| Program : | **Diploma in Electronics Engineering / Electronics and Communication Engineering** |
|---|---|
| Course Code : **5049A** | Course Title: **Microwave Engineering Lab** |
| Semester : **5** | Credits: **1.5** |
| Course Category: **Program Elective** | |
| Periods per week: **3 (L:0, T:0, P:3)** | Periods per semester: **45** |

**Course Objectives:**

- To familiarize with working of microwave devices
- To study the working of microwave generators and antennas
- To give an outline on antenna designing software

**Course Prerequisites:**

| Topic | Course code | Course name | Semester |
|---|---|---|---|
| Microwave Devices | | Microwave Devices and Radar | 5 |

**Course Outcomes:**

On completion of the course, the student will be able to:

| COn | Description | Duration (Hours) | Cognitive Level |
|---|---|---|---|
| CO1 | Apply the concepts of the wave guide parameters | 9 | Applying |
| CO2 | Experiment with microwave coupling devices | 9 | Applying |
| CO3 | Demonstrate the operation of Microwave generators and radiators | 9 | Applying |
| CO4 | Design antenna with high frequency simulation software | 12 | Applying |
| | Lab Exam | 6 | |

**CO – PO Mapping:**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | | 3 | | | |
| **CO2** | 3 | | | 3 | | | |
| **CO3** | 3 | | | 3 | | | |
| **CO4** | 3 | 3 | 3 | 2 | | | 3 |

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

**Course Outline:**

| Module Outcomes | Description | Duration (Hours) | Cognitive Level |
|---|---|---|---|
| **CO1** | **Apply the concepts of the wave guide parameters** | | |
| M1.01 | Familiarize microwave components and instruments. | 3 | Applying |
| M1.02 | Measure the frequency and wave length of a microwave signal. | 3 | Applying |
| M1.03 | Determination of VSWR of a given load. | 3 | Applying |
| **CO2** | **Experiment with microwave coupling devices** | | |
| M2.01 | To measure the isolation between E and H arms of magic tee and demonstrate power division in magic tee. | 1.5 | Applying |
| M2.03 | To demonstrate the isolation of E and H plane tee and its power division. | 1.5 | Applying |
| M2.04 | To measure the coupling factor, insertion loss and directivity of directional coupler | 3 | Applying |
| M2.05 | To measure VSWR, insertion loss and isolation of a circulator. | 3 | Applying |
| | Lab Exam – I | 3 | |
| **CO3** | **Demonstrate the operation of Microwave generators and radiators** | | |
| M3.01 | Plot the V-I characteristics of Gunn diode. | 3 | Applying |
| M3.02 | Plot the characteristics of reflex klystron tube. | 3 | Applying |
| M3.03 | Measure the gain of Horn antenna. | 3 | Applying |

| CO4 | Design antenna with high frequency simulation software | | |
|---|---|---|---|
| M4.01 | Familiarize high Frequency Simulation Software(FSS) | 3 | Understanding |
| M4.02 | Using FSS design a monopole antenna | 3 | Applying |
| M4.03 | Using FSS design a dipole antenna | 3 | Applying |
| M4.04 | Open Ended experiments** | 3 | Applying |
| | Lab Exam – II | 3 | |

**** - Suggested Open Ended Projects**

(Not for End Semester Examination but compulsory to be included in Continuous Internal Evaluation. Students can do open ended experiments as a group of 4-5. There is no duplication in experiments between groups. Open ended experiments should include the concepts of circuit design and application)

1) Application of high frequency simulation software
   - Radiation pattern of microstrip antenna
   - VSWR measurements
   - Gain and Directivity measurements
   - Polarization plots

Text / Reference:

| T/R | Book Title/Author |
|---|---|
| T1 | Balanis_Advanced Engineering Electromagnetics, John Wiley & Sons, 2012 |
| T2 | Samuel Y.Liao "Microwave Devices and circuits" - Pearson |
| R2 | G.S.N.Raju "Microwave Engineering" -I K International |

**Online Resources:**

| Sl.No | Website Link |
|---|---|
| 1 | https://www.ansys.com/en-in/academic/students/ansys-electronics-desktop-student |
| 2 | https://vlab.amrita.edu/?sub=3&brch=179&sim=400&cnt=407 |
| 3 | http://eem-iitd.vlabs.ac.in/exp7.html |