

RISE KRISHNA SAI GANDHI GROUP OF INSTITUTIONS:: ONGOLE

Department of Electronics and Communication Engineering



Certificate Program

On

“Antenna Design using HFSS”

Date: 02nd to 06th Feb - 2021

Dr.P.Surendra Kumar,

Associate Professor, Bapatla Engineering College,
Bapatla

PRINCIPAL
RISE KRISHNA SAI GANDHI
GROUP OF INSTITUTIONS
VALLURU:: ONGOLE.



RISE KRISHNA SAI GANDHI GROUP OF INSTITUTIONS

(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)
NH-16, Valluru, Ongole, Prakasam (District)-523272

Valluru,

Date: 05-01-2021

To

Dr.P.Surendra Kumar,
Associate Professor, Bapatla Engineering College,
Bapatla.

Dear Sir,

Subject: Inviting for Certificate program “**Antenna Design using HFSS**”- Reg.


Greetings from RISE Krishna Sai Gandhi Group of Institutions, Ongole

As per the discussion with Dr.K.V.Subrahmanyam , Principal, of our Institute, I hereby take this opportunity to invite you to conduct the Certificate program on **Antenna Design using HFSS** “ From 02-02-2021 to 06-02-2021.

You are requested to interact and provide guidance to our IV B.Tech students, who are looking forward to their bright career ahead. I will feel honored by your gracious presence at our organization. I believe that your lecture will help our students and faculty members to explore knowledge.

Thanking you in anticipation.

Yours sincerely,


Principal
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Dr. P. Surendrakumar

Associate Professor

ECE

Bapatla Engineering College, Bapatla.

Email: mailme_surendranitk@yahoo.co.in



Biography

Dr. P. Surendra Kumar, received his B.Tech degree from V.R. Siddhardha Engineering College, Vijayawada and M.Tech in Digital Electronics and Advanced communications (DEAC) from National Institute of Technology (NIT) Surathkal Karnataka in the Department of Electronics and Communication Engineering, received Ph.D. in Microstrip antenna design from Nagarjuna University, Guntur, (AP) He has 15 years of teaching experience as an Associate professor in Bapatla Engineering College, Bapatla. His areas of interests are Microstrip Antenna design, MIMO antenna and antenna design for 5G and 6G wireless applications. He has published 30+ research papers in top journals and conferences.

Awards & Honors

1. Received **1st Best Research paper award** from **IEEE Hyderabad** section (InCAP2018).
2. Received **3rd Best Research paper award** from IISc Bangalore, INDICON2016.
3. Received **Best Young Researcher Award** from Global Education (GECL2k19).
4. Nominated for **Young Scientist Award-2018** from innovative research developers.
5. Reviewer for SCI Journal (International Journal of RF and Microwave Computer-Aided Engineering, John Wiley & Sons Periodicals, Impact factor:1.306).
6. Published research papers in **IISc Bangalore, IIT Roorkee** and **IIT Bhubaneswar**.
7. Published IEEE SCI journal research papers in IEEE Antennas and Propagation.
8. Reviewer for IEEE International Conference.
9. Received UGC Minor research project of worth 2.3 Lakhs.
10. Reviewer for IEEE Access.

Selected Publications: latest 5 publications

1. **P. Surendrakumar**, "Miniaturization of patch antenna using partially loaded non-uniform meta-surfaces with metamaterial," **IEEE Antennas and Propagation Magazine**, Vol.61, Issue. 01, Feb 2019.
2. **P. Surendrakumar**, "Design of Triple Frequency Vertex Feed Pentagonal slot antenna with E-slot for WiMAX and WLAN Applications," **IEEE Antennas and Propagation Magazine**, Vol.60, Issue. 03, June2018.
3. **P. Surendrakumar**, Triple-UWB Millimeter-wave MIMO Antenna with Improved Isolation for 5G Wireless Applications, **IEEE Indian conference on Antennas and Propagation 2019**, Dec21.
4. **P. Surendrakumar**, A Compact Hexa-Band and UWB Antenna Using Heptagon and Nonagon Rings with Vertex Feed, **IEEE Indian Conference on Antennas and Propagation, Dec 2018**.
5. **P. Surendrakumar**, "Design of a Miniaturized triple-band antenna with conductor backed metasurfaces CPW-fed for 5G Wireless applications," **IEEE Indian council hosted by an IEEE section, IEEE Bangalore, Dec 2017**.



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NH-16, Valluru, Ongole, Prakasam (District)-523272

Department of Electronics and Communication Engineering

PROPOSAL FORM

SUB: Certificate program.

TO THE SECRETARY/CORRESPONDENT THROUGH PRINCIPAL FOR KIND
APPROVAL

1	NAME OF THE INSTITUTION	Rise Krishna Sai Gandhi Group of Institutions
2	NAME OF THE DEPARTMENT	Electronics & Communication Engineering
3	TITLE OF THE PROGRAMME	Certificate program
4	NAME OF THE PROGRAMME	Certificate program on “ Antenna Design using HFSS ”
5	OBJECTIVE OF THE PROGRAMME	To bring the exposure in the Antenna Design.
6	DETAILS OF RESOURCE PERSON(S)& CV ATTACHED.	Dr.P.Surendra Kumar, Associate Professor, Bapatla Engineering College, Bapatla.
7	PROPOSED DATE(S)/ACADEMIC YEAR	02-02-2021 to 06-02-2021
8	DURATION OF THE PROGRAMME	FIVE DAY
9	VENUE	MPMC Lab
10	TARGETS	IV ECE students
11	No. OF PARTICIPANTS	111 Students
12	REGISTRATION FEE	Free
13	NAME OF PROGRAMME CO ORDINATOR(S)	Mr. R.V.Kiran Kumar
14	NAME OF THE STUDENTS COORDINATOR(S)	1.Ms. Nuthalapati Thriveni (178B1A0430) 2.Mr. Shaik Baji (178B1A04B4)

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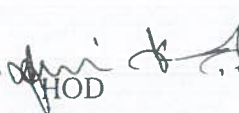
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NH-16, Valluru, Ongole, Prakasam (District)-523272

Department of Electronics and Communication Engineering

15	SOURCE OF FUND IDENTIFIED	Management
16	MANAGEMENT CONTRIBUTION REQUIRED	YES
17	PROPOSAL PREPARED BY	Mr. R.V.Kiran Kumar (CO-ORDINATOR)

Coordinator

S.V. 
HOD

HEAD OF THE DEPARTMENT
Department of E.C.E
RISE Krishna Sai Gandhi Group
of Institutions, VALLURU, A.P.-523 272


Principal

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Department of Electronics and Communication Engineering

Valluru,

Date: 29-01-2021.

CIRCULAR

This is to inform IV B.Tech students and faculty that there will be a 5-Day Certificate program on "Antenna Design using HFSS" from 02-02-2021 to 06-02-2021 by Dr.P.Surendra Kumar, Associate Professor, Bapatla Engineering College, Bapatla.

Copy to:

Principal

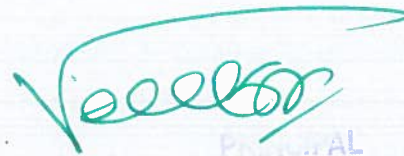
Staff Circular

Students of ECE IV year

ECE Department Notice Boards

S.V. 
HOD

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Department of E.C.E
RISE Krishna Sai Gandhi Group
of Institutions, VALLURU, A.P.-523 272



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Department of Electronics and Communication Engineering


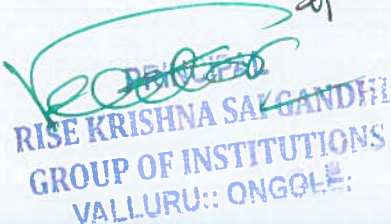
Certificate Program on "Antenna Design using HFSS"

Date: 02nd to 06th Feb 2021

SCHEDULE FROM 02-02-2021 TO 06-02-2021

S. No	Program List	Timing	
		From	To
DAY - 01 (02-02-2021)			
1	Program started	09.00 AM	--
2	Lamp lighting	09.00 AM	09.10 AM
3	Principal speech	09.10 AM	09.25 AM
4	HOD Introduction about Antenna Design	09.25 AM	09.35 AM
5	Tea Break	09.35 AM	10.00 AM
6	Introduction to Antennas	10.00 AM	01.00 PM
7	Lunch Break	01.00 PM	01.45 PM
8	Antenna Architecture	01.45 PM	05.00 PM
DAY - 02 (03-02-2021)			
9	Introduction to HFSS	09.00 AM	12.15 PM
10	Lunch Break	12.15 PM	01.00 PM
11	Antenna Parameters	01.00 PM	05.00 PM
DAY - 03 (04-02-2021)			
12	Importance of HFSS with other tools	09.00 AM	12.15 PM
13	Lunch Break	12.15 PM	01.00 PM
14	Antenna Designing Mathematical Calculations	01.00 PM	05.00 PM
DAY - 04 (05-02-2021)			
15	Antenna Designing Procedures	09.00 AM	12.15 PM
16	Lunch Break	12.15 PM	01.00 PM
17	Di-Pole Antenna Design in HFSS	01.00 PM	05.00 PM
DAY - 05 (06-02-2021)			
18	Result Analysis	09.00 AM	12.15 PM
19	Lunch Break	12.15 PM	01.00 PM
20	Some Sample Antenna Designs	01.00 PM	04.15 PM
21	Certificate Program Exam	04.15 PM	04.45 PM
22	Vote of Thanks	04.45 PM	05.00 PM

