO	PO	PO	Level
		1		3	4	5		7	8		10	11	12	
15EC71.1	Comprehend the working of	3	3	-	-	-	-	-	-	-	-	-	-	L2
	Klystron oscillator													
15EC71.2	Examine the transmission lines	3	3	2	2	1	-	-	-	-	-	-	-	L4
	using graphical methods													
15EC71.3	Implement the Z, Y and S	3	3	-	-	-	-	-	-	-	-	-	-	L3
	parameters to Multiport													
	networks													
15EC71.4	Understand the working of	3	2	-	-	-	-	-	-	-	-	-	-	L2
	microwave passive devices													
15EC71.5	Have knowledge of micro,	3	2	-	-	-	-	-	-	-	-	-	-	L3
	parallel and shielded striplines													
15EC71.6	Compute the antenna design	3	3	2	1	-	-	-	-	-	-	-	-	L3
	characteristics using the													
	parameters													
15EC71.7	Extend the antenna parameters	3	3	2	1	-	-	-	-	-	-	-	-	L3
	to the array of point sources													
15EC71.8	Examine the field parameters	3	3	2	1	-	-	-	-	-	-	-	-	L4
	of electric dipole antennas													
15EC71.9	Explain the working of horn	3	2	-	-	-	-	-	-	-	-	-	-	L2
	and loop antennas													
15EC71.10	Compare the working of	3	2	-	-	-	-	-	-	-	-	-	-	L2
	helical, parabola, Yagi-Uda and													
	log-periodic antennas													
Note: Mention the mapping strength as 1, 2, or 3														

4. Mapping Justification

Mapping		Justification		
			Level	
CO	CO PO -			
CO1	PO1	Knowledge of klystron oscillator is required in building complex systems like satellite communication and space ships		
CO1	PO2	Analysing problem in microwave systems require knowledge of		

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		klystron oscillator	
CO2	PO1	The transmission line concept is necessary in the encrypted data	
		transmission technology at high frequencies	
CO2	PO2	Needed in formulating the transmission line problems	
CO2	PO3	Design and development of data transmission systems at high	
		frequencies need the knowledge of transmission lines	
CO2	PO4	Experimenting the concept for complex problems using	
		graphical methods	
CO2	PO5	A graphical method is used. Can be implemented in Smith chart	
		software	
CO3	PO1	The solution of Z, Y and S parameters are used in multichannel	
		data transmission	
CO3	PO2	Used in identification of ports and its characteristics in Z, Y and	
		S parameters	
CO4	PO1	Necessary in building complex microwave systems	
CO4	PO2	Analysis of devices and its measurements	
CO5	PO1	Used in PCB's, microwave boards, and digital systems	
CO5	PO2	Formulating the connections in the circuit boards	
CO6	PO1	Knowledge of antenna parameters are required for building	
		complicated antenna systems.	
CO6	PO2	Analyzing problems on antenna and its parameters	
CO6	PO3	The knowledge is required to find solutions for the antenna	
		parameters of all antennas.	
CO6	PO4	Research based knowledge on the parameters are necessary for	
		the design of antenna and its arrays	
C07	PO1	Knowing about the antenna arrays would help the design of	
		antennas for RADAR applications	
C07	PO2	Analyzing the antenna arrays in broadside and endfire directions	
C07	PO3	Design and development of solutions for antenna arrays as	
		point sources in broadside and endfire directions of space.	
C07	PO4	Valid conclusions are provided for the both the broadside and	
600	DO1	endfire directions of radiation of the antenna arrays	
C08	POT	Used in building highly directive and secured communication	
600		systems	
C08	PO2	Analysis of short dipole and thin linear dipole antenna	
600	BO 2	Characteristics	
08	PO3	Design and development of solutions of the dipole antennas in	
<u> </u>		Short range and as a thin linear array.	
LUS	PO4	antenna complexities	
<u> </u>	DO1	antenna complexities	
09	PUT	Knowledge of these antennas are used in applications like Radio	

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San KHIS	Doc Code: SKIT.Ph5b1.F02 Date: 25					
BANGALORE	Title:	Course Plan	Page: 8 /	36		
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		broadcast, Navigation systems, Radio transmissior	n and			
		reception, GPS, Satellite communication, Radio freq	uency			
		identification				
CO9	PO2	Analyzing the horn and loop antennas and its charac	teristics			
CO10	PO1	Knowledge of these antennas are used in applications	like Radio			
		broadcast, Navigation systems,Radio transmission	n and			
		reception, GPS				
		Satellite communication, Radio frequency identification				
CO10	PO2	Analyzing the parabolic, helical, log periodic, yagi uda antennas				
		and its characteristics				

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	NOT APPLICABLE				
2					
3					
4					
5					

Note: Write Gap topics from A.4 and add others also.

6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	HFSS Tool	Presentation/		Self	
		Mini Project			
2	Antenna Fabrication	Presentaion		Self	
	process				
3					
4					
5					
6					
7					
8					
9					
10					

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	Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019				
BANGALORE	Title:	Course Plan	Page: 9 / 36				
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Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Mod	Title Teaching No. of question in Exam								CO	Levels
ule		Hours	CIA-	CIA-	CIA-	Asg	Extra	SEE		
#			1	2	3		Asg			
1	Microwave Tubes And Microwave	12	5	-	-	1	1	2	CO1,	L2, L4
	Transmission Lines								CO2	
2	Microwave Network Theory and	7	3	-	-	1	1	2	CO3,	L3,L2
	Microwave Passive Devices								CO4	
3	Striplines And Antenna Basics	12	-	3	-	1	1	2	CO5,	L3,L3
									CO6	
4	Point Sources and Arrays and	13	-	6	-	1	1	2	CO7,	L3,L4
	Electric Dipoles								C08	
5	Loop and Horn Antenna And	10	_	-		1	1	2	CO9,	L2,L2
	Antenna Types								CO10	
-	Total	54				5	5	10	-	-

Note: Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	СО	Levels
CIA Exam - 1	15	CO1, CO2, CO3,Co4	L2,L4,L3,L2
CIA Exam - 2	15	CO5, CO6, CO7, C08	L2,L3,L3,L4
CIA Exam - 3	15	CO9, CO10	L2,L2
Assignment – 1	05	CO1, CO2, CO3,Co4	L2,L4,L3,L2
Assignment – 2	05	CO5, CO6, CO7, C08	L2,L3,L3,L4
Assignment – 3	05	CO9, CO10	L2,L2
Seminar – 1			
Seminar - 2			
Seminar – 3			
Other Activities – Mini	_	CO9, CO10	L2,L2

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Project						
Final CIA Marks		20	-	-		

Note : Blooms Level in last column shall match with A.2 above.

D1. TEACHING PLAN - 1

Module – 1

Title:	Microwave Tubes And Microwave Transmission Lines	Appr	12 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Comprehend the working of Klystron oscillator	CO1	L2
2	Examine the transmission lines using graphical methods	CO2	L4
b	Course Schedule	-	-
Class	Module Content Covered	СО	Level
No			
1	Introduction to microwave, Construction of Klystron Oscillators	CO1	L2
2	Mechanism of Oscillations,, Modes Of Oscillations, Mode Curve	CO1	L2
3	Introduction to Transmission lines, Microwave Frequencies, devices and systems	CO1	L2
4	Transmission Line Equations, Transmission Line Solutions	CO1	L2
5	Reflection Co-efficient, Transmission Co-efficient	CO1	L2
6	Standing Wave And Standing Wave Ratio	CO2	L2
7	Introduction to Smith chart, Construction of smith chart	CO2	L2
8	Numericals in Smith chart	CO2	L4
9	Single Stub Matching using Smith chart	CO2	L4
10	Numericals in Single Stub Matching using Smith chart	CO2	L4
11	Numericals in Transmission Lines	CO2	L3
12	Numericals in Transmission Lines	CO2	L3
C	Application Areas	СО	Level
1	Local oscillators in radar receivers and modulators in microwave	CO1	L2
	transmitters		
2	Propagation and transmission of high microwave frequency signals	CO2	L4
d	Review Questions	-	-
1	Define microwave tube.	CO1	L2
2	Explain the construction of Reflex Klystron oscillator?	CO1	L2
3	Explain the mechanism of oscillations in Klystron oscillator?	CO1	L2
4	What is a transmission line?	CO2	L2
5	Derive the transmission line equation in voltage and current forms?	CO2	L2

MISTITUTE OF THE	SKIT	Teaching Process	Rev No.:	: 1.0
Sen Kris	Doc Code:	SKIT.Ph5b1.F02	Date: 25	5-08-2019
BANGALORE	Title:	Course Plan	Page: 1	I / 36
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6	Derive the solu	itions for transmission line equations?	CO2	L2
7	Define reflection	on co-efficient and derive an expression for the same?	CO2	L2
8	Define transm	ission co-efficient and derive an expression for the	CO2	L2
	same?			
9	Explain how th	e standing waves are generated?	CO2	L2
10	Derive an expr	ession for standing wave ratio?	CO2	L2
11	Explain line im	pedance and admittance?	CO2	L2
12	Explain the co	nstruction of smith chart using suitable expression?	CO2	L3
13	Analyze the sir	ngle stub matched transmission line using smith chart?	CO2	L4
е	Experiances		-	-
1				
2				
3				
4				
5				

Module – 2

Title:	Microwave network theory and Microwave passive devices	Appr	7 Hrs
		Time:	
a	Course Outcomes		Blooms
_	The student should be able to:		Level
1	Implement the Z, Y and S parameters to Multiport networks	CO3	L3
2	Understand the working of microwave passive devices	CO4	L2
b	Course Schedule		
Class No	Module Content Covered	CO	Level
13	Introduction to microwave network theory, Symmetrical Z parameters for Reciprocal Networks	CO3	L2
14	Symmetrical Y parameters for Reciprocal Networks, S-matrix representation of multi-port networks	CO3	L2
15	Numericals in multiport networks	CO3	L3
16	Numericals in multiport networks	CO3	L3
17	Co-axial connectors and adapters	CO3	L2
18	Attenuators and phase shifters	CO4	L2
19	Waveguide tees and magic tees	CO4	L2
С	Application Areas	СО	Level
1	Conventional Radio Resources for phase control	CO3	L3

THISTITUTE OF THE	SKIT	Teaching Process	Rev No.:	1.0
Sen Kris	Doc Code:	SKIT.Ph5b1.F02	Date: 25-	-08-2019
AANGALORE*	Title:	Course Plan	Page: 12	/ 36
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2	Services medio	al, security, home, entertainment, and communication	CO4	L2
	industries			
d	Review Ques	tions	-	-
14	Represent the	reciprocal networks using symmetrical Z parameters?	CO3	L2
15	Describe the re	eciprocal networks using symmetrical Y parameters?	CO3	L2
16	Implement the	multiport networks using S-matrix?	CO3	L2
17	Explain the wo	rking co-axial connectors, adapters, attenuators, phase	CO4	L2
	shifters and wa	aveguide tees?		
е	Experiences		-	-
1				
2				
3				
4				
5			-	

