Course Title: Microwave Engineering		
Course Code : ETE 415	Credit Hour : 3.0	Total Marks : 100

Rationale: In order to meet up the challenges of Telecommunication Sector and Wireless Communication filed, students need to learn about the concepts and sound understanding of complete RF & microwave-engineering. Therefore, this course is intended to better prepare future engineers and computational scientists in understanding microwave-engineering.

Objectives:

1. Understand the basic electromagnetic theory in the context of Microwave engineering
2. Analyse transmission lines with the transmission line theory and Smith chart
3. Explain the characteristics of common transmission lines and waveguides
4. Describe RF sub-systems with microwave network analysis (Y, Z, scattering, and ABCD matrices)
5. Perform impedance matching and tuning
6. Explain the characteristics of amplifiers, oscillators, and mixers
7. Understand how RF components constitute RF transmitters and receivers

Learning Outcomes	Course Content	Teaching/Learning Strategy	Assessment Strategy
Understand the basic electromagnetic theory in the context of Microwave engineering	**Topic 1 : Introduction to Microwave Engineering:** Course topics - Microwave bands - Microwave applications, etc	Lecture, Discussion, Problem based learning	Problem solving, Assignment
1.Analyse transmission lines with the transmission line theory and Smith chart 2.Explain the characteristics of common transmission lines and waveguides	**Topic 2 :** **T-Line model –** Course topics -Telegrapher equations, characteristic impedance - input impedance - terminated T-line (load, matched load, open, short)	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand the basic electromagnetic theory in the context of Microwave engineering	**Topic 3 : VSWR -** Slotted line measurement - Power flow on a T-Line - Transient on T-lines and Bounce diagram	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Perform impedance matching and tuning	**Topic 4 : Smith Chart**	Lecture, Discussion, Problem based learning	Problem solving, Assignment

Perform impedance matching and tuning	**Topic 5: Impedance Matching:** Matching with L-Sections (lumped elements), Stub tuners (T-line), and Quarter wave impedance transformers**.**	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand the waveguides theory.	**Topic 6 : Waveguides:-** TE waveguide - TM Waveguide - Cutoff frequency - Mode chart - Wave impedance - Physical interpretation of wave propagation inside waveguide.	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand the waveguides theory.	**Topic 7 : Waveguides:-** Wave Impedance - Field Patterns - Power Flow - Dispersion - Group Velocity - Modes Excitation - Impossibility of TEM wave in Waveguide	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand how RF components constitute RF transmitters and receivers	**Topic 8 : Microwave Network Analysis S-Parameters & Scattering Matrix**	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand how RF components constitute RF transmitters and receivers	**Topic 9: Basic Properties of 3-Port Networks, Circulators, T-Junction Power Divider, Wilkenson Power Divider.**	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand how RF components constitute RF transmitters and receivers	**Topic 10 : 4-Port Networks:** Directional Couplers, Quadrature (90°) Hybrid Coupler, 180° Hybrid Coupler, Magic T, 4-Port Circulator	Lecture, Discussion, Problem based learning	Problem solving, Assignment
Understand how RF components constitute	**Topic 11: Microwave Filter Design-I:** Filter design by the insertion	Lecture, Discussion, Problem based learning	Problem solving, Assignment

RF transmitters and receivers	loss method, Filter transformations, Stepped-impedance low-pass filters.		

Recommended Books

Text Books:

D. M. Pozar, Microwave Engineering, 4th ed., John Wiley & Sons, 2012.

Reference Books:

[1] Ahmad Shahid Khan, Microwave Engineering Concepts and Fundamentals, CRC Press, 2014.

[2] R. Sorrentino and G. Bianchi, Microwave and RF Engineering, John Wiley & Sons, 2010

[3] M. Steer, Microwave and RF Design, 1st ed., SciTech Publishers, 2010.

[4] R. E. Collin, Foundations for Microwave Engineering, 2nd ed., Wiley-IEEE Press, 2001.

Assessment Plan:

Attendance	**7%**
Quiz	**15%**
Assignment	**5%**
Presentation	**8%**
Mid Term	**25%**
Final	**40%**