Coordinator



RISE KRISHNA SAI GANDHI GROUP OF INSTITUTIONS:: ONGOLE
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Student Feedback Form

Name of the Student: *K. Manisha*

Roll No : *178B1A0422*

Topic : Certificate Program on "Antenna Design using HFSS"

Date: 06-02-2021

S.No	Feedback Points	5	4	3	2	1
1	Is the certification program useful or not ?	✓				
2	Is the certification program well planned or not?	✓				
3	Lecture makes objectives clear?		✓			
4	Lecture speaks clearly and audibly?		✓			
5	Lecture explains with examples clearly?	✓				
6	Is your doubts clarified or not?	✓				

5-Excellent

4-Good

3-Average

2-Poor

1- No comment

K. Manisha
Student Signature

[Signature]
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Student Feedback Form

Name of the Student: *K. Bhavysri*

Roll No : *178BIAB0419*

Topic : Certificate Program on "Antenna Design using HFSS"

Date: 06-02-2021

S.No	Feedback Points	5	4	3	2	1
1	Is the certification program useful or not ?	✓				
2	Is the certification program well planned or not?	✓				
3	Lecture makes objectives clear?	✓				
4	Lecture speaks clearly and audibly?		✓			
5	Lecture explains with exaples clearly?		✓			
6	Is you are doubts clarified or not?	✓				

5-Excellent 4-Good 3-Average 2-Poor 1- No comment

K. Bhavysri
Student Signature

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Student Feedback Form

Name of the Student: M. Yamini

Roll No : L78B1A0426

Topic : Certificate Program on "Antenna Design using HFSS"

Date: 06-02-2021

S.No	Feedback Points	5	4	3	2	1
1	Is the certification program useful or not ?	✓				
2	Is the certification program well planned or not?	✓				
3	Lecture makes objectives clear?		✓			
4	Lecture speaks clearly and audibly?	✓				
5	Lecture explains with examples clearly?	✓				
6	Is your doubts clarified or not?	✓				

5-Excellent

4-Good

3-Average

2-Poor

1- No comment

Yamini
Student Signature

V. S. Rao

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Student Feedback Form

Name of the Student: P. Nagalakshmi

Roll No : 178B1A0434

Topic : Certificate Program on "Antenna Design using HFSS"

Date: 06-02-2021

S.No	Feedback Points	5	4	3	2	1
1	Is the certification program useful or not ?	✓				
2	Is the certification program well planned or not?	✓				
3	Lecture makes objectives clear?		✓			
4	Lecture speaks clearly and audibly?		✓			
5	Lecture explains with examples clearly?	✓				
6	Is your doubts clarified or not?	✓				

5-Excellent 4-Good 3-Average 2-Poor 1- No comment

P. Naga
Student Signature

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
CERTIFICATE PROGRAM FEEDBACK ANALYSIS

A.Y: 2020-2021

Year : IV B.Tech ECE

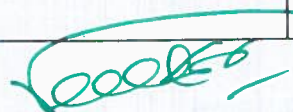
Date: 06-02-2021

Name of the Certificate Program: Antenna Design using HFSS

S.No	Roll Number	Name	1	2	3	4	5	6
1	178B1A0401	ANNAPAREDDY BHARATHI	5	4	4	4	4	5
2	178B1A0402	ATCHALA CHANDRAKALA	5	5	5	5	5	5
3	178B1A0403	BADUGU AKSHA TEJA	4	5	4	5	4	5
4	178B1A0404	BALAGANI SURYA KANTHAM	5	4	4	4	5	5
5	178B1A0405	BHUMA VENKATA SUNEETHA	5	5	5	5	5	5
6	178B1A0406	BURRA SAI LAKSHMI	5	5	5	5	5	5
7	178B1A0407	CHEREDDY KALPANA	5	5	5	5	5	5
8	178B1A0408	CHINTHAPATLA PAVITHRA	5	5	5	5	5	4
9	178B1A0409	CHIRITOTI LAVANYA	5	5	5	5	5	4
10	178B1A0410	DAMA VENKATA KEERTHANA	5	4	5	4	5	5
11	178B1A0411	G MANISHA	5	5	5	4	5	4
12	178B1A0412	GUNAPANENI VANDANA	5	5	5	5	5	5
13	178B1A0413	GUNDLAPALLI Sampurna	5	4	5	5	5	5
14	178B1A0414	JONNALA GADDA ALEKYA	5	5	5	5	5	5
15	178B1A0415	JONNALAGADDA SRUTHI SRAVYA	5	5	4	5	5	5
16	178B1A0416	KADIRI DEEPTHI	5	5	4	5	4	4
17	178B1A0417	KAKARLA YAMINI	5	5	5	4	5	4

Principal
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S.No	Roll Number	Name	1	2	3	4	5	6
18	178B1A0418	KANDEPI VENKATA SAI SRAVANI	5	4	4	5	4	4
19	178B1A0419	KOLAPARTI BHAVYASRI	5	5	5	4	4	5
20	178B1A0420	KOLLI MARLA SWETHA	5	5	5	4	5	5
21	178B1A0421	KOMATINENI MOUNIKA	5	4	5	5	4	5
22	178B1A0422	KONIDENA MANISHA	4	5	5	4	5	5
23	178B1A0423	LAKKU MEENAKSHI	5	5	4	4	5	5
24	178B1A0424	LAKSHMISSETTY VYSHNAV KEERTHI	5	5	4	5	5	5
25	178B1A0425	MANNAM SRAVANI	5	5	4	5	5	5
26	178B1A0426	MANNEM YAMINI	5	5	5	4	4	5
27	178B1A0427	NARISINGU VASANTHI	4	5	4	5	5	5
28	178B1A0428	NERELLA VENKATA SUSHMA	5	5	4	5	5	4
29	178B1A0429	NUTHALAPATI SRILATHA	5	5	5	5	5	5
30	178B1A0430	NUTHALAPATI THRIVENI	5	5	4	5	4	4
31	178B1A0431	PABBISSETTY SAI LAKSHMI VANDANA	4	5	4	5	5	5
32	178B1A0432	PABBISSETTY VENKATA RAMYASRI	5	5	5	5	4	5
33	178B1A0433	PERLA VENKATA SAI DEEPTHI	4	5	4	5	5	5
34	178B1A0434	PURIMITLA NAGA LAKSHMI	5	5	4	4	5	5
35	178B1A0435	RENUMALA MOUNIKA	5	5	4	4	5	4
36	178B1A0436	SHAIK SAMINA	5	5	4	5	4	4
37	178B1A0437	SHAIK YASMIN	4	4	4	5	5	5


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S.No	Roll Number	Name	1	2	3	4	5	6
38	178B1A0438	SURA NARAYANAMMA	5	4	4	4	5	5
39	178B1A0439	THANIKANTI HARIKA	4	5	4	5	5	5
40	178B1A0440	UDARAGUDI SAILAJA	5	4	5	5	5	5
41	178B1A0441	YARICHARLA MOUNIKA	5	5	4	5	4	5
42	178B1A0442	ALLA ASHOKREDDY	5	4	4	4	5	5
43	178B1A0443	ALLIKEPALI SRIKANTH	4	5	4	5	5	5
44	178B1A0444	CHAKKA NITHISH	5	5	5	4	4	5
45	178B1A0445	DANNARAPU PAVAN KALYAN	4	5	4	5	5	5
46	178B1A0446	DODDI STEPHEN RAJ	4	4	4	5	5	4
47	178B1A0447	ELURI VENKATA SANJAY	5	4	4	5	5	4
48	178B1A0448	KOPPOLU RAMA KRISHNA	4	5	5	4	4	5
49	178B1A0449	KOTA BRAHMAREDDY	4	5	5	5	5	4
50	178B1A0450	MUVALA SAI VENKATA NAGA VINAY	4	4	5	4	4	5
51	178B1A0451	PABBISSETTY MANOJ	5	4	5	5	5	4
52	178B1A0452	POLIMIREDDY MALAKONDA REDDY	5	4	5	5	5	4
53	178B1A0453	PONIGETI HANUMANTHA REDDY	4	4	4	5	4	5
54	178B1A0454	SANKARAMANCHI NAGAMANOHAR SHARMA	5	5	5	4	5	5
55	178B1A0455	SHAIK YASDHANI	4	5	5	5	5	5
56	178B1A0456	SIGHAKOLLI BALA SUBRAMANYAM	5	5	5	4	5	5
57	178B1A0457	SUNDARASETTY NIKHIL	4	5	5	4	5	5

(Handwritten Signature)

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S.No	Roll Number	Name	1	2	3	4	5	6
58	178B1A0458	THOGURU PRAVEEN KUMAR	5	4	5	5	4	4
59	178B1A0459	THOKALA SAMSON	4	5	5	4	5	5
60	178B1A0461	ADAPALA ANUSHA	5	4	5	5	5	5
61	178B1A0462	ALURI RAYELAMMA	4	5	5	4	5	5
62	178B1A0463	BATCHALI VENKATA SAI SARATH PRATYUSHA	5	5	5	4	5	5
63	178B1A0464	BIJJAM SRI LEENA	5	5	4	4	5	5
64	178B1A0465	BIRUDURAJU NAVYA SUSHMA	5	5	5	5	5	5
65	178B1A0466	CHINTHALA KEERTHANA	4	5	5	4	5	5
66	178B1A0467	DEVULAPALLI MAHALAKSHMAMMA	5	5	5	4	5	5
67	178B1A0468	DODDAKA NAGA DEEPTHI	4	4	5	4	5	5
68	178B1A0470	GUJJULA MAHALAKSHMI	5	5	5	5	4	4
69	178B1A0471	GUNJI ANUSHA	5	5	5	5	5	5
70	178B1A0472	KALLAGUNTA VANI VARSHITHA	5	4	4	5	5	5
71	178B1A0473	KARETI PRAVALLIKA	4	5	5	5	4	5
72	178B1A0474	KATTA HYNDAVI	5	5	5	5	5	5
73	178B1A0475	KELAM RAMA DEVI	5	5	4	4	5	5
74	178B1A0476	MADALA VENKATA SAI LAKSHMI	5	5	5	5	5	5
75	178B1A0477	MARELLA VENKATA SIREESHA	5	4	5	5	4	4
76	178B1A0478	MOLAKALAPALLI MADHAVI LATHA	4	5	5	5	5	5
77	178B1A0479	MONDRU MARY AMULYA	5	5	5	5	4	5



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S.No	Roll Number	Name	1	2	3	4	5	6
78	178B1A0480	MOTHUKURI ANILA	5	4	4	5	5	4
79	178B1A0482	NELAMALLI SUREKHA	5	5	5	5	5	5
80	178B1A0483	NUKATHOTI DEENAMMA	5	5	5	5	4	5
81	178B1A0484	PATHAKAMURI VIJAYA NAGA DURGA	5	5	4	5	5	5
82	178B1A0485	PATHI TULASI REDDY	5	5	5	5	4	5
83	178B1A0486	PATIBANDLA SIREESHA	5	5	5	4	4	4
84	178B1A0487	PITTU PAVAN KALYANI REDDY	5	5	5	4	4	5
85	178B1A0488	POTHUGANTI CHINNA SIDDAMMA	4	5	5	5	5	5
86	178B1A0489	RAMIREDDY PRAVALLIKA	4	5	4	5	4	4
87	178B1A0490	RAVELLA APARNA	5	5	5	5	5	5
88	178B1A0491	SALAVA POOJA	5	5	4	5	5	5
89	178B1A0492	SHAIK KARISHMA	5	5	5	4	5	5
90	178B1A0493	SURA KUSUMALATHA	5	4	5	5	5	5
91	178B1A0494	SYED MEHASEENA	5	4	4	5	5	4
92	178B1A0495	THANNEERU ROSHINI RUPA	5	5	5	4	5	5
93	178B1A0496	VEERANKI TEJASWI	5	4	5	5	4	4
94	178B1A0497	AKKALA PRAVEEN KUMAR REDDY	4	5	4	5	4	5
95	178B1A0498	BATTULA PRADEEP CHANDRA	4	4	5	5	5	5
96	178B1A0499	BEERALA RAM PAVAN KALYAN	5	4	5	5	4	4
97	178B1A04A0	CHITTELA HEMANTH KUMAR	4	4	4	4	5	5

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S.No	Roll Number	Name	1	2	3	4	5	6
98	178B1A04A1	DAMA RAMA KRISHNA	5	4	5	5	4	5
99	178B1A04A3	JALADANKI JAYAPRAKASH NARAYANA	5	5	5	4	5	4
100	178B1A04A4	KALAVAKURI SIVAKRISHNA	5	4	4	5	5	5
101	178B1A04A5	KOLISETTY MALLIKARJUNA	5	5	5	5	5	5
102	178B1A04A6	KOLLURI RAJA SHEKAR	5	4	5	4	5	4
103	178B1A04A7	KONKA VENKATA JAGADEESH BABU	5	5	5	5	4	5
104	178B1A04B0	NUKALAPATI CHANDRA SEKHAR	4	4	5	5	5	5
105	178B1A04B2	PARUCHURI GOPI	5	5	4	4	4	4
106	178B1A04B4	SHAIK BAJI	5	5	5	4	5	5
107	178B1A04B5	TANNERU MAHESH	4	5	4	5	5	5
108	178B1A04B6	TELLAMEKALA RAJA HANUMA	5	4	5	5	5	5
109	178B1A04B7	THUMMALA VISHNU	5	5	5	5	5	5
110	178B1A04B8	UDDAGIRI NAVEEN	4	5	4	5	5	4
111	178B1A04B9	YESUPOGU VIJAY	4	4	5	4	5	5
			4.71	4.63	4.63	4.63	4.88	4.75
			94.29	92.50	92.50	92.50	97.50	95.00


Coordinator


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HEAD OF THE DEPARTMENT
Department of E.C.E
RISE Krishna Sai Gandhi Group
of Institutions, VALLURU, A.P.-523 272



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NH-16, Valluru, Ongole, Prakasam (District)-523272

Department of Electronics and Communication Engineering

Certificate program Feedback Analysis


Topic : Certification program on "Antenna Design using HFSS"
Resource Person : Dr.P.Surendra Kumar,
Associate Professor, Bapatla Engineering College, Bapatla.
Dates : 02-02-2021 to 06-02-2021
Venue : MPMC Lab
Targeted Students : IV Year students

S.No	No. of students Participated	No. of students given feedback	Feedback %
1	111	111	100%

Coordinator

S.V. 
Head of the Department

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Department of E.C.E.
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Department of Electronics and Communication Engineering

Certificate Program on Antenna Design using HFSS Model Question Paper

Branch/Sem: IV ECE/I SEM
Name of the Student: _____

ROLL Number: _____

1. HFSS is a software tool used for _____ simulations. []

- a) Mechanical
- b) Electromagnetic
- c) Thermal
- d) Fluid dynamics

2. The acronym HFSS stands for _____. []

- a) High-Frequency Signal Simulation
- b) High-Fidelity Structure Solver
- c) High-Frequency Structure Simulator
- d) High-Field Simulation Software

3. HFSS is commonly used for designing and simulating _____. []

- a) Antennas
- b) Bridges
- c) Buildings
- d) Automobiles

4. In HFSS, the unit of frequency is typically expressed in _____. []

- a) Hertz (Hz)
- b) Watts (W)
- c) Newtons (N)
- d) Volts (V)

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5. The most common type of antenna simulated using HFSS is the _____ antenna.

- a) Yagi-Uda
- b) Patch
- c) Dipole
- d) Log-periodic

6. HFSS uses the _____ method for solving Maxwell's equations.

- a) Finite Difference Time Domain (FDTD)
- b) Method of Moments (MoM)
- c) Finite Element Method (FEM)
- d) Finite Integration Technique (FIT)

7. What does the acronym MoM stand for in the context of electromagnetic simulations?

- a) Method of Moments
- b) Moments of Magnitude
- c) Moments of Motion
- d) Method of Magnetics

8. HFSS can analyze antennas operating in different frequency domains, including

- a) DC (Direct Current)
- b) RF (Radio Frequency)
- c) Optical
- d) All of the above

9. The term "meshing" in HFSS refers to the process of dividing the geometry into

- a) Materials
- b) Domains
- c) Mesh elements

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d) Layers

10. HFSS can simulate both _____ and _____ antennas. []

a) Active, Passive

b) Linear, Non-linear

c) Planar, Non-planar

d) Omni-directional, Directional

11. The S-parameter that represents the power reflected back from an antenna is _____

a) S11 []

b) S21

c) S12

d) S22

12. The characteristic impedance of a transmission line is represented by the _____ parameter. []

a) Z11

b) Z21

c) Z12

d) Z22

13. HFSS can simulate the radiation pattern of an antenna, which describes its _____ []

a) Frequency response

b) Gain

c) Spatial distribution of radiation

d) Polarization

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14. The "far-field" region of an antenna is also known as the _____ region. []

- a) Reactive
- b) Near-field
- c) Intermediate
- d) Radiative

15. The radiation efficiency of an antenna is a measure of _____. []

- a) How well it radiates
- b) How well it receives signals
- c) The losses in the antenna system
- d) The bandwidth of the antenna

16. HFSS can simulate the coupling between different antennas in an array using _____ analysis. []

- a) Near-field
- b) Far-field
- c) Mutual
- d) Self

17. The term "substrate" in the context of antenna design refers to _____. []

- a) The conductive material of the antenna
- b) The dielectric material on which the antenna is mounted
- c) The length of the antenna elements
- d) The frequency of operation

18. HFSS can analyze the effect of _____ on antenna performance. []

- a) Temperature
- b) Humidity
- c) Wind speed

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d) All of the above

19. The design of a microstrip patch antenna involves specifying the dimensions of the _____.

[]

a) Ground plane

b) Substrate

c) Patch

d) All of the above

20. The term "gain" in antenna design refers to _____.

[]

a) The ability of an antenna to concentrate radiation in a particular direction

b) The total power radiated by the antenna

c) The frequency response of the antenna

d) The impedance matching of the antenna

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ANSWERS

1. Answer: Electromagnetic
2. Answer: High-Frequency Structure Simulator
3. Answer: Antennas
4. Answer: Hertz (Hz)
5. Answer: Patch
6. Answer: Finite Element Method (FEM)
7. Answer: Method of Moments
8. Answer: All of the above
9. Answer: Mesh elements
10. Answer: Planar, Non-planar
11. Answer: S11
12. Answer: Z11
13. Answer: Spatial distribution of radiation
14. Answer: Radiative
15. Answer: How well it radiates
16. Answer: Mutual
17. Answer: The dielectric material on which the antenna is mounted
18. Answer: Temperature
19. Answer: All of the above
20. Answer: The ability of an antenna to concentrate radiation in a particular direction

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Department of Electronics and Communication Engineering

Certificate Program on Antenna Design using HFSS
Model Question Paper

19
20

Branch/Sem: IV ECE/I SEM

Name of the Student: renumala Mounika ROLL Number: 178B1A0435

1. HFSS is a software tool used for _____ simulations.

[b] ✓

- a) Mechanical
- b) Electromagnetic
- c) Thermal
- d) Fluid dynamics

2. The acronym HFSS stands for _____.

[c] ✓

- a) High-Frequency Signal Simulation
- b) High-Fidelity Structure Solver
- c) High-Frequency Structure Simulator
- d) High-Field Simulation Software

3. HFSS is commonly used for designing and simulating _____

[a] ✓

- a) Antennas
- b) Bridges
- c) Buildings
- d) Automobiles

4. In HFSS, the unit of frequency is typically expressed in _____

[a] ✓

- a) Hertz (Hz)
- b) Watts (W)
- c) Newtons (N)
- d) Volts (V)


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5. The most common type of antenna simulated using HFSS is the _____ antenna.

a) Yagi-Uda

[b] ✓

b) Patch

c) Dipole

d) Log-periodic

6. HFSS uses the _____ method for solving Maxwell's equations.

[c] ✓

a) Finite Difference Time Domain (FDTD)

b) Method of Moments (MoM)

c) Finite Element Method (FEM)

d) Finite Integration Technique (FIT)

7. What does the acronym MoM stand for in the context of electromagnetic simulations?

a) Method of Moments

[a] ✓

b) Moments of Magnitude

c) Moments of Motion

d) Method of Magnetics

8. HFSS can analyze antennas operating in different frequency domains, including [b]

a) DC (Direct Current)

b) RF (Radio Frequency)

c) Optical

d) All of the above

9. The term "meshing" in HFSS refers to the process of dividing the geometry into [c]

a) Materials

b) Domains

c) Mesh elements

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d) Layers

10. HFSS can simulate both _____ and _____ antennas.

[c]

a) Active, Passive

b) Linear, Non-linear

c) Planar, Non-planar

d) Omni-directional, Directional

11. The S-parameter that represents the power reflected back from an antenna is _____

a) S11

[b]

b) S21

c) S12

d) S22

12. The characteristic impedance of a transmission line is represented by the _____ parameter.

[a]

a) Z11

b) Z21

c) Z12

d) Z22

13. HFSS can simulate the radiation pattern of an antenna, which describes its _____.

[c]

a) Frequency response

b) Gain

c) Spatial distribution of radiation

d) Polarization

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14. The "far-field" region of an antenna is also known as the _____ region. [a]

- a) Reactive ✓
- b) Near-field
- c) Intermediate
- d) Radiative

15. The radiation efficiency of an antenna is a measure of _____. [a]

- a) How well it radiates ✓
- b) How well it receives signals
- c) The losses in the antenna system
- d) The bandwidth of the antenna

16. HFSS can simulate the coupling between different antennas in an array using _____ analysis. [c]

- a) Near-field ✓
- b) Far-field
- c) Mutual
- d) Self

17. The term "substrate" in the context of antenna design refers to _____. [b]

- a) The conductive material of the antenna
- b) The dielectric material on which the antenna is mounted ✓
- c) The length of the antenna elements
- d) The frequency of operation

18. HFSS can analyze the effect of _____ on antenna performance. [b]

- a) Temperature
- b) Humidity ✓
- c) Wind speed

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d) All of the above

19. The design of a microstrip patch antenna involves specifying the dimensions of the _____.

[d]

a) Ground plane

b) Substrate

c) Patch

d) All of the above

20. The term "gain" in antenna design refers to _____.

[a]

a) The ability of an antenna to concentrate radiation in a particular direction

b) The total power radiated by the antenna

c) The frequency response of the antenna

d) The impedance matching of the antenna

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Department of Electronics and Communication Engineering

Certificate Program on Antenna Design using HFSS
Model Question Paper

Branch/Sem: IV ECE/I SEM

Name of the Student: Adapala Anusha

ROLL Number: 178BIA0461

18
20

1. HFSS is a software tool used for _____ simulations.

- a) Mechanical
- b) Electromagnetic
- c) Thermal
- d) Fluid dynamics

[A]

2. The acronym HFSS stands for _____.

- a) High-Frequency Signal Simulation
- b) High-Fidelity Structure Solver
- c) High-Frequency Structure Simulator
- d) High-Field Simulation Software

[A]

3. HFSS is commonly used for designing and simulating _____

- a) Antennas
- b) Bridges
- c) Buildings
- d) Automobiles

[A]

4. In HFSS, the unit of frequency is typically expressed in _____

- a) Hertz (Hz)
- b) Watts (W)
- c) Newtons (N)
- d) Volts (V)

[A]

Veetha

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5. The most common type of antenna simulated using HFSS is the _____ antenna.

- a) Yagi-Uda
- b) Patch
- c) Dipole
- d) Log-periodic

[B]

6. HFSS uses the _____ method for solving Maxwell's equations.

- a) Finite Difference Time Domain (FDTD)
- b) Method of Moments (MoM)
- c) Finite Element Method (FEM)
- d) Finite Integration Technique (FIT)

[C]

7. What does the acronym MoM stand for in the context of electromagnetic simulations?

- a) Method of Moments
- b) Moments of Magnitude
- c) Moments of Motion
- d) Method of Magnetics

[A]

8. HFSS can analyze antennas operating in different frequency domains, including [B]

- a) DC (Direct Current)
- b) RF (Radio Frequency)
- c) Optical
- d) All of the above

9. The term "meshing" in HFSS refers to the process of dividing the geometry into [D]

- a) Materials
- b) Domains
- c) Mesh elements

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d) Layers

10. HFSS can simulate both _____ and _____ antennas.

10

a) Active, Passive

b) Linear, Non-linear

c) Planar, Non-planar

d) Omni-directional, Directional

11. The S-parameter that represents the power reflected back from an antenna is _____

a) S11

b) S21

c) S12

d) S22

11

12. The characteristic impedance of a transmission line is represented by the _____ parameter.

12

a) Z11

b) Z21

c) Z12

d) Z22

13. HFSS can simulate the radiation pattern of an antenna, which describes its _____.

13

a) Frequency response

b) Gain

c) Spatial distribution of radiation

d) Polarization

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14. The "far-field" region of an antenna is also known as the _____ region. [A]

- a) Reactive
- b) Near-field
- c) Intermediate
- d) Radiative

15. The radiation efficiency of an antenna is a measure of _____.

- a) How well it radiates
- b) How well it receives signals
- c) The losses in the antenna system
- d) The bandwidth of the antenna

16. HFSS can simulate the coupling between different antennas in an array using _____ analysis.

- a) Near-field
- b) Far-field
- c) Mutual
- d) Self

17. The term "substrate" in the context of antenna design refers to _____.

- a) The conductive material of the antenna
- b) The dielectric material on which the antenna is mounted
- c) The length of the antenna elements
- d) The frequency of operation

18. HFSS can analyze the effect of _____ on antenna performance.

- a) Temperature
- b) Humidity
- c) Wind speed

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d) All of the above

19. The design of a microstrip patch antenna involves specifying the dimensions of the _____.

a) Ground plane

b) Substrate

c) Patch

d) All of the above

20. The term "gain" in antenna design refers to _____.

a) The ability of an antenna to concentrate radiation in a particular direction

b) The total power radiated by the antenna

c) The frequency response of the antenna

d) The impedance matching of the antenna

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Certificate Program on Antenna Design using HFSS Marks