E1. CIA EXAM - 1

a. Model Question Paper - 1

Crs Code	و .	15EC71 Sem: VII Marks: 30 Time: 75 minutes									
Cour	Course: Microwave and Antennas										
-	-	Note: Ans	swer any	2 questi	ons, each c	arry eq	ual marks.		Mark s	СО	Level
1	a	Explain th oscillations	ne worki s?	ng of K	lystron oscil	lator a	nd its mod	es of	5	CO1	L2
	b	Derive an forms?	expressi	on for tra	ansmission li	ne in v	oltage and c	urrent	10	CO2	L2
2	a	Explain reflection and transmission co-efficients with suitabl						iitable	5	CO2	L2
	b	Given dVm Vmin=20c find the loa	iin=18cm m, VSWR ad imped	, I=52cm, =2.5, Zo= ance and i	λ/2 distance 300. Analyze nput impeda	betwee the tra nce?	n adjacent so nsmission lir	urces, ie and	10	CO2	L4
									_		
3	a b	Describe th Write short tees?	ne S-matr t notes oi	n phase sl	nifters, adapt	ultiport ers, atte	networks? enuators and	magic	5 10	CO3	L2 L2
				· · · · · ·					-	603	
4	a b	Describe the	ne z para expressio	meters in n for stan	reciprocal ne ding wave rat	tworks? io and e	xplain?		5 10	C03	L2 L3



b. Assignment -1

Note: A distinct assignment to be assigned to each student.

		Model Assignment Questions			
Crs C	ode: 15EC7	Sem: VII Marks: 5 Time: 9	0 - 120	minut	es
Cours	se: MICRO	WAVE AND ANTENNAS			
Note:	Each studen	t to answer 2–3 assignments. Each assignment carries equa	l mark.		
SNo	USN	Assignment Description	Mark s	CO	Level
1	1KT15EC001	Explain the construction of Klystron oscillator and its mechanism of oscillations?	5	CO1	L2
2	1KT15EC003	Describe the modes of oscillations and mode curve of a klystron oscillator?	ı 5	CO1	L2
3	1KT15EC004	Mention the microwave frequencies? Explain briefly about the microwave transmission lines, its devices and systems?	5	CO1	L2
4	1KT15EC005	Derive an expression for Microwave transmission line equations in the voltage and current forms? Explain.	2 5	CO2	L2
5	1KT15EC006	Derive an expression for the solution of the microwave transmission line? Explain.	2 5	CO2	L2
6	1KT15EC007	Bring out an expression for reflection and transmission co-efficient of a microwave transmission line?	5	CO2	L2
7	1KT15EC008	With suitable explanation derive an expression for line impedance and line admittance of a microwave transmission lines?	2 5	CO2	L2
8	1KT15EC009	What are standing waves? Derive an expression for the standing wave ratio and explain?	5	CO2	L2
9	1KT15EC010	Implement the construction of Smith chart?	5	CO2	L2
10	1KT15EC011	Implement the symmetric Z and Y parameters to reciprocal networks?	5	CO2	L2
11	1KT15EC012	Describe the S-matrix implementation of multiport networks?	5	CO2	L2
12	1KT15EC013	A load $Z_L = 100 + j50 \Omega$ is connected across a TL with Zo = 50 Ω and I = 0.4 λ . At the generator end, d = I, the line is shunted by an impedance $Z_s = 100 \Omega$. What are the input impedance Z_{in} and admittance Yin of the line including the shunt connected element.	5	CO2	L4
13	1KT15EC014 1KT15EC015	The TL network described in Example 1 is connected to a generator with open circuit voltage phasor $V_g = 100 \ge 0$ V and internal impedance $Z_g = 25 \Omega$. What is the average power (a) input of the shunted line, (b) delivered to the shunt element, delivered to the load. A TL of length $I = 0.3\lambda$ has an input impedance $Z_{-} = 50 + 100$	5	CO2	L4
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SRI KRISH		Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08	-2019
* BANG	SALORE*	Titl	e:	Course Plan	Page:	14 / 3	6
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			J50 (2. Determine the load impedance $Z_L = Z(0)$ and $Y_L = Y$			
1.5	1671	5EC017	(U) gi	wen that $Z_0 = 50.02$ for the line.		602	1.4
15	INII	SEC017	AIL	of length I = 0.5A and $Z_0 = 50 \Omega$ has a load reflection	5	CO2	L4
			coen	Itient $I_L = 0.5$ and and a shuft connected IL at $d =$			
			0.27.	The shunt connected IL has $I = 0.3\Lambda$, $Z_0 = 50.02$, and			
			a 10a	a reflection coefficient $I_L = -0.5$. Determine the input			
			impe	dance of the line. What is the load impedance Z_Ls			
			impo	dance 7			
16	1KT1	5EC019	Impe	unce Z_{L}	F	<u> </u>	12
		012001)	lic 2 l	iossiess transmission line, the velocity of propagation $E \propto 10^8 m/c$. Capacitance of the line is $20 nE/m$. Find	5	02	LS
			15 Z.	nductance per mater of the line, phase constant at			
				Altz Characteristics impedance of the line			
17	1KT1	5EC020	1000	0 m long line has the following constants $P = 4.5 kHz$	5	CO2	12
		020020		15 mH C=60 mmbo C=12 nE operated at 6 MHz	J	02	LJ
			L-U.	lency Find the propagation constant characteristic			
			imne	dance and velocity of propagation			
18	1KT1	5EC021	Δ tra	ansmission line is lossless and is 30 m long. It is	5	CO2	13
			termi	instead in the load impedance of $7 = (30+i20)0$ at 10	5	02	LJ
			MHz	The inductance and the capacitance of the line are			
			are 1	00nH/m C=20nF/m Find the input impedance of the			
			line a	at the source end and at the mid point of the line.			
19	1KT1	5EC022	Δ tra	nsmission line with a characteristic impedance of 300	5	CO2	13
			ohm	s is terminated in a purely resistive load. It is found by	5	002	25
			meas	surement that the minimum line voltage upon it is			
			5mV	and a maximum of 7.5mV. What is the value of load			
			impe	dance?			
20	1KT1	5EC023	Dete	rmine the length and impedance of a guarter wave	5	CO2	L3
			trans	former that will match a load of 150 ohm to a line of			
			75oh	m at a frequency of 12GHz?			
21	1KT1	5EC024	Expla	ain the construction of Klystron oscillator and its	5	CO1	L2
			mech	nanism of oscillations?			
22	1KT1	5EC025	Desc	ribe the modes of oscillations and mode curve of a	5	CO1	L2
			klyst	ron oscillator?			
23	1KT1	5EC026	Ment	ion the microwave frequencies? Explain briefly about	5	CO1	L2
			the n	nicrowave transmission lines, its devices and systems?			
24	1KT1	5EC028	Deriv	e an expression for Microwave transmission line	5	CO2	L2
			equa	tions in the voltage and current forms? Explain.			
25	1KT1	5EC029	Deriv	e an expression for the solution of the microwave	5	CO2	L2
			trans	mission line? Explain.			
26	1KT1	5EC030	Bring	out an expression for reflection and transmission	5	CO2	L2
			co-e	fficient of a microwave transmission line?			

AN INSTITUTION	TUTE OF THE	SKI	Т	Teaching Process	Rev N	o.: 1.0	
SAI KRIS		Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08	-2019
BANG	GALORE	Titl	e:	Course Plan	Page:	15 / 3	6
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27	IKII	SEC031	With	suitable explanation derive an expression for line	5	CO2	L2
			impe	dance and line admittance of a microwave			
	11/1	5EC022	trans	mission lines?		602	
28	1611	JEC032	What	are standing waves? Derive an expression for the	5	CO2	L2
	11/1	(EC401	stand	ang wave ratio and explain?			
29	11/1	0EC401	Imple	ement the construction of Smith chart?	5	CO2	L2
30	IKII	0EC403	Imple	ement the symmetric 2 and Y parameters to reciprocal	5	CO2	L2
21	1671	6FC406	Desc	vike the C matrix implementation of multipart		602	1.2
51	IKII	OLC-100	netw	orks?	С	02	LZ
32	1KT1	6EC408	A loa	d Z_L = 100 + j50 Ω is connected across a TL with Zo	5	CO2	L4
			= 50	Ω and I = 0.4 λ . At the generator end, d = I, the line			
			is sh	unted by an impedance Z_s = 100 Ω . What are the			
			input	: impedance Z _{in} and admittance Yin of the line,			
			inclu	ding the shunt connected element.			
33	1KT1	6EC411	The ⁻	TL network described in Example 1 is connected to a	5	CO2	L4
			gene	rator with open circuit voltage phasor $V_g = 100 \angle 0 V$			
			and	internal impedance $Z_g = 25 \Omega$. What is the average			
			powe	er (a) input of the shunted line, (b) delivered to the			
	11/1	550020	shun	t element, delivered to the load.			
34	IKII	SEC036	A TL	of length I = 0.3 λ has an input impedance Z _{in} = 50 +	5	CO2	L4
			j50 (2. Determine the load impedance $Z_{L} = Z(0)$ and $Y_{L} = Y$			
	11/1	50027	(0) gi	ven that $Z_0 = 50 \Omega$ for the line.			
35	IKII	SEC037	AIL	of length I = 0.5 λ and Z _o = 50 Ω has a load reflection	5	CO2	L4
			coeff	Iclent $I_L = 0.5$ and and a shunt connected IL at $d =$			
			0.27.	The shuft connected TL has $I = 0.3A$, $Z_0 = 50.22$, and direction coefficient $\Gamma_{0} = 0.5$. Determine the input			
			a ioa	d reflection coefficient $T_L = -0.5$. Determine the input dance of the line. What is the load impedance \overline{T} is			
			tormi	insting the churt connected stub? What is the load			
			imne	dance 7			
36	1KT1	5EC038	Inal	ossless transmission line, the velocity of propagation	5	<u>(0</u> 2	13
			is 2.1	5 x 10^8 m/s. Capacitance of the line is 30 m/s. Find	5	202	
			the i	nductance per meter of the line, phase constant at			
			100	IHz. Characteristics impedance of the line			
37	1KT1	5EC039	A 30	0 m long line has the following constants $R=4.5 kHz$.	5	CO2	L3
			L=0.	15mH, G=60mmho, C=12nF operated at 6MHz	-		-
			frequ	iency. Find the propagation constant, characteristic			
			impe	dance and velocity of propagation.			
38	1KT1	5EC041	A tra	ansmission line is lossless and is 30 m long. It is	5	CO2	L3
			termi	inated in the load impedance of $Z_L = (30+j20)\Omega$ at 10			
			MHz.	The inductance and the capacitance of the line are			
			are 1	00nH/m, C=20pF/m. Find the input impedance of the			

