

| Course Code | Course Name | Teaching Scheme | | | Credits Assigned | | | |
|-------------|---------------------------------|-----------------|-----------|----------|------------------|-----------|----------|-------|
| | | Theory | Practical | Tutorial | Theory | Practical | Tutorial | Total |
| ETC704 | Microwave and Radar Engineering | 04 | -- | -- | 04 | -- | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | | |
|-------------|---------------------------------|---------------------|--------|---------------------------|---------------|---|-----------|-----------|------|-------|
| | | Theory Marks | | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | | |
| | | Test 1 | Test 2 | Ave. Of Test 1 and Test 2 | | | | | | |
| ETC704 | Microwave and Radar Engineering | 20 | 20 | 20 | 80 | - | - | - | 100 | |

Pre requisite :

- ETC 404 Wave Theory and Propagation
- ETC 504 RF Modeling and Antenna

Course Objective: To teach the students

- Radio-frequency spectrum space, microwave communication.
- Microwave principles, working of microwave devices.
- RADAR and their applications.

Course Outcome: After Completing this course student will be able to

- Analyze the microwave passive circuit components and design the tuning and matching networks.
- Identify the state of art in microwave tubes and semiconductors and their uses in real life.
- Apply the microwave devices and RADAR for industrial and scientific purposes

| Module No. | | Topics | Hrs. |
|--------------|-----|---|-----------|
| 1. | | Waveguides and Microwave Components | 10 |
| | 1.1 | Frequency bands and characteristics of microwaves | |
| | 1.2 | Rectangular and circular waveguides, mode analysis | |
| | 1.3 | Resonators, reentrant cavities, scattering parameters, tees, hybrid ring, directional couplers, phase shifters, terminations attenuators, ferrite devices such as isolators, gyrators, and circulators. | |
| 2 | | Impedance Matching and Tuning | 08 |
| | 2.1 | Lumped element matching | |
| | 2.2 | Single stub tuning, double stub tuning, triple stub tuning | |
| | 2.3 | Quarter wave transformer | |
| 3 | | Generation and Amplification of Microwaves | 10 |
| | 3.1 | Two Cavity Klystron and Reflex Klystron | |
| | 3.2 | Helix Travelling Wave Tube and Backward Wave Oscillator | |
| | 3.3 | Cross Field Amplifier, Cylindrical Magnetron, and Gyrotrons | |
| 4 | | Semiconductor Microwave Devices (construction, working, equivalent circuit and performance characteristics) | 10 |
| | 4.1 | Varactor, PIN, Tunnel, Point Contact, Schottky Barrier, Gunn, IMPATT, TRAPATT, and BARITT. | |
| | 4.2 | BJT, Hetro junction BJT, MESFET, and HEMT | |
| | 4.3 | Parametric Amplifiers | |
| 5 | | RADAR | 08 |
| | 5.1 | Basics of RADAR and RADAR range equation | |
| | 5.2 | Types of RADAR: Pulsed, Continuous wave and FMCW, Doppler, MTI, and Phased Array | |
| | 5.3 | Types of displays and Clutter | |
| | 5.4 | Tracking RADAR: Monopulse, Conical, Sequentiallobing | |
| 6 | | Microwave Applications | 06 |
| | 6.1 | Microwave heating and bio-medical applications | |
| | 6.2 | Remote sensing RADAR, MSTRADAR, radiometer, instrumentation landing system, and RADAR based navigation | |
| Total | | | 52 |

Recommended Books:

1. David M Pozar, “*Microwave Engineering*”, John Wiley & Sons, Inc. Hoboken, New Jersey, Fourth Edition, 2012.
2. Samuel Y Liao, “*Microwave Devices and Circuits*”, Pearson Education, Third Edition
3. Merrill Skolnik, “*Introduction to RADAR Systems*”, Tata McGraw Hill, Third Edition
4. Annapurna Das and Sisir K Das, “*Microwave Engineering*”, Tata McGraw Hill, New Delhi, Second Edition, 2009
5. K. T. Matthew, “*Microwave Engineering*”, Wiley India, 2011

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining questions will be selected from all the modules