A.Y : 2020-2021

Year : IV

S. No	Reg. No	Name of the Candidate	Marks
1	178B1A0401	ANNAPAREDDY BHARATHI	18
2	178B1A0402	ATCHALA CHANDRAKALA	18
3	178B1A0403	BADUGU AKSHA TEJA	17
4	178B1A0404	BALAGANI SURYA KANTHAM	19
5	178B1A0405	BHUMA VENKATA SUNEETHA	20
6	178B1A0406	BURRA SAI LAKSHMI	20
7	178B1A0407	CHEREDDY KALPANA	16
8	178B1A0408	CHINTHAPATLA PAVITHRA	19
9	178B1A0409	CHIRITOTI LAVANYA	16
10	178B1A0410	DAMA VENKATA KEERTHANA	20
11	178B1A0411	G MANISHA	19
12	178B1A0412	GUNAPANENI VANDANA	16
13	178B1A0413	GUNDLAPALLI SAMPURNA	19
14	178B1A0414	JONNALA GADDA ALEKYA	19
15	178B1A0415	JONNALAGADDA SRUTHI SRAVYA	20
16	178B1A0416	KADIRI DEEPTHI	17
17	178B1A0417	KAKARLA YAMINI	18
18	178B1A0418	KANDEPI VENKATA SAI SRAVANI	17
19	178B1A0419	KOLAPARTI BHAVYASRI	18
20	178B1A0420	KOLLI MARLA SWETHA	19
21	178B1A0421	KOMATINENI MOUNIKA	18
22	178B1A0422	KONIDENA MANISHA	18
23	178B1A0423	LAKKU MEENAKSHI	18
24	178B1A0424	LAKSHMISETTY VYSHNAV KEERTHI	18
25	178B1A0425	MANNAM SRAVANI	18
26	178B1A0426	MANNEM YAMINI	18
27	178B1A0427	NARISINGU VASANTHI	15
28	178B1A0428	NERELLA VENKATA SUSHMA	19
29	178B1A0429	NUTHALAPATI SRILATHA	18
30	178B1A0430	NUTHALAPATI THRIVENI	19
31	178B1A0431	PABBISETTY SAI LAKSHMI VANDANA	17
32	178B1A0432	PABBISETTY VENKATA RAMYASRI	18
33	178B1A0433	PERLA VENKATA SAI DEEPTHI	18
34	178B1A0434	PURIMITLA NAGA LAKSHMI	18

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S. No	Reg. No	Name of the Candidate	Marks
35	178B1A0435	RENUMALA MOUNIKA	19
36	178B1A0436	SHAIK SAMINA	18
37	178B1A0437	SHAIK YASMIN	19
38	178B1A0438	SURA NARAYANAMMA	17
39	178B1A0439	THANIKANTI HARIKA	19
40	178B1A0440	UDARAGUDI SAILAJA	16
41	178B1A0441	YARICHARLA MOUNIKA	16
42	178B1A0442	ALLA ASHOKREDDY	16
43	178B1A0443	ALLIKEPALI SRIKANTH	17
44	178B1A0444	CHAKKA NITHISH	15
45	178B1A0445	DANNARAPU PAVAN KALYAN	18
46	178B1A0446	DODDI STEPHEN RAJ	17
47	178B1A0447	ELURI VENKATA SANJAY	19
48	178B1A0448	KOPPOLU RAMA KRISHNA	20
49	178B1A0449	KOTA BRAHMAREDDY	20
50	178B1A0450	MUVALA SAI VENKATA NAGA VINAY	17
51	178B1A0451	PABBISSETTY MANOJ	19
52	178B1A0452	POLIMIREDDY MALAKONDA REDDY	18
53	178B1A0453	PONIGETI HANUMANTHA REDDY	19
54	178B1A0454	SANKARAMANCHI NAGAMANO HAR SHARMA	19
55	178B1A0455	SHAIK YASDHANI	19
56	178B1A0456	SIGHAKOLLI BALA SUBRAMANYAM	19
57	178B1A0457	SUNDARASETTY NIKHIL	19
58	178B1A0458	THOGURU PRAVEEN KUMAR	19
59	178B1A0459	THOKALA SAMSON	18
60	178B1A0461	ADAPALA ANUSHA	18
61	178B1A0462	ALURI RAYELAMMA	17
62	178B1A0463	BATCHALI VENKATA SAI SARATH PRATYUSHA	19
63	178B1A0464	BIJJAM SRI LEENA	17
64	178B1A0465	BIRUDURAJU NAVYA SUSHMA	16
65	178B1A0466	CHINTHALA KEERTHANA	16
66	178B1A0467	DEVULAPALLI MAHALAKSHMAMMA	15
67	178B1A0468	DODDAKA NAGA DEEPTHI	18
68	178B1A0470	GUJJULA MAHALAKSHMI	17
69	178B1A0471	GUNJI ANUSHA	19
70	178B1A0472	KALLAGUNTA VANI VARSHITHA	19
71	178B1A0473	KARETI PRAVALLIKA	19

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S. No	Reg. No	Name of the Candidate	Marks
72	178B1A0474	KATTA HYNDAVI	20
73	178B1A0475	KELAM RAMA DEVI	15
74	178B1A0476	MADALA VENKATA SAI LAKSHMI	16
75	178B1A0477	MARELLA VENKATA SIREESHA	15
76	178B1A0478	MOLAKALAPALLI MADHAVI LATHA	15
77	178B1A0479	MONDRU MARY AMULYA	18
78	178B1A0480	MOTHUKURI ANILA	17
79	178B1A0482	NELAMALLI SUREKHA	18
80	178B1A0483	NUKATHOTI DEENAMMA	19
81	178B1A0484	PATHAKAMURI VIJAYA NAGA DURGA	18
82	178B1A0485	PATHI TULASI REDDY	18
83	178B1A0486	PATIBANDLA SIREESHA	17
84	178B1A0487	PITTU PAVAN KALYANI REDDY	19
85	178B1A0488	POTHUGANTI CHINNA SIDDAMMA	20
86	178B1A0489	RAMIREDDY PRAVALLIKA	20
87	178B1A0490	RAVELLA APARNA	16
88	178B1A0491	SALAVA POOJA	19
89	178B1A0492	SHAIK KARISHMA	16
90	178B1A0493	SURA KUSUMALATHA	20
91	178B1A0494	SYED MEHASEENA	16
92	178B1A0495	THANNEERU ROSHINI RUPA	19
93	178B1A0496	VEERANKI TEJASWI	18
94	178B1A0497	AKKALA PRAVEEN KUMAR REDDY	19
95	178B1A0498	BATTULA PRADEEP CHANDRA	18
96	178B1A0499	BEERALA RAM PAVAN KALYAN	17
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98	178B1A04A1	DAMA RAMA KRISHNA	17
99	178B1A04A3	JALADANKI JAYAPRAKASH NARAYANA	19
100	178B1A04A4	KALAVAKURI SIVAKRISHNA	16
101	178B1A04A5	KOLISETTY MALLIKARJUNA	19
102	178B1A04A6	KOLLURI RAJA SHEKAR	19
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107	178B1A04B5	TANNERU MAHESH	20

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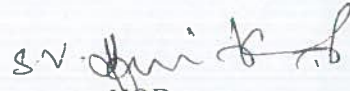
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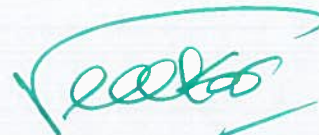
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Department of Electronics and Communication Engineering

S. No	Reg. No	Name of the Candidate	Marks
108	178B1A04B6	TELLAMEKALA RAJA HANUMA	18
109	178B1A04B7	THUMMALA VISHNU	19
110	178B1A04B8	UDDAGIRI NAVEEN	19
111	178B1A04B9	YESUPOGU VIJAY	20

Coordinator


HOD
HEAD OF THE DEPARTMENT
Department of E. C. E
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Certification Program Report on

“Antenna Design using HFSS”

Date: 02nd to 06th February 2021

Introduction:

The Antenna Design using HFSS Certification Program, held from February 2nd to February 6th, 2021, was organized under the visionary leadership of the Head of the Department, Mr. S.V. Ravi Kumar. The program aimed to provide participants with an in-depth understanding of antenna design principles and hands-on experience with the High-Frequency Structure Simulator (HFSS) software. Dr. K.V. Subrahmanyam, our esteemed Principal, and Dr. P. Surendra Kumar, a distinguished resource person, played pivotal roles in ensuring the success of this educational endeavor.

Syllabus covered:

- 1. Introduction to Antennas:** The program commenced under the guidance of Dr. P. Surendra Kumar, whose leadership set the tone for an exploration of fundamental antenna concepts. Participants delved into the historical development of antennas, their role in communication systems, and various antenna types. Antennas are fundamental components in the field of electromagnetic communication, serving as the bridge between electronic devices and the surrounding electromagnetic environment. These devices play a pivotal role in transmitting and receiving electromagnetic waves, enabling wireless communication across a myriad of applications such as radio and television broadcasting, mobile communication, radar systems, satellite communication, and more.

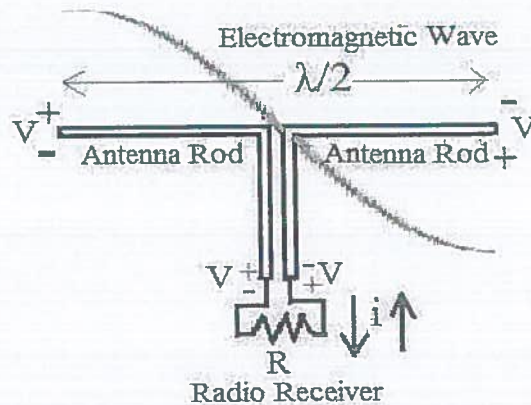
Historical Evolution: The history of antennas traces back to the late 19th century, coinciding with the groundbreaking work of pioneers such as Heinrich Hertz and Guglielmo Marconi. Hertz's experiments with radio waves and Marconi's subsequent development of practical wireless communication marked the advent of antenna technology. Since then, antennas have evolved significantly, driven by technological advancements and the ever-expanding demands of modern communication systems.

