Course Title: Microwave Devices and Systems
Course Code: ETEG 408
Credit Hours: 3

Course Description:
This course focuses on microwave technology from a systems viewpoint

Course Contents:

Unit 1: Microwave Communication Basics
Introduction of microwave frequency spectrum, Microwave band designation; Overview of waveguide; Overview of microwave hybrid circuits- waveguide tees (E & H plane), Magic tees, Hybrid ring, Directional coupler, Circulator, Isolator; Waveguide corners, Bend and twist; Tunnel and Gunn diodes; Strip-line and Micro-strip; Microwave linear beam tubes (O Type)- Klystron, Traveling wave tube; Microwave crossed field tubes (M Type)- Magnetron; SAW devices- Characteristic, Operation.

Unit 2: Microwave Radio Relay Systems
Overview of terrestrial microwave radio relay system; Microwave link repeater system; Link design considerations and site selection; Multipath effect and mitigation using Fresnel zones clearance; ITU-T recommendations (G.826)

Unit 3: Satellite and Space Communication
Development of communication satellite system; Satellite Characteristics- Common frequency band, orbits and swaths; Kepler's laws, Geostationary satellite; Doppler shift; Link budgets; Carrier to noise ratio; Pros and Cons of satellite communication; Applications of communication satellite.

Unit 4: Radio Detection and Ranging Systems
Principle of Radio Detection and Ranging (RADAR); Classification of RADAR; Pulse radar- The radar equation, Noise, Radar cross section, Pulse integration; Doppler radar- System block diagrams, Continuous Wave (CW) Doppler radar, Frequency Modulated Continuous Wave (FMCW) radar, Moving Target Indicator (MTI) radar; Search and tracking radar, Primary and secondary radar, RADAR Display.

Unit 5: Microwave Navigation Systems
Overview of Global Navigation Satellite System (GNSS); Global Positioning System (GPS)- Principle, working and application; Overview of GLONASS, Very High Frequency Omni-directional Radio Range (VOR), Doppler VOR.

Unit 6: Microwave Hazard, Limit and Safety
Hazard of microwave radiation; Safety limit for radiation exposure; Permissible Exposure Level (PEL)- Specific Absorption Rate (SAR); Radiation protection and safety.

References:
1. John Griffiths, *Radio Wave Propagation and Antennas,* PHI

2. George Kennedy, *Electronic Communication Systems (3rd Ed)*, Tata McGraw Hill
3. J. J. Spilker, *Digital Communications by Satellite*, Prentice Hall

Evaluation:
In-Semester Evaluation: 50%
End-Semester Evaluation: 50%