ALORE **	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
	Title:	Course Plan	Page: 16 / 36
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		line at the source end and at the mid point of the line.			
39	1KT15EC043	A transmission line with a characteristic impedance of 300 ohms is terminated in a purely resistive load. It is found by measurement that the minimum line voltage upon it is 5mV and a maximum of 7.5mV. What is the value of load impedance?	5	CO2	L3
40	1KT15EC044	Determine the length and impedance of a quarter wave transformer that will match a load of 150 ohm to a line of 750hm at a frequency of 12GHz?	5	CO2	L3
41	1KT15EC045	A TL of length I = 0.5λ and $Z_o = 50 \Omega$ has a load reflection coefficient $\Gamma_L = 0.5$ and and a shunt connected TL at d = 0.2λ . The shunt connected TL has I = 0.3λ , $Z_o = 50 \Omega$, and a load reflection coefficient $\Gamma_L = -0.5$. Determine the input impedance of the line. What is the load impedance Z_L s terminating the shunt connected stub? What is the load impedance Z_L	5	CO2	L4
42	1KT15EC046	In a lossless transmission line, the velocity of propagation is 2.5 x 10^8 m/s. Capacitance of the line is 30 pF/m. Find the inductance per meter of the line, phase constant at 100MHz, Characteristics impedance of the line	5	CO2	L3
43	1KT15EC047	A 300 m long line has the following constants R=4.5kHz, L=0.15mH, G=60mmho, C=12nF operated at 6MHz frequency. Find the propagation constant, characteristic impedance and velocity of propagation.	5	CO2	L3
44	1KT15EC048	A transmission line is lossless and is 30 m long. It is terminated in the load impedance of $Z_L=(30+j20)\Omega$ at 10 MHz. The inductance and the capacitance of the line are are 100nH/m, C=20pF/m. Find the input impedance of the line at the source end and at the mid point of the line.	5	CO2	L3
45	1KT15EC049	A transmission line with a characteristic impedance of 300 ohms is terminated in a purely resistive load. It is found by measurement that the minimum line voltage upon it is 5mV and a maximum of 7.5mV. What is the value of load impedance?	5	CO2	L3
46	1KT15EC051	Explain the construction of Klystron oscillator and its mechanism of oscillations?	5	CO1	L2
47	1KT15EC052	Describe the modes of oscillations and mode curve of a klystron oscillator?	5	CO1	L2
48	1KT15EC053	Mention the microwave frequencies? Explain briefly about the microwave transmission lines, its devices and systems?	5	CO1	L2
49	1KT15EC054	Derive an expression for Microwave transmission line equations in the voltage and current forms? Explain.	5	CO2	L2

Jul INSTITUT	TUTE OF THE	SK	Т	Teaching Process	Rev N	o.: 1.0	
Sal KRish	A A A A A A A A A A A A A A A A A A A	Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08-	-2019
* BANG	SALORE*	Titl	e:	Course Plan	Page:	17/3	5
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50	IKII	5EC055	Deriv	e an expression for the solution of the microwave	5	CO2	L2
	11/1	55005(trans	mission line? Explain.			
51	IKII	SEC036	Bring	out an expression for reflection and transmission	5	CO2	L2
	11771	55.0050	co-ei	ficient of a microwave transmission line?			
52	IKTI	5EC058	With	suitable explanation derive an expression for line	5	CO2	L2
			impe	dance and line admittance of a microwave			
	11771	55.0050	trans	mission lines?			
53	IKTI	5EC059	What	are standing waves? Derive an expression for the	5	CO2	L2
	477774		stanc	ling wave ratio and explain?			
54	IKTI	SEC061	Imple	ement the construction of Smith chart?	5	CO2	L2
55	1KT1	5EC062	Imple	ement the symmetric Z and Y parameters to reciprocal	5	CO2	L2
			netw	orks?			
56	1KT1	5EC063	Desc	ribe the S-matrix implementation of multiport	5	CO2	L2
			netw	orks?			
57	1KT1	5EC064	A loa	d Z_L = 100 + j50 Ω is connected across a TL with Zo	5	CO2	L4
			= 50	Ω and I = 0.4 λ . At the generator end, d = I, the line			
			is sh	unted by an impedance $Z_s = 100 \ \Omega$. What are the			
			input	impedance Z _{in} and admittance Yin of the line,			
			inclu	ding the shunt connected element.			
58	1KT1	5EC067	The ⁻	TL network described in Example 1 is connected to a	5	CO2	L4
	gen		gene	rator with open circuit voltage phasor V_g = 100 \angle 0 V			
	and		and i	internal impedance Z_g = 25 Ω . What is the average			
	pow		powe	er (a) input of the shunted line, (b) delivered to the			
			shun	t element, delivered to the load.			
59	1KT1	6EC412	A TL	of length I = 0.3 λ has an input impedance $Z_{in}=$ 50 $+$	5	CO2	L4
			j50 Ω	2. Determine the load impedance $Z_L = Z(0)$ and $Y_L = Y$			
			(0) gi	ven that $Z_o = 50 \ \Omega$ for the line.			
60	1KT1	6EC416	A TL	of length I = 0.5 λ and Z_o = 50 Ω has a load reflection	5	CO2	L4
			coeff	icient $\Gamma_{\scriptscriptstyle L}=$ 0.5 and and a shunt connected TL at d =			
			0.2λ.	The shunt connected TL has I = 0.3 λ , Z _o = 50 Ω , and			
			a loa	d reflection coefficient $\Gamma_L = -0.5$. Determine the input			
			impe	dance of the line. What is the load impedance $Z_{L}s$			
			termi	nating the shunt connected stub? What is the load			
			impe	dance Z_L			
61	1KT1	6EC419	In a l	ossless transmission line, the velocity of propagation	5	CO2	L3
			is 2.5	$5 \times 10^8 \text{ m/s}$. Capacitance of the line is 30pF/m . Find			
			the i	nductance per meter of the line, phase constant at			
			100M	IHz, Characteristics impedance of the line			
62	1KT1	6EC420	A 30	0 m long line has the following constants $R=4.5 kHz$,	5	CO2	L3
			L=0.	15mH, G=60mmho, C=12nF operated at 6MHz			
			frequ	ency. Find the propagation constant, characteristic			
			impe	dance and velocity of propagation.			

		SK	Т	Teaching Process Rev No.: 1.0			
SRI KRIS		Doc C	ode:	SKIT.Ph5b1.F02	Date: 25-08-201		-2019
* BANG	ALORE*	Titl	e:	Course Plan	Page:	18 / 3	6
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63	1KT1	6EC421	A tra	nsmission line is lossless and is 30 m long. It is	5	CO2	L3
			termi	nated in the load impedance of $Z_L = (30+j20)\Omega$ at 10			
			MHz.	The inductance and the capacitance of the line are			
			are 1	00nH/m, C=20pF/m. Find the input impedance of the			
	477774	(T) (100	line a	t the source end and at the mid point of the line.			
64	IKTI	6EC422	A tra	nsmission line with a characteristic impedance of 300	5	CO2	L3
			ohms	is terminated in a purely resistive load. It is found by			
			meas	urement that the minimum line voltage upon it is			
			5mV	and a maximum of 7.5mV. What is the value of load			
			impe	dance?			
65	65 ^{1KT16EC423} Dete		Deter	mine the length and impedance of a quarter wave	5	CO2	L3
trans		trans	former that will match a load of 150 ohm to a line of				
	75ohm at a frequency of 12GHz?						
66	$6 {}^{1\text{KT16EC424}} \text{The}$		The T	FL network described in Example 1 is connected to a	5	CO2	L4
			genei	rator with open circuit voltage phasor $V_g = 100 \angle 0 V$			
			and i	nternal impedance $Z_g = 25 \Omega$. What is the average			
	power (a) input of the		powe	r (a) input of the shunted line, (b) delivered to the			
			shunt	t element, delivered to the load.			
67	1KT1	6EC426	A TL	of length I = 0.3 λ has an input impedance Z_{in} = 50 $+$	5	CO2	L4
			j50 Ω	2. Determine the load impedance $Z_L = Z(0)$ and $Y_L = Y$			
			(0) gi	ven that $Z_o = 50 \ \Omega$ for the line.			
68	1KT1	4EC067	A TL	of length I = 0.5 λ and Z_{o} = 50 Ω has a load reflection	5	CO2	L4
			coeff	icient $\Gamma_{\scriptscriptstyle L}$ = 0.5 and and a shunt connected TL at d =			
	0.2λ		0.2λ.	The shunt connected TL has I = 0.3 λ , Z $_{o}$ = 50 Ω , and			
	a loa		a loa	d reflection coefficient $\Gamma_L = -0.5$. Determine the input			
			impe	dance of the line. What is the load impedance $Z_{L}s$			
			termi	nating the shunt connected stub? What is the load			
			impe	dance Z _L			

D2. TEACHING PLAN – 2

Module - 3

Class No	Module Content Covered	CO	Level
b	Course Schedule		
2	Compute the antenna design characteristics using the parameters	CO6	L3
1	Have knowledge of micro, parallel and shielded striplines	CO5	L2
-	The student should be able to:	-	Level
а	Course Outcomes	-	Blooms
		Time:	
Title:	Striplines And Antenna Basics	Appr	12 Hrs