Basic Concepts: At its core, an antenna is a transducer that converts electrical signals into electromagnetic waves for transmission or vice versa for reception. This process involves the manipulation of electric and

magnetic fields to generate a propagating electromagnetic wave. Key parameters such as frequency, gain, polarization, and radiation pattern define the performance characteristics of an antenna.

- a. **Types of Antennas:** Antennas come in various forms, each tailored to specific applications and operating principles. Common types include dipole antennas, monopole antennas, patch antennas, yagi-uda antennas, and parabolic antennas. The selection of an antenna type depends on factors such as frequency range, directional requirements, and the overall communication system's design goals.
 - b. **Role in Communication Systems:** In communication systems, antennas serve as the interface between electronic circuits and the surrounding electromagnetic field. In transmission, an electrical signal is applied to the antenna, converting it into an electromagnetic wave that propagates through space to reach the intended receiver. In reception, the antenna captures incoming electromagnetic waves, converting them back into electrical signals for further processing.
 - c. **Parameters and Characteristics:** Understanding and optimizing antenna parameters are essential for efficient communication system design. Parameters such as impedance, bandwidth, radiation pattern, and efficiency influence an antenna's performance. Engineers and designers carefully consider these factors to achieve desired outcomes in terms of signal coverage, range, and reliability.
 - d. **Technological Advancements:** Advancements in materials, design techniques, and computational tools have significantly contributed to the evolution of antenna technology. Computer-aided design (CAD) software, electromagnetic simulation tools, and advanced manufacturing processes have empowered engineers to create antennas with enhanced performance and reduced size, pushing the boundaries of what is achievable in modern communication systems.
 - e. **Future Trends:** The evolution of antennas continues as we enter an era of pervasive connectivity and the Internet of Things (IoT). Miniaturization, multi-functionality, and adaptability are becoming increasingly important. Antennas are expected to play a crucial role in the development of 5G networks, smart cities, and emerging technologies, further shaping the landscape of wireless communication.
2. **Antenna Architecture:** Antenna architecture encompasses the structural design and configuration of antennas, defining their physical layout and arrangement of elements to achieve specific performance goals. The choice of architecture is crucial as it directly influences the antenna's characteristics, including gain, directivity, bandwidth, and radiation pattern. In this exploration, we delve into various antenna architectures, their applications, and the considerations that guide their design.

- a. **Dipole Antennas:** Dipole antennas are one of the simplest and most widely used antenna architectures. They consist of a conductive element, typically a straight wire or pair of wires, with a voltage source applied across its ends. Dipole antennas radiate energy in a symmetric pattern and are commonly used in radio and television broadcasting due to their omnidirectional characteristics.



- b. **Monopole Antennas:** A monopole antenna is a single, straight conductor mounted over a ground plane. It is a half-wave dipole with one-half of the dipole element replaced by a ground plane. Monopole antennas are extensively used in mobile communication devices, where their compact size and omnidirectional radiation pattern make them suitable for various applications.
- c. **Patch Antennas:** Patch antennas, also known as microstrip antennas, consist of a flat, metallic patch mounted above a ground plane. They find widespread use in communication systems due to their low profile, ease of integration, and suitability for planar and conformal applications. Patch antennas are commonly employed in wireless communication systems, RFID, and satellite communication.
- d. **Yagi-Uda Antennas:** Yagi-Uda antennas are directional antennas consisting of multiple parallel elements, including one driven element, a reflector, and one or more directors. This architecture provides high gain and directivity, making Yagi-Uda antennas suitable for point-to-point communication, such as in television reception and amateur radio.
- e. **Parabolic Antennas:** Parabolic antennas utilize a parabolic reflector to focus incoming or outgoing electromagnetic waves. The feed antenna, often located at the reflector's focal point, provides a highly directional beam. Parabolic antennas are widely used in satellite communication, radar systems, and point-to-point microwave links, where high gain and narrow beamwidth are critical.
- f. **Horn Antennas:** Horn antennas feature a flared opening that allows for a gradual transition between the transmission line and free space. They are characterized by their wide bandwidth

and moderate gain. Horn antennas are employed in radar systems, satellite communication, and microwave applications, where a balanced compromise between gain and bandwidth is required.

- g. Log-Periodic Antennas:** Log-periodic antennas consist of multiple dipole elements arranged in a geometric pattern that repeats logarithmically. This architecture provides consistent performance over a broad frequency range, making log-periodic antennas suitable for applications requiring wideband coverage, such as in television broadcasting and communication systems.

3. Considerations in Antenna Architecture:

- a. Frequency Range:** The chosen architecture should be suitable for the frequency range of interest.
- b. Gain and Directivity:** Different architectures offer varying levels of gain and directivity, influencing the coverage and reach of the antenna.
- c. Size and Form Factor:** The physical size and form factor of antenna architecture are critical considerations, especially in space-constrained environments.
- d. Polarization:** The desired polarization (e.g., vertical, horizontal) for communication needs guides the selection of antenna architecture.
- e. Environmental Factors:** Considerations such as wind loading, temperature, and environmental conditions impact the choice of antenna architecture.

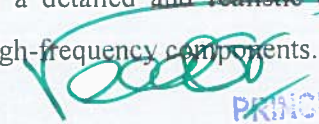
As technology continues to advance, antenna architectures evolve to meet the demands of emerging applications. The selection of the most suitable architecture involves a careful balance of performance requirements, environmental considerations, and the specific needs of the communication system in which the antenna is deployed.

4. Introduction to HFSS:

HFSS, or High-Frequency Structure Simulator, is powerful and versatile electromagnetic simulation software developed by Ansys, Inc. It is widely used in the field of radio frequency (RF), microwave, and high-speed digital design for simulating and analyzing electromagnetic fields. HFSS provides engineers and designers with a comprehensive platform to model, simulate, and optimize complex electromagnetic systems, including antennas, RF/microwave components, and integrated circuits.

5. Key Features and Capabilities:

- a. Full-wave Electromagnetic Simulation:** HFSS employs a full-wave simulation approach, solving Maxwell's equations to accurately model the behavior of electromagnetic fields in complex structures. This capability allows for a detailed and realistic representation of the physical phenomena involved in the design of high-frequency components.


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- b. **Broad Frequency Range:** One of HFSS's strengths lies in its ability to handle a broad frequency range, spanning from radio frequencies (RF) to microwave and millimeter-wave frequencies. This makes it suitable for the design and analysis of a wide range of devices, including antennas, filters, transmission lines, and resonators.
- c. **Parametric Analysis and Optimization:** Engineers can perform parametric analysis and optimization studies using HFSS. This functionality enables the exploration of design variations and the optimization of parameters to achieve specific performance goals. It is particularly useful for tuning antenna designs, matching network optimization, and fine-tuning RF/microwave circuits.
- d. **Integration with CAD:** HFSS seamlessly integrates with computer-aided design (CAD) tools, allowing users to import complex 3D geometries and structures. This integration streamlines the design workflow, making it easier for engineers to create accurate models and simulate realistic scenarios.
- e. **Antenna Design and Analysis:** HFSS is widely recognized for its capabilities in antenna design and analysis. Engineers can simulate various types of antennas, including wire antennas, patch antennas, and reflector antennas, among others. The software provides insights into parameters such as radiation patterns, gain, impedance matching, and efficiency.
- f. **High-Frequency Component Simulation:** HFSS is instrumental in the simulation of high-frequency components such as filters, couplers, and resonators. Engineers can analyze the performance of these components in different frequency bands, taking into account the effects of electromagnetic coupling, signal integrity, and impedance matching.
- g. **Finite Element Method (FEM) Solver:** The software employs the finite element method (FEM) as its underlying numerical technique for solving Maxwell's equations. This method enables accurate modeling of complex geometries and material properties, making HFSS suitable for a wide range of applications in electromagnetics.
- h. **Transient and Frequency-Domain Analysis:** HFSS supports transient and frequency-domain analyses, allowing engineers to study the time-dependent behavior of electromagnetic fields and analyze frequency responses. This versatility is beneficial in understanding dynamic behaviors and optimizing designs for various operational conditions.

6. Applications of HFSS:

- a. **Wireless Communication Systems:** HFSS is widely used in the design and optimization of antennas for wireless communication systems, including mobile devices, base stations, and satellite communication.



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- b. **RF and Microwave Circuits:** Engineers leverage HFSS to simulate and optimize RF and microwave circuits, such as filters, amplifiers, and matching networks, ensuring optimal performance and reliability.
- c. **Radar Systems:** HFSS plays a crucial role in the design and analysis of radar systems, including the antennas and components used in radar transmitters and receivers.
- d. **Integrated Circuits (ICs):** For high-speed digital design, HFSS aids in the simulation of signal integrity, crosstalk, and electromagnetic interference in integrated circuits, ensuring robust performance.
- e. **Medical Devices:** In the medical field, HFSS is applied to model and analyze electromagnetic interactions in devices such as MRI coils and biomedical sensors. HFSS is a comprehensive electromagnetic simulation tool that empowers engineers to design and optimize high-frequency components with confidence and precision. Its versatile features and broad application spectrum make it an indispensable tool in industries ranging from telecommunications to aerospace and beyond.

7. **Antenna Parameters:** Antennas are essential components in the field of wireless communication, serving as the interface between electronic devices and the surrounding electromagnetic environment. The performance of an antenna is characterized by various parameters that define its behavior and effectiveness in transmitting or receiving electromagnetic waves. Understanding these parameters is crucial for antenna design, optimization, and integration into communication systems. Here, we explore key antenna parameters and their significance:

a. **Radiation Pattern:**

Definition: The radiation pattern of an antenna describes the distribution of radiated electromagnetic energy in space.

Significance: It provides insights into how an antenna focuses or spreads its energy in different directions. Common patterns include omnidirectional, directional, and sectorial, influencing coverage and signal strength.

b. **Gain:**

Definition: Antenna gain measures the ability of an antenna to direct or concentrate radiated power in a specific direction.

Significance: A higher gain indicates increased directional focus, enabling longer communication range or improved signal strength in a particular direction. However, gain is often a trade-off with beam width and coverage.



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c. Directivity:

Definition: Directivity represents the concentration of radiated power in a particular direction, often compared to an isotropic radiator (perfectly omnidirectional).

Significance: High directivity indicates a more focused radiation pattern, contributing to increased gain in the desired direction.

d. Beam width:

Definition: Beam width is the angular width of the main lobe in the radiation pattern, measured between points where the power is half the maximum.

Significance: Narrow beam width enhances directionality but may limit coverage. Broad beam width is beneficial for omnidirectional coverage.

e. Polarization:

Definition: Polarization refers to the orientation of the electric field in the electromagnetic wave radiated by the antenna.

Significance: Proper polarization alignment between transmitting and receiving antennas is essential for efficient signal coupling. Common polarizations include vertical, horizontal, and circular.

f. Impedance:

Definition: Antenna impedance represents the opposition to the flow of alternating current in the antenna.

Significance: Matching antenna impedance with the transmission line or system impedance is critical for minimizing signal reflections and maximizing power transfer.

g. Bandwidth:

Definition: Bandwidth refers to the range of frequencies over which the antenna can operate effectively, often defined by the frequency range where the gain falls within a specified threshold.

Significance: A broader bandwidth allows the antenna to support a wider range of frequencies, making it versatile in diverse communication environments.

h. Efficiency:

Definition: Efficiency quantifies how effectively the antenna converts input power into radiated electromagnetic waves.

Significance: High efficiency ensures that a significant portion of the input power contributes to useful radiation, minimizing power losses.



i. VSWR (Voltage Standing Wave Ratio):

Definition: VSWR measures the ratio of the maximum voltage to the minimum voltage in a standing wave pattern along the transmission line.

Significance: A low VSWR indicates good impedance matching and minimal signal reflection, optimizing power transfer.

j. Resonant Frequency:

Definition: Resonant frequency is the frequency at which an antenna exhibits maximum efficiency and performance.

Significance: Operating an antenna at its resonant frequency enhances its effectiveness and ensures optimal performance in a specific frequency band.

k. Front-to-Back Ratio:

Definition: The front-to-back ratio measures the relative strength of the radiation pattern in the forward direction compared to the backward direction.

Significance: A higher front-to-back ratio is desirable for directional antennas, minimizing interference from signals arriving from the rear.

8. Importance of HFSS with other Tools:

HFSS, as a high-fidelity electromagnetic simulation tool, plays a pivotal role in the design and analysis of antennas, RF/microwave components, and other high-frequency structures. While HFSS is a powerful standalone tool, its integration with other simulation and design tools enhances the overall engineering workflow, providing a more comprehensive approach to solving complex electromagnetic problems. Here's an exploration of the importance of HFSS in conjunction with other tools:

9. Comprehensive Simulation Capabilities:

- a. HFSS Strengths:** HFSS excels in full-wave electromagnetic simulations, accurately capturing complex electromagnetic phenomena.
- b. Complementary Tools:** Coupling HFSS with tools for structural, thermal, or fluid dynamics simulations allows for comprehensive multi-physics analysis, ensuring a more realistic representation of real-world scenarios.

10. Antenna Designing Mathematical Calculations: Dr. P. Surendra Kumar led participants through the mathematical foundations of antenna design, including formulas for impedance matching, gain calculations, and directivity. Real-world applications and case studies illustrated the practical significance of mathematical calculations in the design process.


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11. Antenna Designing Procedures:

Antenna design with HFSS involves leveraging the software's capabilities for electromagnetic simulation and optimization. Here's a step-by-step procedure for designing an antenna using HFSS:

a. Define Design Requirements:

Clearly specify the purpose of the antenna (e.g., communication, radar, satellite). Identify key specifications such as frequency range, gain, radiation pattern, and polarization.

b. Research and Choose Antenna Type:

Explore different antenna types suitable for the application. Use HFSS's knowledge base and documentation to understand the strengths and limitations of various antenna types. Choose an antenna type based on the research and requirements.

c. HFSS Project Setup:

Launch HFSS and set up a new project. Define project unit, frequency range, and other simulation settings.

d. Geometry and Dimensions:

Create the 3D geometry of the antenna using HFSS's modeling tools. Input the calculated dimensions based on the chosen antenna type and operating frequency.

e. Excitation and Boundary Conditions:

Define the feeding mechanism (e.g., port, waveguide) using HFSS's excitation features. Apply appropriate boundary conditions to simulate the antenna's interaction with its surroundings.

f. Material Assignment:

Assign material properties to the antenna structure using HFSS's material library. Choose materials based on their electromagnetic characteristics and environmental considerations.

g. Meshing:

Generate a mesh for the antenna geometry using HFSS's meshing tools. Adjust mesh parameters to ensure accuracy and efficiency in the simulation.

h. Simulation:

Run a simulation to analyze the antenna's electromagnetic behavior. Examine key parameters such as S-parameters, radiation pattern, gain, and impedance matching.

i. Optimization:

Utilize HFSS's optimization tools to improve antenna performance. Perform parametric sweeps or use optimization algorithms to adjust antenna parameters for optimal results. Iteratively simulate and optimize until the desired performance is achieved.



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j. Post-Processing and Visualization:

Analyze simulation results using HFSS's post-processing tools. Visualize radiation patterns, far-field plots, and other relevant data. Evaluate performance metrics and compare with design requirements.

k. Fabrication and Prototyping:

Use the optimized design parameters to fabricate a physical prototype. Verify dimensions and configurations against the simulation results.

l. Validation and Testing:

Set up a testing environment consistent with real-world conditions. Measure key parameters using testing equipment such as network analyzers and spectrum analyzers. Validate the prototype's performance against simulation results.

m. Fine-Tuning and Adjustment:

If necessary, make adjustments to the antenna based on testing results. Iterate between simulation, fabrication, and testing to refine the design.

n. Documentation:

Document the final antenna design, including specifications, simulation results, and testing outcomes. Create a comprehensive report that can be shared with stakeholders.

o. Integration into System:

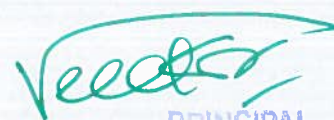
Integrate the designed antenna into the larger communication or electronic system. Verify compatibility and performance in the system environment.

p. Field Deployment:

Conduct field tests to validate the antenna's performance in real-world conditions. Gather feedback and make any necessary adjustments or improvements.

q. Maintenance and Optimization:

Develop a plan for long-term maintenance and potential future optimizations. Establish a feedback loop for continuous improvement based on field performance and user feedback. By following this comprehensive procedure, engineers can leverage HFSS's powerful simulation and optimization capabilities to design antennas that meet or exceed performance requirements. The iterative nature of the process, combined with the simulation tools provided by HFSS, allows for efficient and effective antenna development.



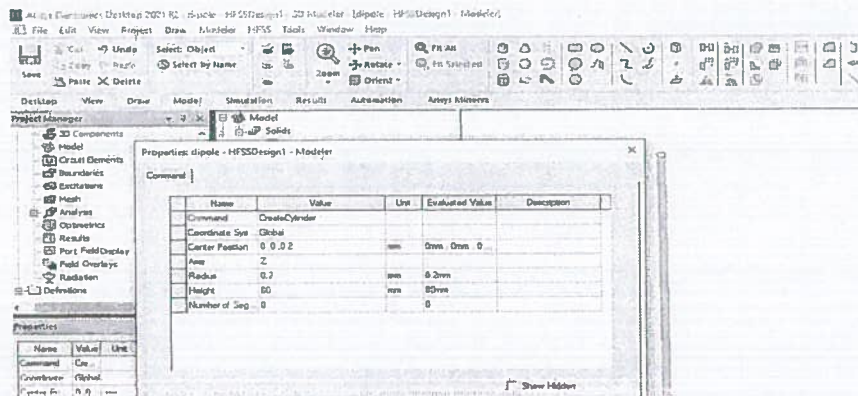
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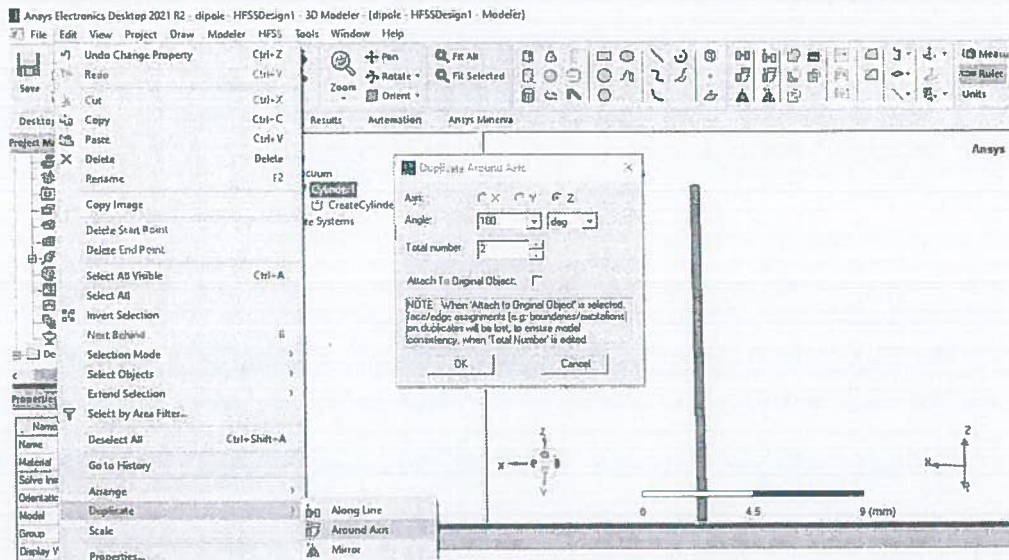
12. Sample Antenna Design in HFSS:

Design Procedure using HFSS software:

- Start ANSYS Electronics Desktop. Check (and change if necessary) that the working mode is Driven Modal, HFSS > Solution Type > Modal.
- Set Modeler length units to mm, Modeler > Units > mm.
- To draw a dipole element, select Draw > Cylinder and enter calculated values at radius and height position

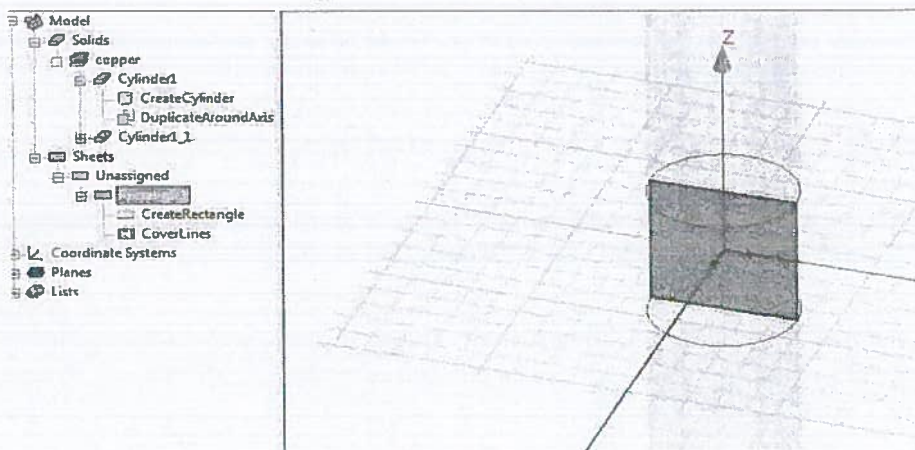
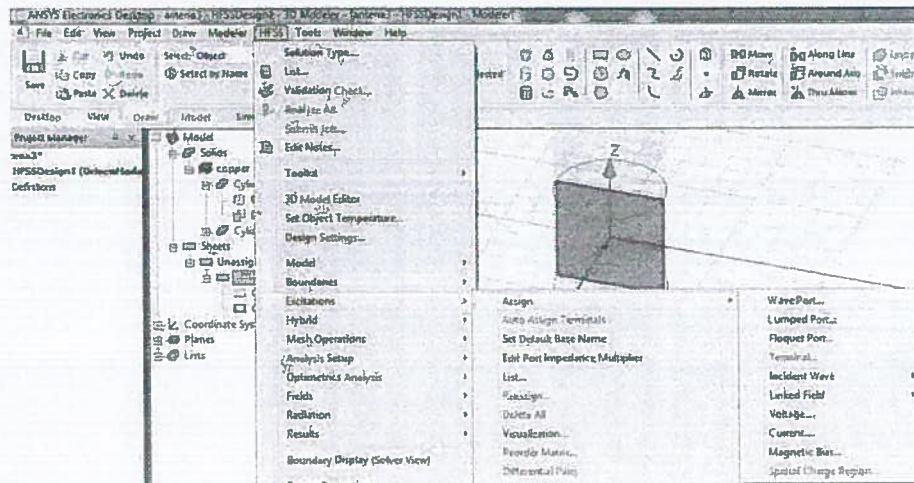


- After drawing the first element of the dipole we will create the second one by symmetry.

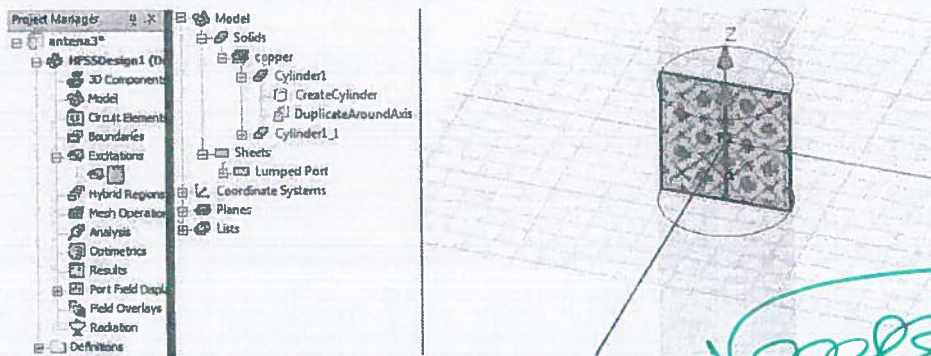


- Select the first cylinder and then select Edit > Duplicate > Around Axis, choose the axis X or Y and enter the angle of 180° , Total number 2.
- To provide an input source to perform the simulation. Select Draw > Rectangle and draw

a rectangle (! it's a surface model not a volume one) between the two wires, as in the figures below.



- g. Select the drawn rectangle and define it as the input signal area/port HFSS > Excitations > Assign > Lumped Port.



[Handwritten signature]

- h. Select HFSS > Model > Create Open Region. Choose the frequency of interest (around 900 MHz) and Radiation boundary.
- i. Add a solution. Select HFSS > Analysis Setup > Add Solution Setup
- j. After meshing, we define a broadband analysis. Select the previously defined solution (Project Manager > Analysis > Setup1) and add a broadband solution around the frequency corresponding to the single frequency solution HFSS > Analysis Setup > Add Frequency Sweep.
- k. Select HFSS > Validation Check to verify that all required steps have been completed.
- l. Select HFSS > Analyze All to start the simulation. Click the Show Progress button to view the progress of the solver.
- m. Select HFSS > Results > Create Modal Solution Data Report > Rectangular Plot to display the S parameter corresponding to input port P1 (in dB).
- n. Similarly plot far-fields parameters of the antenna.

Dr. P. Surendra Kumar demonstrated the practical application of knowledge through a sample antenna design using HFSS. Participants engaged in hands-on exercises, applying concepts learned during the program. The Q&A session facilitated direct interaction, allowing participants to seek clarification on specific design aspects.

Result Analysis: The critical aspect of interpreting simulation results. Participants acquired the skills to analyze and compare simulated results with theoretical expectations. Iterative design refinement based on result analysis was emphasized.

Certificate Program Exam: The program concluded with a comprehensive exam under the guidance of Mr. S.V. Ravi Kumar. The exam evaluated participants on theoretical knowledge and practical skills, covering topics from the entire program. The assessment aimed to certify participants based on their understanding and application of the concepts learned.

Vote of Thanks: We extend our sincere gratitude to Mr. S.V. Ravi Kumar, Head of the Department, for his visionary leadership, Dr. K.V. Subrahmanyam, Principal, for his unwavering support, and Dr. P. Surendra Kumar, the esteemed resource person, for their invaluable contributions to the success of the Antenna Design using HFSS Certification Program. Your guidance and mentorship have been instrumental in shaping the learning experience for all participants.



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NH-16, Valluru, Ongole, Prakasam (District)-523272

Department of Electronics and Communication Engineering

Date: 06-02-2021.

CLOSING REPORT

To,
The Principal,
RISE Krishna Sai Gandhi Group of Institutions.

As per the approved schedule, the ECE department has conducted a Certificate Program on “Antenna Design using HFSS” at ECE Seminar hall from 02-02-2021 to 06-02-2021. 111 students of IV ECE have participated in this program. Dr.P.Surendra Kumar, Associate Professor, Bapatla Engineering College, Bapatla, A.P. acted as the resource person for this program.

Main issues addressed:

1. Introduction to Antenna.
2. Antenna Design
3. Antenna Architecture
4. Introduction to HFSS
5. Antenna Design using HFSS and Result Analysis

We are expecting your support in future also. Thanking you sir,

Yours faithfully,

Coordinator

S. N. Srinivas Reddy
HOD

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of Institutions, VALLURU, A.P.-523 272

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