# MOHAMMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

			LESSON	PLAN						
		Department of E	lectronics and C	Communi	cation E	ngineering				
N	ame of the Subject	ANTENNAS AND MICROWAVE ENGINEERING	3	Regulatio	on	2017				
Su	bject Code	EC8701		Ye	ar / Sem	IV / VII				
	Acad Year	2020-2021			Batch	2017-2021				
			Course Ob	jective						
• To e	nable the s	tudent to understand the basic principles in a	antenna and micro	owave sys	tem desi	gn				
• To 6	enhance the	e student knowledge in the area of various ar	ntenna designs.							
•To e	nhance the	student knowledge in the area of microwave	e components and	l antenna	for pract	ical applicati	ons.			
			Course Ou	itcome						
CO1: and its	Describe t s radiation	he Knowledge of the concepts of Antenna fu.	undamentals							
CO2: anteni	Illustrate v nas, Reflec	various antenna designs such as Wire and loc tor antennas, Microstrip antennas and Frequ	op antennas, Aper ency independent	rture t antennas						
CO3:	Categoriz	e the radiation characteristics of antenna arra	iys.							
and th	e operation	nal concepts of microwave vacuum tubes-bas	sed oscillators and	d amplifie	ers.					
CO5: given	Design a n applicatior	nicrowave system comprising of filter, LNA, a specifications and impedance matching of A	power amplifier, Antenna and in N	, oscillator ficrowave	r and mix	xer for the s.				
			Lesson I	Plan						
SI.			T / R*	Periods	Mode	of Teaching	Blooms Level			
No.		Topic(s)	Book	Require d	(BB / P / MO	PT / NPTEL OC / etc )	(L1-L6)	СО		
UNI	T I: INT	RODUCTION TO MICROWAVE	SYSTEMS A	ND AN	TENN	AS				
1	Microwav radiation,	e frequency bands, Physical concept of Near- and far-field regions	T1,R1	1	РРТ	/NPTEL	L1	CO1		
2	Fields and Pattern Ch	Power Radiated by an Antenna, Antenna aracteristics.	T1,R1	1	BB/PF	PT/NPTEL	L4	CO1		
3	Antenna C	Gain and Efficiency	T1,R1	1	BB/PF	PT/NPTEL	L1	CO1		
4	Aperture I	Efficiency and Effective Area	T1,R1	1	BB/PF	PT/NPTEL	L1	CO1		
5	Antenna N	loise Temperature and G/T	T1,R1	1	BB/PF	T/NPTEL	L1	CO1		
6	Impedance	e matching	T1, T2	1	BB/PF	PT/NPTEL	L1	CO5		
7	Friis trans	mission equation	T1,R1	1	BB/PI	PT/NPTEL	L1	CO1		

8	Link budget and link margin	T1,R1	1	BB/PPT/NPTEL	L1	CO1
9	Noise Characterization of a microwave receiver	T1,R1	1	BB/PPT/NPTEL	L1	CO1

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any.

Evaluation method: Comparative analysis of Horn Antenna in lab - Tutorial

### UNIT II: RADIATION MECHANISMS AND DESIGN ASPECTS

10	Radiation Mechanisms of Linear Wire Antenna	T1,R1	1	<b>BB/PPT/NPTEL</b>	L3	CO2
11	Loop antennas-Design considerations and applications	T1,R1	1	BB/PPT/NPTEL	L3	CO2
13	Aperture antennas-Design considerations and applicati	T1,R1	2	BB/PPT/NPTEL	L3	CO2
15	Reflector antennas-Design considerations and applications Radiation pattern of parabolic reflector	T1,R1	2	BB/PPT/NPTEL	L4	CO2
16	Microstrip antennas-Design considerations and applications.	T1,R1	1	<b>BB/PPT/NPTEL</b>	L4	CO2
18	Frequency independent antennas-Design considerations and applications.	T1,R1	2	<b>BB/PPT/NPTEL</b>	L3	CO2

### Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Evaluation method: Determination of radiation pattern for a parabolic reflector in Lab

### UNIT III: ANTENNA ARRAYS AND APPLICATIONS

21	Two-element array Antenna-Array factor, Pattern multiplication- Types	T1,R1	3	BB	L3	CO3
23	Uniformly spaced arrays with uniform excitation amplitudes	T1,R1	2	BB	L3	CO3
25	Uniformly spaced arrays with non-uniform excitation amplitudes	T1,R1	2	BB	L3	CO3
26	Smart antennas	T1,R1	1	BB	L3	CO3
27	PROBLEMS - Array antennas	Notes	1	BB	L3	CO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

**Evaluation method: Assignment** 

UNI	T IV: PASSIVE AND ACTIVE MICROWA	AVE DEVICE	ËS			
28	Microwave Passive components: Directional Coupler	T2,R2	1	BB/PPT/NPTEL	L2	CO4
29	Power Divider, Magic Tee	T2,R2	1	BB/PPT/NPTEL	L2	CO4
30	Attenuator, Resonator	T2,R2	1	BB/PPT/NPTEL	L2	CO4
31	Principles of Microwave Semiconductor Devices: Gunn Diodes- Characteristics of Gunn diode	T2,R2	1	BB/PPT/NPTEL	L4	CO4
32	IMPATT diodes	T2,R2	1	<b>BB/PPT/NPTEL</b>	L2	CO4
33	Schottky Barrier diodes, PIN diodes	T2,R2	1	BB/PPT/NPTEL	L2	CO4
34	Microwave tubes: Klystron- Mode characteristics of Reflex klystron	T2,R2	1	BB/PPT/NPTEL	L4	CO4
35	TWT	T2,R2	1	BB/PPT/NPTEL	L2	CO4
36	Magnetron-	T2,R2	1	BB/PPT/NPTEL	L4	CO4

### Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

Evaluation method: Case study on Microwave Oven- Case study

## **UNIT V: MICROWAVE DESIGN PRINCIPLES**

37	Impedance transformation	T1,R2	1	BB	L2	CO5
38	Impedance Matching	T1, T2	1	BB	L1	CO5
39	Microwave Filter Design	T1,R2	2	BB	L3	CO5
41	RF and Microwave Amplifier Design	T1,R2	1	BB	L3	CO5
42	Microwave Power amplifier Design	T1,R2	1	BB	L3	CO5
43	Low Noise Amplifier Design	T1,R2	1	BB	L3	CO5
44	Microwave Mixer Design	T1,R2	1	BB	L3	CO5
45	Microwave Oscillator Design	T1,R2	1	BB	L3	CO5

### Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any

**Evaluation method: Assignment** 

**Content Beyond the Syllabus Planned** 

1	Working p	Working principle of Helical, Yagi uda Antenna and its characteristics											
2	Fundamer	amental structure and field distribution of E- Plane, H - Plane TEEs											
3	Port struct	rt structure and field distribution of Circulator , Isolator											
						,	Text Bo	oks					
1	John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, II, III)												
2	David M.	Pozar, "Mi	crowave E	ngineering	", Fourth Ed	ition, Wi	iley India	a, 2012.(U	JNIT I,IV	/,V)			
						Re	ference	Books					
1	Constanti	ne A.Balani	is, —Anter	ina Theory	Analysis an	d Desigr	I, Third	edition, J	ohn Wile	y India Pvt I	Ltd., 200	5.	
2	R.E.Collir	n, "Foundat	ions for M	icrowave E	ngineering"	, Second	edition,	IEEE Pre	ss, 2001				
					V	Vebsite	/ URL	Referen	ices				
1	https://n	ptel.ac.in/	<u>courses/1</u>	.08/101/1	08101092	<u>/</u>							
2	https://n	ptel.ac.in/	courses/1	.08/103/1	.08103141,								
						В	looms I	Jevel					
Level	1 (L1) :	Remembe	ering		Lower	Fixed	Level 4	4 (L4) : A	Analysir	ıg			Higher
Level	2 (L2) :	Understa	nding		Order	Hour	Level 5	5 (L5) : I	Evaluati	ng			Order Thinkin
Leve	3 (1.3) •	Annlying			Thinking	Exams	Level (	<u> </u>	reating				g
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	nit No	Introductio	Unit on to Miero	Name	ems and	1/1	L'4		1.4	13		LOI	1101
ι	J <b>nit 1</b>	antennas		muve byst	child und	8	0	0	1	0	0	8	1
ι	J <b>nit 2</b>	Radiation	Mechanisn	ns and Des	ign Aspects	0	0	6	3	0	0	6	3
ι	J <b>nit 3</b>	Antenna A	Arrays and	Application	ıs	0	0	9	0	0	0	9	0
τ	J <b>nit 4</b>	Passive an	d Active N	licrowave	Devices	0	6	0	3	0	0	6	3
ι	J <b>nit 5</b>	Microwav	e Design P	rinciples		1	1	7	0	0	0	9	0
			Гotal			9	7	22	7	0	0	38	7
		Total F	Percenta	ige		20	15.556	48.889	15.556	0	0	84.44	15.556
						CC	) PO Ma	pping				•	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	1	1	0	0	0	0	0	0	0	1	1
CO2	3	3	2	1	0	0	0	0	0	0	0	1	2
CO3	3	3	1	1	0	0	0	0	0	0	0	1	2
<b>CO4</b>	3	3	1	1	0	0	0	0	0	0	0	1	2
CO5	3	3	1	1	0	0	0	0	0	0	0	1	2
Avg	2	2	1	1	0	0	0	0	1	1	1	1	2
					Jus	stificatio	n for CO	<b>D-PO ma</b>	pping				

CO1	PO1:Applying of engineering concept is more predominent, PO2, PO3,PO4: Applying the formulas and analyze the problems of moderately, PO12: Concepts helps in life long learning							
CO2	PO1:Applying of engineering concept is more predominent, PO2: Applying the formulas and analyze the problems considered r PO3,PO4- A small impact is given to the complex problems. PO12: Concepts helps in life long learning							
CO3	PO1: Engi the solving	neering concept contribution is r g complex problemsmoderately ,	nore, PO2: Applying PO12: Concepts hel	g the basic fromulas and and ps in life long learning	alyze the problem sign	nificantly, PO3,F		
CO4	PO1:Unde moderatel	erstanding and applying the engir y, PO3,PO4- Handlng of comple	neering concept is me ex problems is very l	ore, PO2: High degree of so ess, PO12: Concepts helps	olving problems by an in life long learning	alysing the data		
CO5	PO1:Unde moderatel	erstanding and applying the engir y, PO3,PO4- Handlng of comple	neering concept is me ex problems is very l	ore, PO2: High degree of so ess, PO12: Concepts helps	olving problems by an in life long learning	alysing the data		
	3	High level	2	Moderate level	1	Low		
Name	Name & Sign of Faculty Incharge : Dr. E. Dhiravidachelvi							
Name	e & Sign c	of Subject Expert :						
Head	of the De	partment :Mr. M. Ka	amarajan					

Format No :231

РО
PO1,PO12
PO1-PO4, PO12
PO1-PO2,PO12
PO1-PO2,PO12
PO1-PO3,PO12
PO1-PO2,PO12
PO1-PO2,PO12

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PO1-PO3,PO12
PO1-PO2,PO12
PO1-PO3
PO1-PO3
PO1-PO3
r01- r04
PO1-PO3,P12
PO1-PO3
PO1-PO3
PO1-PO3
PO1-PO3
PO1-PO4,P12
PO1,PO2, PO4

PO1-PO3
PO1-PO3
PO1,PO2, PO3 P12
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PO4,PO12 PO1 PO2
PO3,P12
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PO3,P12
PO1,PO2,
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$\begin{array}{c} PO1, PO2, \\ PO2, P12 \end{array}$
PO1 PO2
PO1,PO2, PO3.P12

, 2006. (UNIT I,
Projects / Mini
Projects
Total
9
9
9
9
9
45
100
PSO2
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noderately,	
PO4- Impact of	
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level	