

1.0 Course Overview

Course: BECE305L – Antenna and Microwave Engineering

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VIT[®]

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

Course objective (Mapping of syllabus)

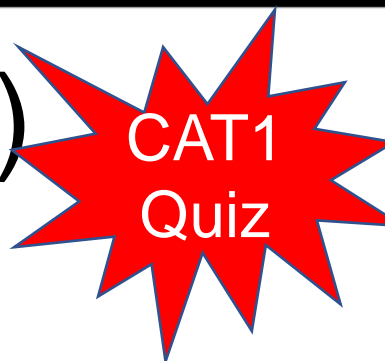
- To introduce and discuss the mechanism for antenna parameters, radiating principles, fundamental characteristics and design concepts of HF, UHF, Microwave antennas and arrays.
- To design and analyse various passive and active microwave circuits.
- To familiarize the operational principles of microwave sources and to characterize microwave networks.

Course outcome (CO1-CO6)

At the end of the course, the Students will be able to

- Examine the radiation mechanism of electromagnetic fields and identify the various antenna parameters.
- Apply the design criteria to Linear, HF, UHF, microwave antenna and arrays.
- Comprehend the performance of different microwave sources and ferrite devices.
- Design and analyze the passive components at microwave frequencies.
- Design and analyze the various passive circuits at microwave frequencies.
- Infer the importance of high frequency transistors to design microwave amplifiers.

Syllabus (Total Lecture hours: 45 hours)



CAT1
Quiz

Module:1 EM Radiation and Antenna Parameters 8 hours

- Radiation mechanism - single wire, two wire and current distribution, Hertzian dipole, Dipole and monopole - Radiation pattern, beam width, field regions, radiation power density, radiation intensity, directivity and gain, bandwidth, polarization, input impedance, efficiency, antenna effective length and area, antenna temperature. Friis transmission equation, Radar range equation.

Module:2 Linear and Planar Arrays 6 hours

- Two element array, N-element linear array - broadside array, End fire array - Directivity, radiation pattern, pattern multiplication. Non-uniform excitation - Binomial, Chebyshev distribution, Arrays: Planar array, circular array, Phased Array antenna (Qualitative study).

Syllabus

Module:3 HF, UHF and Microwave Antennas 7 hours

- Wire Antennas - long wire, loop antenna - helical antenna. Yagi-Uda antenna, Frequency independent antennas - spiral and log periodic antenna - Aperture antennas – Horn antenna, Parabolic reflector antenna - Microstrip antenna.

Module:4 Microwave Sources 5 hours

- Microwave frequencies and applications, Microwave Tubes: TWT, Klystron amplifier, Reflex, Klystron & Magnetron. Semiconductor Devices: Gunn diode, Tunnel diode, IMPATT – TRAPATT - BARITT diodes, PIN Diode.

Module:5 Microwave Passive components 6 hours

- Microwave Networks - ABCD, 'S' parameter and its properties. E-Plane Tee, H-Plane Tee, Magic Tee and Multi-hole directional coupler. Principle of Faraday rotation, isolator, circulator and phase shifter.

Syllabus



Module:6 Microwave Passive circuits 7 hours

- T junction and resistive power divider, Wilkinson power divider, branch line coupler (equal & unequal), Rat Race Coupler, Filter design: Low pass filter (Butterworth and Chebyshev) - Richards transformation and stepped impedance methods.

Module:7 Microwave Active Circuits 4 hours

- Microwave transistors, Microwave amplifiers: Two port power gains, stability of the amplifier, Microwave oscillators.

Module:8 Contemporary issues 2 hours

- Guest Lecture by Industry Experts

Text Books

1. C.A. Balanis, Antenna Theory - Analysis and Design, 2016, 4th Edition, Wiley & Sons, New York, USA.
2. D. M. Pozar, Microwave engineering, 2013, 4th Edition, Wiley & Sons, USA.

Reference books:

3. R Ludwig, Gene Bogdanov, RF Circuit design: Theory and applications, 2013, 2nd Edition, Pearson India
4. John D Krauss, Antennas for all Applications, 2008, 4th Edition, Tata McGraw Hill, India

Mode of evaluation(as of now)*

Assessment type	Date	Max marks*	Weightage*	Remarks	Course outcomes
Quiz	All assessments before CAT 1	20-30	10	Includes multiple assignments/ surprise quizzes	CO1, CO2
Project Progress presentation – 1	Week after CAT 1	30	10	Literature survey – 10 Workflow - 5 Preliminary Design – 15	
Project Progress presentation - 2	Week after CAT 2	30	10	Preliminary Analysis – 15 Parametric analysis – 15	
CAT – I	As per the announcement by the University		15	Schedule will be announced	CO1-CO2
CAT – II			15		CO4-CO5
FAT			40		All

Mode of evaluation(as of now)*

Assessment type	Date	Max marks*	Weightage*	Remarks	Course outcomes
Lab experiments	Regular basic 6 experiments	60	36 in LAB internals	<ul style="list-style-type: none"> Regular basic experiments on waveguide setups 	CO1, CO2
Project Documentation	Weekly – Documentation	50/60	24 in LAB internals	<ul style="list-style-type: none"> Progress documentation Steps in each lab day 	CO1, CO2
LAB FAT – Project final presentation	Week prior to LAB FAT week	50	40 in LAB FAT	<ul style="list-style-type: none"> Literature: 5 marks Presentation: 5 marks Design complexity: 5 marks Design and analysis: 15 marks Results: 10 marks Fabrication and measurement: 10 marks 	CO1, CO2

*Changes if any, will be updated then and there

Mode of Communication

1. Queries/doubts: Post them in channel
2. Personal Queries/doubts: Post them directly in Teams personal chat
3. You may also write email to : richards.stanislaus@vit.ac.in with subject
2023-24: Winter: G1 : BECE305L: SubjectOfYourEmail

Regarding Lecture Slides:

- Lecture slides and link to lecture videos will be available in **VTOP course page** which will be configured soon:
- For today, I shall update in Teams:

