



MANIPAL UNIVERSITY JAIPUR

School of Electrical, Electronics & Communication Engineering (SEEC)

Department of Electronics & Communication Engineering
Course Hand-out

Microwave Components and Devices | EC1602 | 4 Credits | 3 | 0 | 4

Session: July 14 – Dec 14 | Faculty: Prof. V. N. Tiwari | Class: Core Course

- A. Course Outcomes:** At the end of the course, students will be able to
- [1602.1]. Understand electromagnetic waves, their propagation and field patterns in waveguides to promote sustainable development in high frequency.
 - [1602.2]. Understand the different waveguide components designing and their characteristic measurement and hence develop employability skills in high frequency industries.
 - [1602.3]. Analyse the operation of different microwave generators and devices at high frequency.

B. SYLLABUS

Transmission lines: Transmission line equations and their solution, characteristic impedance, reflection coefficient, Transmission lines at high frequencies, standing waves on transmission line for different loads, SWR, eighth, quarter and half wave line, impedance matching; **Smith chart:** Construction single and double stub matching; **Guided waves:** Transverse electric, Transverse magnetic and Transverse electromagnetic waves in conducting planes, characteristics of TE TM and TEM waves, wave impedance, attenuation; **Rectangular and circular wave guides:** TE, TM and TEM waves in rectangular and circular wave guide, characteristics of TE and TM mode and excitation of wave guides; **Strip lines and micro strip lines:** Characteristic impedance, losses and quality factor Q of micro strip lines, coplanar strip lines and shielded strip lines, parameters and its properties; **Passive components:** Resonators, Directional Couplers, E-plane Tee, H-plane Tee and Hybrid Tee, Hybrid ring, Attenuators, Circulator, Faraday rotation principle, Isolators, Gytrators, Phase Shifters, their applications; **Microwave active Devices:** Limitations of conventional vacuum tube devices; **Two cavity klystron:** Reentrant cavities, velocity modulation process, bunching process, output power and beam loading; **Reflex klystron:** Velocity modulation, power output and efficiency and electronic admittance; **Traveling wave tube:** Slow wave structure, amplification process, convection current, axial electric field, wave modes and gain consideration; **Magnetron:** Mode of oscillation, Strapping and Rising Sun Magnetron; **Parametric amplifiers:** Physical structure, nonlinear reactance and Manley Rowe relations, applications; **Microwave diodes and transistors:** Tunnel diode, Varactor diode, Gunn diode, IMPATT diode, Microwave transistors and FETs.

C. TEXT BOOKS

1. S. Liao "Microwave Devices and Circuits" Prentice Hall, 2004
2. D. M. Pozar "Microwave Engineering" John Wiley & Sons, 2004

D. REFERENCE BOOKS

1. J. Ryder "Network lines and Fields" Prentice Hall, 1999.
2. I. Jordan & Balmain "Electromagnetic waves and Radiating System" Prentice Hall, 1968.