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JA INSTITUTE OF IN	SKIT Teaching Process Rev No.: 1		.0		
	Doc Code: SKIT.Ph5b1.F02	Date: 25-08-2019			
#BANGALORE	Title: Course Plan	Page: 19 / 36			
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20	Introduction to striplines, Characteristic impedance and effective	e CO5	L3		
	dielectric of striplines				
21	Losses in microstriplines and quality factor, Parallel striplines	CO5	L3		
22	Coplanar striplines and shielded striplines	CO5	L3		
23	Introduction to antennas	CO6	L2		
24	Radiation patterns, Radiation intensity	CO6	L2		
25	Beam width, Radian and Steradian, Beam area, Beam efficiency	CO6	L2		
26	Directivity, Gain and Resolution	CO6	L2		
27	Antenna Aperture, Maximum power transfer, Antenna bandwidth Radio communication link	, CO6	L2		
28	Effective height, Antenna efficiency, Antenna Field Zones and	I CO6	L2		
20	rolarization		1.2		
29	Numericais on antenna parameters	C06	L3		
30	Numericals on antenna parameters	C06	L3		
51	numericais on antenna parameters	006	L3		
	Application Areas	<u> </u>			
C	Application Areas Printed circuit boards of radio receivers, mother boards				
2	Transmission and recention of signals of any frequency		13		
	Transmission and reception of signals of any frequency	200			
h	Review Questions				
18	Explain with suitable expressions the characteristic impedance and		11		
	effective dielectric of striplines?		L1		
19	Summarize the losses in microstriplines and derive an expression for quality factor of a microstripline?	CO1	L3		
20	Explain in detail the Parallel striplines?	CO2	L2		
21	Describe with suitable expressions the coplanar and shielded	I CO2	L2		
	striplines				
22	Compare the different radiation patterns of the antenna	CO2	L2		
23	Review the radiation intensity and beam width of an antenna	CO2	L2		
24	Compute the expressions for Radian and Steradian	CO2	L2		
25	Associate and explain beam area and beam efficiency of an antenna	CO2	L2		
26	Derive suitable expressions for directivity and gain of an antenna	CO2	L2		
27	What is an antenna Aperture? Explain the physical and effective apertures?	CO2	L2		
28	Define antenna bandwidth with suitable expressions?	CO2	L2		
29	Derive suitable expressions for effective height and antenna efficiency of an antenna?	i CO2	L2		
30	Summarize the antenna Field Zones and Polarization concept?	CO2	L2		
31	Explain radio communication link with suitable diagram?	CO2	L2		

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SKIT	Teaching Process	Rev No.: 1.0
Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
Title:	Course Plan	Page: 20 / 36

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е	Experiances	-	-			
1						
2						
3						
4						
5						

Module - 4

Title:	Antenna Point sources and Arrays And Electric Dipoles	Appr	13 Hrs
		Time:	
а	Course Outcomes	-	Blooms
_	The student should be able to:	_	Level
1	Extend the antenna parameters to the array of point sources	C07	L3
2	Examine the field parameters of electric dipole antennas	CO8	L4
h	Course Schedule		
Close	Modulo Contont Covorod	<u> </u>	
No		CU	Levei
32	Introduction to point sources, power theorem, power patterns, Radiation intensity	C07	L3
33	Directivity of directional power patterns, Directivity of bidirectional power patterns	C07	L3
34	Field patterns and its application, Introduction to antenna arrays	C07	L3
35	Array of two isotropic point sources, same amplitude and phase, same amplitude and opposite phase	C07	L3
36	Array of two isotropic point sources, same amplitude and quadrature phase, general case, Pattern multiplication	C07	L3
37	Linear array of n isotropic point sources of equal amplitude and spacing: Broad side, end fire and extended endfire array cases	C07	L3
38	Linear array of n isotropic point sources of equal amplitude and spacing: extended endfire array cases	C07	L3
39	Numericals on point sources	C07	L3
40	Numericals on point sources	C07	L3
41	Introduction to short electric dipoles, Fields of a short dipole.	CO8	L4
42	Radiation resistance of short dipole	CO8	L4
43	Radiation resistance of thin linear antenna	CO8	L4
44	Radiation resistance of lambda/2 dipole	CO8	L4
С	Application Areas	CO	Level
1	Mathematical modeling of light, electromagnetic radiation, sound,	C07	L3

ATTUTE OF TECHNOLOGY	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
ANGALORE*	Title:	Course Plan	Page: 21 / 36

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	host	fluid	nolluti

	heat, fluid pollution		
2	A driven element used in feeding the elaborate directional antennas	CO8	L4
	like horn, yagi-uda antennas		
d	Review Questions	-	-
32	What are point sources? Derive an expression for power theorem?	C07	L3
33	Distinguish between the power patterns and field patterns?	C07	L3
34	What is pattern multiplication? Explain with suitable expressions the	C07	L3
	array of two isotropic point sources with same amplitude and phase?		
35	Explain with suitable expressions the array of two isotropic point	C07	L3
	sources with same amplitude and opposite phase?		
36	Explain with suitable expressions the array of two isotropic point	C07	L3
	sources with same amplitude and quadrature phase?		
37	Explain the array of n isotropic point sources of equal amplitude and	C07	L3
	phase for broadside, endfire and extended end fire cases		
38	Define the fields of a short dipole?	CO8	L4
39	Derive an expression for the radiation resistance of a short dipole	CO8	L4
40	Derive an expression for the radiation resistance of thin linear	CO8	L4
	antennas		
41	Derive an expression for the radiation resistance of a lambda/2	CO8	L4
	antenna		
е	Experiences	-	-
1			
2			
3			
4			
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs		15EC71	Sem:	VII	Marks:	30	Time:	75 minutes			
Cod	e:										
Cou	rse:	: MICROWAVE AND ANTENNAS									
-	-	- Note: Answer any 2 questions, each carry equal marks.							lark	СО	Level
									S		
1	a	List and ex	plain the ty	pes of strip	lines?				7	CO5	L2
	b	Define the	following	erms with	respect to	antenna: I)	Directivity	ii)	8	CO6	L3
		Radiation resistance iii) Effective height iv) antenna aperture									
2	a	The power	received b	y the receiv	ing antenn	a at a dista	nce of 0.5 k	m	5	CO6	L3

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	SKIT	Teaching Process	Rev No.: 1.0
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ANGALORE*	Title:	Course Plan	Page: 22 / 36
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	over free space at a frequency of 1GHz is 01.8Mw. Calculate the input			
	to the transmitting antenna if gain of transmitting antenna and			
	receiving antenna is 25dB and 20dB respectively. The gain is with			
	respect to isotropic sources			
b	State and explain the power theorems in terms of power density and	5	C07	L3
	radiation intensity			
с	Show that the exact directivity of unidirectional pattern $U=U_m \cos^n \varphi$	5	C07	L3
a	Extract the field pattern for the array of two isotropic point sources	7	C07	L3
	of same amplitude and opposite phase?			
b	Derive an expression for the radiation resistance of the Hertzian	8	CO8	L4
	dipole antenna			
a	Extract the field pattern for the ordinary linear end fire array of n	7	C07	L3
	isotropic point sources of equal amplitude and spacing			
b	Prove that the radiation resistance of a thin linear antenna is 75 ohm	8	CO8	L4
_	b a b a b	 over free space at a frequency of 1GHz is 01.8Mw. Calculate the input to the transmitting antenna if gain of transmitting antenna and receiving antenna is 25dB and 20dB respectively. The gain is with respect to isotropic sources b State and explain the power theorems in terms of power density and radiation intensity c Show that the exact directivity of unidirectional pattern U=U_m cosⁿφ a Extract the field pattern for the array of two isotropic point sources of same amplitude and opposite phase? b Derive an expression for the radiation resistance of the Hertzian dipole antenna a Extract the field pattern for the ordinary linear end fire array of n isotropic point sources of equal amplitude and spacing b Prove that the radiation resistance of a thin linear antenna is 75 ohm 	 over free space at a frequency of 1GHz is 01.8Mw. Calculate the input to the transmitting antenna if gain of transmitting antenna and receiving antenna is 25dB and 20dB respectively. The gain is with respect to isotropic sources b State and explain the power theorems in terms of power density and radiation intensity c Show that the exact directivity of unidirectional pattern U=U_m cosⁿ φ a Extract the field pattern for the array of two isotropic point sources of same amplitude and opposite phase? b Derive an expression for the radiation resistance of the Hertzian dipole antenna a Extract the field pattern for the ordinary linear end fire array of n isotropic point sources of equal amplitude and spacing b Prove that the radiation resistance of a thin linear antenna is 75 ohm 8 	over free space at a frequency of 1GHz is 01.8Mw. Calculate the input to the transmitting antenna if gain of transmitting antenna and receiving antenna is 25dB and 20dB respectively. The gain is with respect to isotropic sourcesAbState and explain the power theorems in terms of power density and radiation intensity5CO7cShow that the exact directivity of unidirectional pattern U=Um cos ⁿ Φ5CO7aExtract the field pattern for the array of two isotropic point sources of same amplitude and opposite phase?7CO7bDerive an expression for the radiation resistance of the Hertzian dipole antenna8CO8aExtract the field pattern for the ordinary linear end fire array of n isotropic point sources of equal amplitude and spacing7CO7bProve that the radiation resistance of a thin linear antenna is 75 ohm8CO8

b. Assignment - 2

Note: A distinct assignment to be assigned to each student.

				Mode	l Assignmer	t Quest	ions			
Crs C	ode:	15EC71	Sem:	VII	Marks:	5	Time:	90 - 120) minut	tes
Cours	se:									
Note:	Each	al mark.								
SNo	l	JSN		Assi	gnment De	scriptio	on	Mark	СО	Level
								S		
1	1KT	15EC001	A short ante	nna with	a uniform c	urrent o	listribution in fr	ee 5	C07	L3
			space has Id	L=3x10 ⁻⁴	⁴ Am. Calcul	ate the	$ E_{\theta} $ for $\theta = 90^{\circ}$ and	nd		
			$\phi = 0^{\circ}$. If λ	= 10cm	and r=20	Ocm as	suming far fie	ld		
			components							
2	1KT	15EC003	2003 The radiation resistance of an antenna is 72 Ω and the los						C07	L3
	resistance is 8Ω . What is the directivity if the gain is 30									
3	1KT	15EC004	Calculate the	e radiatio	on resistanc	e of λ	10 wire dipole	in 5	C07	L3
			free space							
4	1KT	15EC005	Find the cur	rent requ	uired to rad	iate a p	power of 100W	at 5	C07	L3
			100MHz from	n a 0.01r	n Hertzian d	lipole				
5	1KT	15EC006	Explain with	suitable	expressions	the arr	ay of two isotrop	ic 5	C07	L3
			point source	s with sa	me amplitud	le and c	pposite phase?			
6	1KT	15EC007	An antenna	receives	a maximu	n powe	er of 2µW from	a 5	C07	L3
			radio statior	n. Calcula	ate its maxi	num ef	fective area if tl	ne		
			antenna is lo	ocated in	the far field	d of the	station where	E		
			= 50mV/m							
7	1KT	15EC008	A microwave	e relay li	nk is to be	desigr	ed such that th	ne	C07	L3

