**19EC4101 – MICROWAVE TECHNIQUES**

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| **Course category:** | Program core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 2 - 2 - 0 |
| **Prerequisite:** | Electro Magnetic Fields & Waves, Antenna &wave Propagation. | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected: | |
| 1. To understand the operation of Klystron amplifier, Reflex Klystron oscillator, Travelling Wave Tube amplifier and Magnetron oscillators. 2. To study the operation of different microwave semiconductor devices like Tunnel diode, Gunn diode, IMPATT diode, Schottkey Barrier diode, PIN diode and varactor diodes. 3. To understand different microwave components like Resonators, attenuators, TEEs, Directional couplers, Isolators and S-parameters of networks. 4. To study the measurement of frequency, VSWR, impedance, S-parameter and ‘Q’ of a cavity. 5. To study parabolic reflector antenna, Horn and Lens antennas. 6. To study Hybrid MICs, strip lines, micro strip lines | |
| **Course Outcomes** | Upon successful completion of the course , the students will be able to: | |
| CO1 | Demonstrate the Magnetron and tunnel diode as oscillator. |
| CO2 | Derive the power efficiency in parametric amplifier and klystron amplifier. |
| CO3 | Understand the measurement of impedance using Microwave TEEs. |
| CO4 | Measure various parameters like power, VSWR at microwave frequencies with the help of various microwave components. |
| CO5 | Design Parabolic antenna and explain MIC. |
| CO6 | Understand the fabrication technique of MICs and radiation pattern of Horn Antenna. |
| **Course**  **Content**  **Course**  **Content** | **UNIT-I**  **MICRO WAVE TUBES:** Klystron Amplifier, Reflex Klystron Oscillator, Travelling Wave Tube Amplifier and Magnetron Oscillator.  **UNIT-II**  **MICROWAVE SEMOCONDUCTOR DEVICES:** Tunnel Diode, Gunn Diode, IMPATT Diode, PIN Diode, SchottKey Barrier Diode, Varactor Diode and Parametric Amplifier, MASER.  **UNIT-III**  **MICROWAVE COMPONENTS:** Waveguides, Cavity Resonators, Attenuators, TEEs, Bends, Corners, Windows, Phase Shifters, Directional Couplers, Matching elements, Isolators, Circulators, S-Parameters of Networks.  **UNIT-IV**  **MICROWAVE MEASUREMENTS:** Measurement of Frequency, Power, VSWR, Impedance, Reflection Coefficient, Attenuation Constant and Dielectric Constant, S-parameters, ‘Q’- of a Cavity.  **UNIT-V**  **MICROWAVE ANTENNAS:** Parabolic Reflector Antenna, Passive Reflector Antenna, Helical antenna, Horn and Lens Antennas  **UNIT-VI**  **MICs:** Fabrication of MICs, Advantages of MICs, Hybrid MICs, Strip Lines, and Microstrip Lines, Monolithic MICs | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. Samuel Y Liao, “Microwave Devices and Circuits”, Prentice Hall, 1999. 2. M. Kulkarni, “Microwave and Radar Engineering”,Umesh Publications, 1998. 3. Annapurna Das and Sisir K. Das, “Microwave Engineering”, TMH, 2000   **REFERENCE BOOKS:**   1. D. C. Dube, “Microwave Devices and Applications”,Narosa Publications, 2011. 2. David M. Pozar, “Microwave Engineering”, IE, 1997. 3. Robert E. Collin, “Foundations for Microwave Engineering”, John Wiley and Sons, 2007 | |
| **E-Resources** | 1. <http://nptel.ac.in/syllabus/117105029/> 2. <https://www.youtube.com/user/nptelhrd> | |

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| **Contribution of Course Outcomes towards achievement of Program Outcomes** | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 1 | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | - | - | 2 | 1 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | 2 | 3 | 3 |