Course Outline

Code	Course Title	T-P-Pj (Credit)	Prerequisite
CSCU2080	Communication Systems Domain	4-8-6 (18)	NIL

Course Division

1. Microwave & RADAR Communications (2-1-0)
2. Satellite & TV Communications (1-2-0)
3. Cell Site and BTS Operation, Maintenance and Troubleshooting: RF Planning and Drive Test (0-3-0)
4. Optics and Wireless Sensor Networks (1-2-0)
5. Project (0-0-6)

Objective

- Develop the skills required to design a next generation wireless networks
- To involve the students in the theory and practice of optical and wireless sensor networks

Course outcome

- Various Communications available and its challenges in modern era
- Antenna designs for high frequency applications
- Wireless Sensor Network Set up using Arduino with Wireless Modules
- Installation of BTS and measuring different RF factors involved

Evaluation Systems

As perUniversity Norms

Course content

1. Microwave & RADAR Communications (2-1-0) (33 Hours)

1.1 Introduction to Microwaves: Microwave frequencies

1.2 Scattering matrix formulation

1.3 Passive microwave devices

1.4 Active Microwave Devices

1.5 Study of field pattern of various modes inside a rectangular waveguide

1.6 Microwave Measurements

1.7 Transit time limitations in Microwave Bipolar Transistors

1.8 Power frequency limitations Microwave Field Effect Transistors

1.9 Gunn Effect

1.10 IMPATT diodes

1.11 TRAPATT diodes

1.12 Microwave vacuum tube based devices

1.13 Limitations of conventional tubes at UHF

1.14 Microwave Klystron

1.15 Reflex klystron,

1.16 Traveling wave tube

1.17 Magnetron

1.18 Introduction to Smith chart and its application for the unknown impedance measurement

1.19 Scattering Matrix Parameters

1.20 Introduction to radar and RADAR Parameters

1.21 MTI RADAR

1.22 FMCW RADAR

1.23 Tracking RADAR

1.24 Monpulse RADAR

1.25 RADAR Receiver

1.26 Synthetic Aperture RADAR

Text Books:

1. R E Collin, “Foundation for Microwave Engineering”, John Wiley & Sons, 2nd Edition, 2007

2. S Y LIAO, “Microwave Devices and Circuits”, PHI, 3rd Edition, 2003.

3. Merrill I skolnik, “Introduction to Radar Systems’, McGraw Hill, 2nd Edition,2007.
4. G S N Raju, “Radar Engineering and Fundamentals of Navigational Aids”, IK international Publishers, 2008
5. G S N Raju, “Microwave Engineering ”, IK international Publishers, 2008.
6. Radar Systems Analysis And Design Using Matlab® Third Edition, Bassem R. Mahafza Decibel Research Inc. Huntsville, Alabama, Usa ,Crc Press Taylor & Francis Group

2. Satellite & TV Communications (32 Hours) (1-2-0)

2.1 Configuration of a satellite communications system
2.2 Types of orbit
2.3 Radio regulations
2.4 Keplerian orbits
2.5 Useful orbits for satellite communication
2.6 Perturbations of orbits
2.7 Digital video broadcasting via satellite (DVB-S)
2.8 Second generation DVB-S
2.9 Digital transmission of telephony
2.10 Digital broadcasting of television
2.11 Configuration of a link
2.12 Uplink received power
2.13 Downlink received power
2.14 Additional losses
2.15 Noise power spectral density at the receiver input
2.16 Individual link performance
2.17 Influence of the atmosphere
2.18 Mitigation of atmospheric impairments
2.19 Overall link performance with transparent satellite
2.20 Overall link performance with regenerative satellite
2.21 Study of 5G new radio (NR) standard, modulation Techniques used for 2G-5G

Case Study: A field report as a part of practice will be submitted by visiting the Nearest center and observing the satellite links and TV transmission techniques .

Text Book

1. Satellite communications systems / Gerard Maral, Michel Bousquet. — 5th ed, wiley , 2010.

2. Satellite Communications, by Dennis Roddy (Fourth edition), McGraw Hill

3. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt (Second Edition), John Wiley & Sons

3. Cell Site and BTS Operation, Maintenance and Troubleshooting: RF Planning and Drive Test (36 Hours) (0-3-0)

3.1 Antennas for mobile Tower

3.2 Power supply at BTS

3.3 Equipment used in the Shelter

3.4 Power Interface Unit (PIU)

3.5 Line Conditioning Unit (LCU)

3.6 Free Cooling Unit (FCU)

3.7 Preventive Maintenance (PM) & site management

3.8 Basic functioning of alarm box and the interface

3.9 Concept on TRX & Baseband receiver unit.

3.10 RF Propagation path loss

3.11Frequency hopping and Planning

3.12 RF Optimization

3.13 GSM RF Drive Test

3.14 3G Optimization

3.15 EMF Radiation Calculation and testing

3.16 4G Optimization

Text Book:

1. “Telecom Tower Maintenance” Vol. 1, Navkar Center for Skills, 2014.

2. Advanced cellular network planning and optimization 2G/2.5G/3G. . .evolution to 4G , Author: Ajay R Mishra, Nokia Networks, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England

3. Radio Network Planning and Optimisation for UMTS,Second Edition,JaanaLaiho and AchimWacker, Nokia Group, Finland, Toma´ sˇ Novosad,,Nokia Networks, Nokia Group, USA, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England

4. Material: E1-E2 Upgradation Course –Consumer Mobility, RF Planning and Drive Test

5. Material: GTL , RF Optimisation.

4. Optical and Wireless Sensor Networks (1-2-0) (33 Hours)

4.1 Propagation of signals in optical fiber:

4.2. Transmission characteristics of optical fiber

4.3 .Optical fiber Transmitters.

4.4. Optical Components.

4.5 Optical fiber loss measurement using power meter, LASER and OTDR.

4.6. Layered Protocol Model in the Transport Network.

4.7. SONET and SDH, Architecture of Optical Transport Networks (OTNs)

4.8 Implementation and performance analysis of TCP/IP protocols. Tools to be used: NS2 Simulator and Socket Programming

4.9. Challenges for Wireless Sensor Networks.

4.10. Single-Node Architecture - Hardware Components.

4.11. Network Architecture - Sensor Network Scenarios

4.12. Physical Layer and Transceiver Design Considerations.

4.13. Routing Protocols.

4.14. Topology Control, Clustering.

4.15 Arduino and Wireless Communications

4.16. Sensor Tasking and Control.

4.17 WSN using Arduino with Wireless modules

4.18 MATLAB Experiments Related to Compressed Sensing for Energy Efficient WSN

4.19. Sensor Node Hardware – Berkeley Motes, Programming Challenges.

4.20. Node-level Software platforms, Node-level Simulators.

TEXT Books

1. John M. Senior, "Optical fiber communication", Pearson edition, 2000

2. Uyless Black "Optical Networks ", Pearson Education , 2011.

3. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005

4. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

Reference books:

1. Rajiv Ramswami and K. N. Sivarajan, "Optical Networks", Morgon Kauffman Publishers, 2008.

2. Gerd Kaiser, "Optical fiber Communication Systems", John Wiley, New York, 2009.

3. Feng Zhao and Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.