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		transmitting and receiving antennas are separated by 30			
		miles. The directive gains of both the antennas are equal			
		to 45dB. Assuming both antennas lossless and matched at			
		3 GHz, find what power is transmitted by the transmitter			
		to have received power in 1mW			
8	1KT15EC009	Explain with suitable expressions the array of two isotropic	5	C07	L3
		point sources with same amplitude and quadrature phase?			
9	1KT15EC010	Explain the array of n isotropic point sources of equal	5	C07	L3
		amplitude and phase for broadside, endfire and extended			
		end fire cases			
10	1KT15EC011	Define the fields of a short dipole?	5	CO8	L4
11	1KT15EC012	Derive an expression for the radiation resistance of a short	5	CO8	L4
		dipole			
12	1KT15EC013	Derive an expression for the radiation resistance of thin	5	CO8	L4
		linear antennas			
13	1KT15EC014	Derive an expression for the radiation resistance of a	5	CO8	L4
		lambda/2 antenna			
14	1KT15EC015	A short antenna with a uniform current distribution in free	5	C07	L3
		space has IdL= 3×10^{-4} Am. Calculate the $ E_{\theta} $ for $\theta = 90^{\circ}$ and			
		$\phi = 0^{\circ}$. If $\lambda = 10$ cm and r=200 cm assuming far field			
		components			
15	1KT15EC017	The radiation resistance of an antenna is 72Ω and the loss	5	C07	L3
		resistance is 8Ω . What is the directivity if the gain is 30			
16	1KT15EC019	Calculate the radiation resistance of $\lambda/10$ wire dipole in	5	C07	L3
		free space			
17	1KT15EC020	Find the current required to radiate a power of 100W at	5	C07	L3
		100MHz from a 0.01m Hertzian dipole			
18	1KT15EC021	Explain with suitable expressions the array of two isotropic	5	C07	L3
		point sources with same amplitude and opposite phase?			
19	1KT15EC022	An antenna receives a maximum power of $2\mu W$ from a	5	CO1	L1
		radio station. Calculate its maximum effective area if the			
		antenna is located in the far field of the station where $ E $			
		= 50mV/m			
20	1KT15EC023	A microwave relay link is to be designed such that the	5	C07	L3
		transmitting and receiving antennas are separated by 30			
		miles. The directive gains of both the antennas are equal			
		to 45dB. Assuming both antennas lossless and matched at			
		3 GHz, find what power is transmitted by the transmitter			
		to have received power in 1mW			
21	1KT15EC024	If the noise figure of the antenna at room temperature is	5	C07	L3
		1.1dB, what is the effective noise temperature			
22	1KT15EC025	Determine maximum effective aperture of an antenna	5	C07	L3

SKI Doc C Titl		SKI	Teaching Process		Rev N	o.: 1.0	
		Doc C	de: SKIT.Ph5b1.F02	Date:	25-08	-2019	
		Titl	: Course Plan	Page:	24 / 3	6	
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			naving small side lobes. The half power bea	am widths in			
			the perpendicular planes intersecting in bear	m axis is 35°			
	11/1	500026	and 40°	.		600	
23	INII	JEC020	A linear array consists of four equal isotr	opic inphase	5	C08	L3
			point sources with spacing equal to $\lambda/3$.	Calculate the			
			directivity and beamwidth if the total length o	of the array is			
24	1KT1	5EC028	Λ and fire array with elements spaced at $\lambda/2$	and with avec		<u> </u>	12
24		012020	All end file allay with elements spaced at $N/2$	and with axes	2	008	LD
			directivity of 36 Determine array alength and w	vidth of major			
			obe.				
25	1KT1	5EC029	Compute the expressions for Radian and Stera	adian	5	C07	L2
26	1KT1	5EC030	Associate and explain beam area and beam	efficiency of	5	C07	L2
			an antenna				
27	1KT1	5EC031	For two element array consisting idention	cal radiators	5	CO8	L3
			carrying equal currents in phase, obtain	positions of			
			maxima and minima of the radiation pa	attern if the			
			distance of seperation $d = \lambda$				
28	1KT1	5EC032	Explain the principle of Pattern multiplication.		5	CO8	L3
29	1KT16EC401		What are point sources? Derive an expression	on for power	5	C07	L3
			heorem?				
30	1KT1	6EC403	Distinguish between the power patterns and fi	ield patterns?	5	CO8	L2
31	1KT1	6EC406	What is pattern multiplication? Explain v	vith suitable	5	CO8	L2
			expressions the array of two isotropic point	sources with			
			same amplitude and phase?				
32	1KT1	6EC408	A broadside array of identical antennas	consists 8	5	CO8	L3
			sotropic radiators separated by distance	$\lambda/2$. Find the			
			adiation field in a plane containing the line of	array showing			
			directions of maxima and null				
33	1KT1	6EC411	Summarize the losses in microstriplines ar	nd derive an	5	CO5	L2
			expression for quality factor of a microstriplin	e?			
34	1KT1	5EC036	Explain in detail the Parallel striplines?		5	CO5	L2
35	1KT1	5EC037	Describe with suitable expressions the c	oplanar and	5	CO5	L2
	411774		shielded striplines				
36	1KT1	5EC038	Compare the different radiation patterns of th	e antenna	5	CO6	L2
37	1KT1	5EC039	Review the radiation intensity and beam	width of an	5	CO6	L2
		- CONTRACTOR	antenna				
38	IKT1	5EC041	ind the length and BFWN for broadside and	endfire array	5	CO8	L3
		-	f the directive gain is 15				
39	1KT1	5EC043	Calculate the radiation resistance of a dipol	e antenna of	5	CO8	L3
			ength λ/8m.				
40	1KT1	5EC044	Calculate the radiation resistance of an anter	nna of length	5	CO8	L3
			$1/10m$ and $\lambda/50m$				

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41	1KT1	5EC045	A ma	ignetic field strength of $5\mu A/m$ is required at a point	5	CO8	L3
			on θ	$=\pi/2$, 2 km away from an antenna in free space.			
			Negle	ecting ohmic loss, how much power must the antenna			
			trans	mit if it is, I) a Hertzian dipole of length $\lambda/25$ ii) a			
			half w	vave dipole iiii) a quarter wave dipole			
42	1KT1	5EC046	Detei	rmine maximum effective aperture of an antenna	5	C07	L3
			havin	ng small side lobes. The half power beam widths in			
			the p	perpendicular planes intersecting in beam axis is 35°			
			and 4	40°			
43	1KT1	5EC047	A lin	ear array consists of four equal isotropic inphase	5	CO8	L3
			point	: sources with spacing equal to $\lambda/3$. Calculate the			
			direc	tivity and beamwidth if the total length of the array is			
			λ				
44	1KT1	5EC048	An ei	nd fire array with elements spaced at $\lambda/2$ and with axes	5	CO8	L3
			of ele	ments at right angles to the line of array is required to have			
			direct	ivity of 36. Determine array alength and width of major			
45	1КТ1	5EC049	Dofin	a antanna handwidth with suitable expressions?	F	<u> </u>	12
45	1671	5EC051	Derin	le antenna bandwidth with suitable expressions:	5 	000	
40	1111	JLC0J1	Deriv	ve suitable expressions for effective neight and	С	C06	LZ
47	1671	5EC052	anter	ma eniciency of an antenna?	-	<u> </u>	1.2
47	1111	510052	Sum	narize the antenna Field Zones and Polarization	С	00	LZ
40	1671	5EC053	CONCO	ept:	-	<u> </u>	1.2
40	1611	5EC055	Expla	the length and REWN for broadcide and endfire array	с г	C08	L2
49	1111	JLC0J4	FINU Set bo	directive gain is 15	Э	00	LS
F 0	1671	5EC055	II the	directive gain is 15	-	600	1.2
50	1111	JEC0JJ	Calcu	hate the radiation resistance of a dipole antenna of	5	CU8	L3
	11/1	50056	lengt	n ۸/8m.	_	600	
51	IKII	SEC030	Calcu	late the radiation resistance of an antenna of length	5	CO8	L3
F 2	1671	5EC058	λ/10n	n and $\lambda/50m$	-	<u> </u>	1.2
52		020000		ignetic field strength of 5μ A/m is required at a point	5	008	LS
				$=\pi/2$, 2 km away from an antenna in free space.			
			negre	mit if it is 1) a Hartzian dinala of langth 2/25 ii) a			
			trans	mit in it is, i) a Hertzian dipole of length 7/25 ii) a			
52	1KT1	5EC059		vave dipole IIII) a quarter wave dipole	5	C08	12
			opor	rate the dimensions of a han wave dipole antenna $rate rate rate rate rate rate rate rate $	J	000	LJ
			opera	tion registance. Cive the total newer radiated if it is			
			fod y	with a surrout of amplitude 25A			
51	1KT1	5EC061	Fypla	a current of amplitude 23A	5	C07	12
54	1671	5EC062	What	are point sources? Derive an expression for neuror	ر ح	C07	1.2
در 			theor	are point sources: Derive an expression for power	C	07	LD
	1671	5EC063		Cill:	-	<u> </u>	1.2
סכ	11/11	5EC064		in nottern multiplication? Furthing with suitche	2 _	CO7	L3
זר	11.11	51004	wnat	is pattern multiplication? Explain with suitable	2	CU/	Lک

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Title: Course PlanPage: 26 / 36Copyright 22017. cAS. All rights reserved.expressions the array of two isotropic point sources with same amplitude and phase?58IKT15EC067A magnetic field strength of 5 μ A/m is required at a point on $\theta = \pi/2$, 2 km away from an antenna in free space. Neglecting ohmic loss, how much power must the antenna transmit if it is, 1) a Hertzian dipole of length $\lambda/25$ ii) a half wave dipole iiii) a quarter wave dipole5CO8L359IKT16EC412Calculate the dimensions of a half wave dipole antenna operating at 100MHz in the free space . What is its radiation resistance . Give the total power radiated if it is fed with a current of amplitude 25ACO6L260IKT16EC410Derive suitable expressions for directivity and gain of an antenna5CO6L261IKT16EC419What is an antenna Aperture? Explain the physical and effective apertures?5CO7L362IKT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L364IKT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate 1) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	RI KRISHI	CHINOLOG	Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08	-2019
Copyright 22017. CAAS. All rights reserved.Copyright 22017. CAAS. All rights reserved.Expressions the array of two isotropic point sources with same amplitude and phase?58IKT15EC067A magnetic field strength of 5μ A/m is required at a point on $\theta = \pi/2$, 2 km away from an antenna in free space. Neglecting ohmic loss, how much power must the antenna transmit if it is, 1) a Hertzian dipole of length $\lambda/25$ ii) a half wave dipole iii) a quarter wave dipole591KT16EC412Calculate the dimensions of a half wave dipole antenna operating at 100MHz in the free space. What is its radiation resistance . Give the total power radiated if it is fed with a current of amplitude 25A5CO6L2601KT16EC416Derive suitable expressions for directivity and gain of an effective apertures?5CO6L2611KT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L3631KT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L3641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate 1) HPBW, ii) Directivity iii) Beam solid angle iv)CO7L3	* BANG	GALORE *	Titl	e:	Course Plan	Page:	26 / 3	6
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on $\theta = \pi/2$, 2 km away from an antenna in free space. Neglecting ohmic loss, how much power must the antenna transmit if it is, 1) a Hertzian dipole of length $\lambda/25$ ii) a half wave dipole iiii) a quarter wave dipoleSelecting ohmic loss, how much power must the antenna transmit if it is, 1) a Hertzian dipole of length $\lambda/25$ ii) a half wave dipole iiii) a quarter wave dipole591KT16EC412Calculate the dimensions of a half wave dipole antenna operating at 100MHz in the free space . What is its radiation resistance . Give the total power radiated if it is fed with a current of amplitude 25A5CO6L2601KT16EC416Derive suitable expressions for directivity and gain of an antenna5CO6L2611KT16EC419What is an antenna Aperture? Explain the physical and effective apertures?5CO7L3621KT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L3631KT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L3641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate 1) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	58	1KT1	5EC067	A ma	agnetic field strength of $5\mu A/m$ is required at a point	5	CO8	L3
Neglecting ohmic loss, how much power must the antenna transmit if it is, 1) a Hertzian dipole of length $\lambda/25$ ii) a half wave dipole iiii) a quarter wave dipole591KT16EC412Calculate the dimensions of a half wave dipole antenna operating at 100MHz in the free space . What is its radiation resistance . Give the total power radiated if it is fed with a current of amplitude 25A5CO6L2601KT16EC416Derive suitable expressions for directivity and gain of an antenna5CO6L2 effective apertures?611KT16EC419What is an antenna Aperture? Explain the physical and identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L3 broadside array of 10 isotropic radiators to have directivity of 7dB641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate 1) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				on 6	$=\pi/2$, 2 km away from an antenna in free space.			
InterfaceIteration of the space				Negl	ecting ohmic loss, how much power must the antenna			
Signal Wave dipoleIIII) a quarter wave dipoleIIII) a quarter wave dipole591KT16EC412Calculate the dimensions of a half wave dipole antenna operating at 100MHz in the free space . What is its radiation resistance . Give the total power radiated if it is fed with a current of amplitude 25A5CO6L3601KT16EC416Derive suitable expressions for directivity and gain of an antenna5CO6L2611KT16EC419What is an antenna Aperture? Explain the physical and effective apertures?5CO6L2621KT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L3631KT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L3641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate 1) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				trans	mit if it is, I) a Hertzian dipole of length $\lambda/25$ ii) a			
39INFIGURE Calculate the dimensions of a han wave dipole antenna3CO8L3operating at 100MHz in the free space . What is its radiation resistance . Give the total power radiated if it is fed with a current of amplitude 25A5CO6L260 $1KT16EC416$ Derive suitable expressions for directivity and gain of an antenna5CO6L261 $1KT16EC419$ What is an antenna Aperture? Explain the physical and effective apertures?5CO6L262 $1KT16EC420$ Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L363 $1KT16EC421$ Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L364 $1KT16EC422$ A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	50	1671	6FC412	half v	vave dipole IIII) a quarter wave dipole		CO ⁰	1.2
60IKT16EC410Sketch the radiation pattern of a two element array having identical radiator spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°CO6L261IKT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°Sco7L363IKT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)Sco7L3	29		020112	Calci	state the dimensions of a han wave dipole antenna $\frac{1}{2}$	2	008	LD
Induction resistance : Give the total power radiated in it is fed with a current of amplitude 25A60 $1KT16EC416$ Derive suitable expressions for directivity and gain of an antenna5CO6L261 $1KT16EC419$ What is an antenna Aperture? Explain the physical and effective apertures?5CO6L262 $1KT16EC420$ Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L363 $1KT16EC421$ Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L364 $1KT16EC422$ A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				radia	tion resistance. Cive the total power radiated if it is			
60IKT16EC416Derive suitable expressions for directivity and gain of an antenna5CO6L261IKT16EC419What is an antenna Aperture? Explain the physical and effective apertures?5CO6L262IKT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L363IKT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L364IKT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				fed w	with a current of amplitude $25A$			
60Define subtract statistic expressions for directivity and gain of all5CoolL2antenna1KT16EC419What is an antenna Aperture? Explain the physical and effective apertures?5CO6L2621KT16EC420Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L3631KT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L3641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	60	1KT1	6EC416	Deriv	ve suitable expressions for directivity and gain of an	5	C06	12
61 $1KT16EC419$ What is an antenna Aperture? Explain the physical and effective apertures?5CO6L262 $1KT16EC420$ Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L363 $1KT16EC421$ Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L364 $1KT16EC422$ A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	00		020110	anter	nna	J	00	LZ
effective apertures?Image: Constant of a two element array having identical radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L3631KT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L3641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	61	1KT1	6EC419	What	is an antenna Aperture? Explain the physical and	5	CO6	L2
62 $1KT16EC420$ Sketch the radiation pattern of a two element array having identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°5CO7L363 $1KT16EC421$ Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L364 $1KT16EC422$ A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				effec	tive apertures?			
identical radiators spaced $\lambda/4$ apart and current in one radiator lags behind other by 90°CO7L3631KT16EC421Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L3641KT16EC422A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	62	1KT1	6EC420	Sketo	ch the radiation pattern of a two element array having	5	C07	L3
Image: constraint of the second se				ident	ical radiators spaced $\lambda/4$ apart and current in one			
63 1KT16EC421 Find the minimum spacing between the elements in a broadside array of 10 isotropic radiators to have directivity of 7dB5CO7L364 1KT16EC422 A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				radia	tor lags behind other by 90°			
broadside array of 10 isotropic radiators to have directivity of 7dBCO764 1KT16EC422 A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3	63	1KT1	6EC421	Find	the minimum spacing between the elements in a	5	C07	L3
				broa	dside array of 10 isotropic radiators to have directivity			
64 1KT16EC422 A uniform linear array consists 16 isotropic point sources with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)5CO7L3				of 7c	IB			
with a spacing of $\lambda/4$. If the phase difference is 90°, claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)	64	1KT1	6EC422	A un	iform linear array consists 16 isotropic point sources	5	C07	L3
claculate I) HPBW, ii) Directivity iii) Beam solid angle iv)				with	a spacing of $~\lambda/4.$ If the phase difference is 90°,			
				clacu	ılate I) HPBW, ii) Directivity iii) Beam solid angle iv)			
effective aperture				effec	tive aperture			
651KT16EC423Derive Hansen-Woodyard condition for n element end fire5CO7L2	65	1KT1	6EC423	Deriv	e Hansen-Woodyard condition for n element end fire	5	C07	L2
array for enhancing its directivity				array	for enhancing its directivity			
$\begin{array}{ c c c c c c c } \hline 66 & {}^{1KT16EC424} & \text{A magnetic field strength of } 5\mu\text{A}/\text{m is required at a point} & 5 & CO8 & L3 \\ \hline \end{array}$	66	1KT1	6EC424	A ma	agnetic field strength of $5\mu A/m$ is required at a point	5	CO8	L3
on $\theta = \pi/2$, 2 km away from an antenna in free space.				on 6	$=\pi/2$, 2 km away from an antenna in free space.			
Neglecting ohmic loss, how much power must the antenna				Negl	ecting ohmic loss, how much power must the antenna			
transmit if it is, I) a Hertzian dipole of length $\lambda/25$ ii) a				trans	mit if it is, I) a Hertzian dipole of length $\lambda/25$ ii) a			
half wave dipole iiii) a quarter wave dipole		11/1	(EC42)	half v	vave dipole iiii) a quarter wave dipole			
67 IKTIGEC426 Determine maximum effective aperture of an antenna 5 CO7 L3	67	IKII	6EC426	Dete	rmine maximum effective aperture of an antenna	5	C07	L3
having small side lobes. The half power beam widths in				havir	ng small side lobes. The half power beam widths in			
the perpendicular planes intersecting in beam axis is 35°				the p	berpendicular planes intersecting in beam axis is 35°			
and 40°		11/1	4EC067	and 4		-	<u> </u>	1.2
68 A linear array consists of four equal isotropic inphase 5 CO8 L3	68			A lir	lear array consists of four equal isotropic inphase	5	COS	L3
point sources with spacing equal to $\Lambda/3$. Calculate the directivity and beamwidth if the total length of the array is				dirac	tivity and beamwidth if the total length of the array is			
				λ	tivity and beamwidth in the total length of the affay is			

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Module – 5

Title:	LOOP AND HORN ANTENNA AND ANTENNA TYPES	Appr	10 Hrs
		Time:	
а	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Explain the working of horn and loop antennas	CO9	L2
2	Compare the working of helical, parabola, Yagi-Uda and log-periodic	CO10	L2
	antennas		
b	Course Schedule		
Class	Module Content Covered	СО	Level
No			
45	Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole	CO9	L2
46	The Loop Antenna General Case	CO9	L2
47	Far field Patterns of Circular Loop Antenna with Uniform Current	CO9	L2
48	Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current	CO9	L2
49	Horn antennas Rectangular Horn Antennas	C09	12
50	Helical Antenna, Helical Geometry	C010	12
50	Practical Design Considerations of Helical Antenna	CO10	12
52	Yagi-Uda array	CO10	12
53	Parabola General Properties	CO10	 L2
54	Log Periodic Antenna	CO10	L2
С	Application Areas	CO	Level
1	Horn-Transmission in wider bandwidth, increasing the directivity and	CO9	L2
	reduces the spurious responses of the parabolic reflector, short range		
	radar system(speed enforcement cameras), Loop- Finding directions		
	in radars, aircraft and radio receivers		
2	Helical-Circularly polarized radio waves for satellite communication,	CO10	L2
	Parabolic-direct the radio waves in radio telescopes, Yagi-Uda-high		
	directivity for log distance communication, Log-Periodic-Wide		
	bandwidth UHF terrestrial TV		
d	Review Questions	_	_
42	Define and Explain loop antenna for different shapes?	CO9	L2
43	Obtain the field pattern of the transmitting loop antenna?	CO9	L2
44	Derive expressions for field components of the loop antenna?	CO9	L2
45	Obtain the expressions for the radiation resistance of the loop	CO9	L2

	SKIT	Teaching Process	Rev No.: 1.0
	Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
ANGALORE*	Title:	Course Plan	Page: 28 / 36

