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| **III B.TECH**  **II SEMESTER** | **L** | **T** | **P** | **INTERNAL**  **MARKS** | **EXTERNAL**  **MARKS** | **TOTAL**  **MARKS** | **CREDITS** |
| **3** | **1** | **0** | **30** | **70** | **100** | **3** |
| **Code:R20EC3201** | **Micro wave and Optical communications** | | | | | | |

**COURSE OBJECTIVES:**

1. To know about different waveguides and mode analysis.

2. To introduce the microwave components and microwave devices.

3. To familiarize in microwave measurements using microwave bench.

4. To introduce different types of optical fibres.

5. To know about different optical sources and optical detectors.

**COURSE OUTCOMES:** After successful completion of the course, the students are able to

**CO1**: **Summarize** the field components and analyse different modes in waveguide **(K2)**

**CO2**: **Interpret** different microwave components and devices **(K2)**

**CO3**: **Experiment** with microwave measurements through bench setup **(K3)**

**CO4**: **Classify** different types of optical fibers **(K4)**

**CO5**: **Categorize** the optical sources, optical detectors and explain digital receiver **(K4)**

**SYLLABUS:**

**UNIT–I:**

**MICROWAVE TRANSMISSION LINES:** Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Dominant and Degenerate Modes, Introduction to Circular wave guides, related problems

**UNIT–II:**

**MICROWAVE COMPONENTS & MICROWAVE TUBES:** Waveguide Attenuators – Resistive Card and Rotary Vane types; Calculation of scattering matrix for E plane, H plane, Magic Tee and Directional Coupler; Ferrite Components – Gyrator, Isolator, Circulator. Classification of Microwave Tubes, Two Cavity Klystron – Structure, Velocity Modulation Equation, Applegate Diagram; Reflex Klystron – Structure, Applegate Diagram; Travelling Wave Tube – operation, Magnetron operation.

**UNIT–III:**

**MICROWAVE SOLID STATE DEVICES & MEASUREMENTS:** Gunn Diode – Principle, RWH Theory; IMPATT Diode, Description of Microwave Bench, Measurement of Attenuation, Frequency, VSWR using Microwave Bench and Power measurement using Bolometer Method.

**UNIT-IV:**

**OVERVIEW OF OPTICAL FIBER COMMUNICATION**:

Historical development, the general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Types of rays, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Related problems.

**UNIT–V:**

**OPTICAL SOURCES & OPTICAL DETECTORS:** LEDs- structures, quantum efficiency, modulation; Laser diodes principle, modes, threshold conditions, external quantum efficiency, resonant frequencies, Reliability of LED&ILD. Photo Diodes- Principle, PIN and avalanche photo diodes; comparison of photo detectors, Temperature effect on avalanche gain, noise in photo detectors Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Digital receiver, Probability of Error ,Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples.

**TEXT BOOKS:**

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| 1. Samuel Y. Liao, “Microwave Devices and Circuits”, PHI, 3rd Edition, 1994. |
| 1. Gerd Keiser, “Optical fiber communications “,3rd  ed.,MGH. (Units -IV to VI). |

**REFERENCE BOOKS:**

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| 1. R.E. Collin, “Foundations for Microwave Engineering”, IEEE Press, John Wiley, 2 nd Edition, 2002. |
| 1. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, “Microwave Principles”, CBS Publishers and Distributors, New Delhi, 2004. |
| 1. Djafar K. Mynbaev and Lowell L. Scheiner, “Fiber Optic Communication Technology”, Pearson Education Asia. |
| 1. M*.*Kulkarni, “Microwave and Radar Engineering ” , Umesh Publications, New Delhi. 3rd Edition. |

**WEB REFERENCES:**

1. <https://freevideolectures.com/subject/microwave>
2. <https://ece.vt.edu/grad/courses/5104G>