* SRI KRISHINA

	antenna		
46	Discuss the different cases for the loop antennas for the calculation of the directivity of the same	CO9	L2
47	List and explain the applications of the loop antenna.	CO9	L2
48	Explain the Babinet's principles for the electromagnetic fields	CO9	L2
49	Explain how horn antennas are constructed. Explain the differnet	CO9	L2
	types of horn antenna.		
50	Derive design equations for the horn antenna	CO9	L2
51	Derive expressions for the field at a point on the axis of E-plane	CO9	L2
	sectoral horn.		
52	Explain how GPR systems differ than the general radar systems. What	CO10	L2
	are the different considerations for antenna used in GPR systems		
53	What is log periodic antenna? Explain with neat sketch the log	CO10	L2
	periodic antenna?		
54	Explain the structure of helix in helical antenna using neat sketches of	CO10	L2
	perpendicular and end fire modes.		
55	What is a parasitic element? Explain with a neat sketch the array of	CO10	L2
	parasitic elements?		
56	Derive an expression for the gain of two element parasitic array in	CO10	L2
	free space with $\lambda/2$ dipole as driven element?		
57	Explain in detail, the yagi-uda antenna. Write the design equations for	CO10	L2
	dimensions of different elements of antenna		
58	Write a note on paraboloid? Explain the principle of parabolic reflector	CO10	L2
	with the help of a neat diagram.		
59	Explain the reflector and director actions of yagi-uda antenna	CO10	L2
60	Mention the applications of helical, log periodic, parabolic and yagi-	CO10	L2
	uda antennas		
е	Experiences	-	-
		C010	L2
2			
3		600	
4		C09	L3
5			

E3. CIA EXAM - 3

a. Model Question Paper - 3

Crs	15EC71	Sem:	VII	Marks:	30	Time:	75	75 minutes		
Code:										
Course:	MICROWAY	VE AND A	NTENNAS							
Note: Answer any 2 questions, each carry equal marks. Mark CO Lev										
Dept EC										
Prepared by Check								ed by		
Approved	ł									

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SKIT	Teaching Process	Rev No.: 1.0
Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
Title:	Course Plan	Page: 29 / 36

			S		
1	a	Obtain the field pattern of the transmitting loop antenna?	5	CO9	L2
	b	Derive expressions for field components of the loop antenna?	5	CO9	L2
	С	Obtain the expressions for the radiation resistance of the loop antenna	5	CO9	L2
2	a	Explain the Babinet's principles for the electromagnetic fields	5	CO9	L2
	b	Explain how horn antennas are constructed. Explain the differnet types of horn antenna.	5	CO9	L2
	с	Derive design equations for the horn antenna	5	CO9	L2
3	a	Calculate the directivity of 20 turn helix with α =12° and circumference equal to one wavelength	5	CO10	L2
	b	Explain in detail, the yagi-uda antenna. Write the design equations for dimensions of different elements of antenna	5	CO10	L2
	С	Write a note on paraboloid? Explain the principle of parabolic reflector with the help of a neat diagram.	5	CO10	L2
4	a	For a 20 turn helical antenna operating at 3GHz with the circumference of 10cm and spacing between the turns 0.3λ is operating at 3GHz. Calculate the directivity and half power beam width.	5	CO10	L2
	b	What is log periodic antenna? Explain with neat sketch the log periodic antenna?	5	CO10	L2
	с	Explain the structure of helix in helical antenna using neat sketches of perpendicular and end fire modes.	5	CO10	L2

b. Assignment - 3

Note: A distinct assignment to be assigned to each student.

	Model Assignment Questions											
Crs C	ode:	15EC71	Sem:	VII	Marks:	5	Time:	90 - 120	0 – 120 minutes			
Cours	se:	MICROW	AVE AND AN	ITENNAS								
Note:	ote: Each student to answer 2–3 assignments. Each assignment carries equal mark.											
SNo	SNo USN Assignment Description					Mark	СО	Level				
						S						
1	1KT1	5EC001	For a 20 turn helical antenna operating at 3GHz with the					ne 5	CO10	L2		
		1	circumferenc	e of 10cm	n and spac	ing betwee	en the turr	ıs				
			0.3λ is opera	ting at 3GH	Hz. Calculat	e the direct	ivity and ha	lf				
	power beam width.											
2	2 1KT15EC003 Calculate the directivity of 20 turn helix with α =12° and				id 5	CO10	L2					
			circumferenc	e equal to	one wavele	ngth						

JA INSTIT	TUTE OF THE	SKI	IT	Teaching Process	Rev N	lo.: 1.0	
RI KRISH		Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08-	-2019
*BANG	SALORE *	Titl	e:	Course Plan	Page:	30 / 30	5
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3	1KT1	5EC004	Defin	e and Explain loop antenna for different shapes?	5	CO9	L2
4	1KT1	5EC005	Obtai	n the field pattern of the transmitting loop antenna?	5	CO9	L2
5	1KT1	5EC006	Deriv	e expressions for field components of the loop	5	CO9	L2
an		anten	ina?				
6	6 1KT15EC007		Obtai	n the expressions for the radiation resistance of the	5	CO9	L2
			loop a	antenna			
7	1KT1	5EC008	Discu	iss the different cases for the loop antennas for the	5	CO9	L2
			calcu	lation of the directivity of the same			
8	1KT1	5EC009	List a	nd explain the applications of the loop antenna.	5	CO9	L2
9	1KT1	5EC010	Expla	in the Babinet's principles for the electromagnetic	5	CO9	L2
			fields				
10	1KT1	5EC011	Expla	in how horn antennas are constructed. Explain the	5	CO9	L2
	differnet types of horn antenna.						
11	1KT1	5EC012	Deriv	e design equations for the horn antenna	5	CO9	L2
12	1KT1	5EC013	Deriv	e expressions for the field at a point on the axis of E-	5	CO9	L2
			plane	sectoral horn.			
13	1KT1	5EC014	Expla	in how GPR systems differ than the general radar	5	CO10	L2
	syst		syste	ms. What are the different considerations for antenna			
			used	in GPR systems			
14	1KT1	5EC015	What	is log periodic antenna? Explain with neat sketch the	5	CO10	L2
			log pe	eriodic antenna?			
15	1KT1	5EC017	Expla	in the structure of helix in helical antenna using neat	5	CO10	L2
			sketc	hes of perpendicular and end fire modes.			
16	1KT1	5EC019	What	is a parasitic element? Explain with a neat sketch the	5	CO10	L2
			array	of parasitic elements?			
17	1KT1	5EC020	Deriv	e an expression for the gain of two element parasitic	5	CO10	L2
			array	in free space with $\lambda/2$ dipole as driven element?			
18	1KT1	5EC021	Expla	in in detail, the yagi-uda antenna. Write the design	5	CO10	L2
			equat	tions for dimensions of different elements of antenna			
19	1KT1	5EC022	Write	a note on paraboloid? Explain the principle of	5	CO10	L2
			parab	polic reflector with the help of a neat diagram.			
20	1KT1	5EC023	Expla	in the reflector and director actions of yagi-uda	5	CO10	L2
			anten	ina			
21	1KT1	5EC024	Menti	ion the applications of helical, log periodic, parabolic	5	CO10	L2
			and y	agi-uda antennas			
22	1KT1	5EC025	For a	20 turn helical antenna operating at 3GHz with the	5	CO10	L2
			circur	mference of 10cm and spacing between the turns			
			0.3λ i	is operating at 3GHz. Calculate the directivity and half			
			powe	r beam width.			
23	1KT15EC026 Calcu		Calcu	late the directivity of 20 turn helix with α =12° and	5	CO10	L2
			circur	mference equal to one wavelength			
24	IKT15EC028 Define and Explain loop antenna for different shapes?		5	CO9	L2		

JA INSTI	Sk		Т	Teaching Process	Rev N	lo.: 1.0	
RI KRISH		Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08-	-2019
*BANG	SALORE *	Titl	e:	Course Plan	Page:	31 / 30	6
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25	1K11	5EC029	Obtai	n the field pattern of the transmitting loop antenna?	5	CO9	L2
26	IKII	SEC030	Derive	e expressions for field components of the loop	5	CO9	L2
27	1671	5EC031	anten	na?	-	600	12
27			Ubtai	n the expressions for the radiation resistance of the	5	09	LZ
28	1KT1	5EC032	Discu	antenna ss the different cases for the loop antennas for the	5	C00	12
20			calcul	lation of the directivity of the same	J	0.09	LZ
29	1KT1	6EC401	l ist a	nd explain the applications of the loop antenna	5	C09	12
30	1KT1	6EC403	Expla	in the Babinet's principles for the electromagnetic	5	C09	12
50			fields				LL
31	1KT1	6EC406	Expla	in how horn antennas are constructed. Explain the	5	CO9	L2
22	11/1	650409	differnet types of horn antenna.				
32	11/11	6EC408	Derive	e design equations for the horn antenna	5	C09	L2
33	INII	0EC411	plane	e expressions for the field at a point on the axis of E- sectoral horn.	5	C09	L2
34	1KT1	5EC036	Expla	in how GPR systems differ than the general radar	5	CO10	L2
	sys		syster	ms. What are the different considerations for antenna			
	use		used	in GPR systems			
35	1KT15EC037 Wha		What	is log periodic antenna? Explain with neat sketch the	5	CO10	L2
			log pe	log periodic antenna?			
36	1KT1	5EC038	Expla	Explain the structure of helix in helical antenna using neat			L2
			sketc	hes of perpendicular and end fire modes.			
37	1KT1	5EC039	What	is a parasitic element? Explain with a neat sketch the	5	CO10	L2
			array	of parasitic elements?			
38	1KT1	5EC041	Derive	e an expression for the gain of two element parasitic	5	CO10	L2
			array	in free space with $\lambda/2$ dipole as driven element?			
39	1KT1	5EC043	Expla	in in detail, the yagi-uda antenna. Write the design	5	CO10	L2
	444774		equat	ions for dimensions of different elements of antenna			
40	IKTI	5EC044	Write	a note on paraboloid? Explain the principle of	5	CO10	L2
	11/1	50.45	parab	polic reflector with the help of a neat diagram.	_		
41	IKII	SEC045	Expla	in the reflector and director actions of yagi-uda	5	CO10	L2
42	11/1	5EC046	anten	ina		6010	
42	INII	JEC040	Menti	on the applications of helical, log periodic, parabolic	5	COTO	L2
42	1671	5EC047	and y	agi-uud antennas		CO10	1.2
43	1111	JLC047	For a	20 turn helical antenna operating at 3GHz with the	5	COTO	LZ
				merence or room and spacing between the turns is operating at 3CHz. Calculate the directivity and half			
			0.5/1	r beam width			
44	1KT1	5EC048	Calcu	late the directivity of 20 turn helix with $\alpha = 12^{\circ}$ and	5	CO10	12
7.7		-	circur	material and an even of 20 tan hein with $\alpha = 12^{\circ}$ and meters equal to one wavelength	5		
45	1KT1	5EC049	Defin	e and Explain loop antenna for different shapes?	5	CUð	12
46	1KT1	5EC051	Obtai	n the field pattern of the transmitting loon antenna?	5	C09	12
			- Stul		-		

		SKI	Т	Teaching Process	Rev N	lo.: 1.0	
SRI KRISH		Doc C	ode:	SKIT.Ph5b1.F02	Date:	25-08-	-2019
* BANG	SALORE*	Titl	e:	Course Plan	Page:	32 / 30	5
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47	IKII	SEC052	Deriv	e expressions for field components of the loop ina?	5	C09	L2
48	1KT1	5EC053	Obtai	in the expressions for the radiation resistance of the	5	CO9	L2
			loop	antenna			
49	49 1KT15EC054		Discu	iss the different cases for the loop antennas for the	5	CO9	L2
			calcu	lation of the directivity of the same			
50	1KT1	5EC055	List a	nd explain the applications of the loop antenna.	5	CO9	L2
51	1KT1	5EC056	Expla	in the Babinet's principles for the electromagnetic	5	CO9	L2
			fields	;			
52	1KT1	5EC058	Expla	in how horn antennas are constructed. Explain the	5	CO9	L2
			differ	net types of horn antenna.			
53	1KT1	5EC059	Deriv	e design equations for the horn antenna	5	CO9	L2
54	1KT1	5EC061	Deriv	e expressions for the field at a point on the axis of E-	5	CO9	L2
			plane	e sectoral horn.			
55	1KT1	5EC062	Expla	in how GPR systems differ than the general radar	5	CO10	L2
			syste	ms. What are the different considerations for antenna			
	use		used	in GPR systems			
56	1KT1	5EC063	What	is log periodic antenna? Explain with neat sketch the	5	CO10	L2
	11771		log p	eriodic antenna?			
57	IKTI	5EC064	Expla	in the structure of helix in helical antenna using neat	5	CO10	L2
	11/11	-F-00/7	sketc	hes of perpendicular and end fire modes.			
58	IKII	5EC06/	What	is a parasitic element? Explain with a neat sketch the	5	CO10	L2
	11/1	(EC412	array	of parasitic elements?		6010	
59	INII	0EC412	Deriv	e an expression for the gain of two element parasitic	5	COTO	L2
60	11/1	650416	array	In free space with $\lambda/2$ dipole as driven element?		CO10	12
60	1111	0110410	Expla	lin in detail, the yagi-uda antenna. Write the design	5	COTO	LZ
61	1671	6FC419	equal	a note on paraboloid? Evaluin the principle of		CO10	1.2
01	11011	ole II)	write	a note on paraboloid? Explain the principle of	С	COTO	LZ
62	1КТ1	6EC420	Evola	in the reflector and director actions of vagi-uda	5	CO10	12
02			anter	ina the reflector and director actions of yagi-uda	J	2010	LZ
63	1KT1	6EC421	Ment	ion the applications of helical, log periodic, parabolic	5	CO10	12
			and y	agi-uda antennas	2		
64	1KT1	6EC422	, For a	20 turn helical antenna operating at 3GHz with the	5	CO10	L2
			circu	mference of 10cm and spacing between the turns			
			0.3λ	is operating at 3GHz. Calculate the directivity and half			
			powe	r beam width.			
65	1KT1	6EC423	Calcu	Ilate the directivity of 20 turn helix with α =12° and	5	CO10	L2
			circu	mference equal to one wavelength			
66	1KT1	6EC424	Defin	e and Explain loop antenna for different shapes?	5	CO9	L2
67	1KT1	6EC426	Obtai	in the field pattern of the transmitting loop antenna?	5	CO9	L2
68	1KT1	4EC067	Deriv	e expressions for field components of the loop	5	CO9	L2

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	antenna?		anten	ina?						

F. EXAM PREPARATION

1. University Model Question Paper

Cou	rse:	MICROWAVE A	ND ANTENN	AS			Month	/ Year	May /	2018
Crs	Code:	15EC71	Sem:	VII	Marks:	80	Time:		180	
									minut	es
-	Note	Answer all FIV	E full questio	ons. All que	stions carry	equal mark	s.	Mark	СО	Leve
								S		I
1	a							16 /	CO1	
								20		
	b									
	c								CO2	
	d									
				OR						
-	a							16 /	CO1	
								20		
	b								CO2	
	c									
	d									
2	a							16 /	C03	
								20		
	b									
	c								CO4	
	d									
				OR						
-	a							16 /	CO3	
								20		
	b								CO4	
	c									
	d									
3	a							16 /	CO5	
								20		
	b									
	c								CO6	
	d									
				OR						
-	a							16 /	CO5	
								20		

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	b						
	C					C06	
	d						
4	a				16 /	C07	
					20		
	b						1
	с					C08	1
	d						
				OR			
-	a				16 /	C07	
					20		
	b					C08	
	с						
	d						
5	a				16 /	CO9	
					20		
	b					CO10	
	с						
	d						
				OR			
	а				16 /	C09	
					20		
	h						
						C010	
	d						

2. SEE Important Questions

Course:		MICROWAVE AND ANTENNAS Month				/ Year	May /	2018			
Crs Code:		15EC71	C71 Sem: 7 Marks: 80 Ti		Time:	Time:		180			
										minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.					-	-			
Мо	Qno.	Important Question				Mark	СО	Year			
dul								S			
e											
1	1	Explain the mechanism of klystron oscillator in different modes with				10	CO1	2004			
		the help of its maximum power parameters									
	2	Derive an eq	uation for	Staring from	the fund	amentals, o	derive the	10	CO2	2013	
		expression for the voltage and on the transmission line. b. An open									
		wire line has l	R = 10 SI's/	km, L = 0.00	037 henry,	/km, C curr	ent at any	r			



SKIT	Teaching Process	Rev No.: 1.0
Doc Code:	SKIT.Ph5b1.F02	Date: 25-08-2019
Title:	Course Plan	Page: 35 / 36

		point			
	3	With a neat diagram, explain the working of a two-hole directional coupler. Also derive the Scattering matrix of the same	10	CO2	2013
	4	A load impedance of 26-j1652's is required to be connected to a line of characteristic impedance 100 O's by using a short circuited stub of length, I located at a distance, d from the load. The wavelength of operation is 1 m. Using Smith chart find d and I. Write the procedural steps.	10	CO2	2013
	5	Derive an expression for the line impedance Z, at point P, at a distance 'd' from the receiving end interms of ZL and Zo	10	CO2	2012
2	1	State and prove the following properties of scattering parameters : i) Symmetry property ii) Unitary property iii) Zero property iv) Phase shifting property.	10	CO3	2012
	2	What are the different properties of Scattering parameters? Explain briefly.	8	CO3	2010
	3	With necessary conditions write the Scattering matrix representation of multiport network	8	CO3	2010
	4	Explain magic tee and its applications.	10	CO4	2012
	5	With a neat diagram, explain the working of a E-plane Tee junction. Also derive its Scattering matrix.	10	CO4	2012
3	1	Explain the construction and field pattern for micro strip line.	8	C05	2012
	2	A strip (shielded strip line) has the following parameters : Dielectric constant of insulator tr = 2.56 ; Strip width w = 63.5mm Strip thickness t = 35mm ; Shield depth d = 180mm. Compute i) Characteristic impedance ii) K factor iii) Fringe capacitance.	8	CO5	2012
	3	Explain the construction and field pattern for microstrip line.	8	CO5	2013
	4	Explain the following terms with proper expressions: i) Directivity ii) Field pattern iii) Half power beam width.	9	CO6	2010
	5	Explain the different radiation patterns for an antenna	9	CO6	2014
				a a =	
4	1	Determine the directivity of the system if the radiation intensity i) $U = U_m \cos^3 \theta$ ii) $U = U_m \sin \theta \sin^2 \Phi$.	10	C07	2009
	2	Derive an expression for array factor of an array of N—isotropic sources.	10	C07	2009
	3	Show that the radiation resistance of $\lambda/2$ is 73 ohms	10	C07	2011
	4	Derive an expression for maximum effective Aperture, A_{em} . Also show that A_{en} , of $\lambda/2$ dipole is 0.1372.	10	CO8	2009

	SKIT	Teaching Process	Rev No	.: 1.0		
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5	Derive the expressions for the field components of a short dipole				2009	
	starting with expressions of electric potential and vector magnetic					
	potential. Also determine the far field components.					
1	Derive Far fiel	d expressions for small loop antenna.	10	CO9	2011	
2	Explain Babir	net's principle with illustrations. Discuss features o	f 10	CO9	2011	
	complementa	ry antenna.				
3	Write short no	otes on: i) Horn antenna ii) Loop antenna.	10	CO9	2010	
4	Describe a He	elical Antenna. Explain its two modes of operation with	า 12	CO10	2012	
	relevant expre	essions.				
5	Write short no	ote on I) Log periodic antenna ii) yagi uda antenna	12	CO10	2009	
	Interest of the second	SKIT Doc Code: Title: Title: Doc Code: Title: Obc Code: Title: Title: Derive the ex starting with potential. Also Explain Babir complementa Write short no 4 Describe a He relevant express 5 Write short no	SKIT Teaching Process Doc Code: SKIT.Ph5b1.F02 Title: Course Plan Int ©2017. cAAS. All rights reserved. 5 Derive the expressions for the field components of a short dipole starting with expressions of electric potential and vector magnetic potential. Also determine the far field components. 1 Derive Far field expressions for small loop antenna. 2 Explain Babinet's principle with illustrations. Discuss features o complementary antenna. 3 Write short notes on: i) Horn antenna ii) Loop antenna. 4 Describe a Helical Antenna. Explain its two modes of operation with relevant expressions. 5 Write short note on I) Log periodic antenna ii) yagi uda antenna	SKITTeaching ProcessRev NoDoc Code:SKIT.Ph5b1.F02Date: 2Title:Course PlanPage: 3ht 62017. cAAS. All rights reserved.Page: 35Derive the expressions for the field components of a short dipole starting with expressions of electric potential and vector magnetic potential. Also determine the far field components.141Derive Far field expressions for small loop antenna.102Explain Babinet's principle with illustrations. Discuss features of complementary antenna.103Write short notes on: i) Horn antenna ii) Loop antenna.104Describe a Helical Antenna. Explain its two modes of operation with relevant expressions.125Write short note on I) Log periodic antenna ii) yagi uda antenna12	SKITTeaching ProcessRev No.: 1.0Doc Code:SKIT.Ph5b1.F02Date: 25-08-Title:Course PlanPage: 36 / 36ht 62017. cAAS. All rights reserved.Derive the expressions for the field components of a short dipole starting with expressions of electric potential and vector magnetic potential. Also determine the far field components.14CO81Derive Far field expressions for small loop antenna.10CO92Explain Babinet's principle with illustrations. Discuss features of complementary antenna.10CO93Write short notes on: i) Horn antenna ii) Loop antenna.10CO94Describe a Helical Antenna. Explain its two modes of operation with relevant expressions.12CO105Write short note on I) Log periodic antenna ii) yagi uda antenna12CO10	