GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Wireless Communication Systems and Networks (EC)

Semester: I

Subject Name: **Wireless Communication Networks**

Sr.No	Course content
1.	**Introduction to Wireless Networks:** Evolution of Wireless Networks, Early Mobile Telephony, Analog Cellular Telephony, Digital Cellular Telephony, Cordless Phones, Wireless Data systems, Fixed Wireless Links, Satellite Communication Systems, Third Generation Cellular Systems and Beyond, Challenges, Wireless Medium Unreliability, Spectrum Use, Power Management, Security, Location/Routing, Interfacing with Wired Networks.
2.	**Wireless Communications Principles and Fundamentals:** Introduction, The Electromagnetic spectrum, Transmission Bands and their Characteristics, Spectrum Regulation, Wireless Propagation Characteristics and Modeling, Wireless Propagation Modeling, Bit Error Rate (BER) Modeling of Wireless Channels, Analog and Digital Data Transmission, Voice Coding, Analog Modulation, Digital Modulation, Multiple Access for Wireless Systems, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), ALOHA-Carrier Sense Multiple Access (CSMA), Polling Protocols, Performance Increasing Techniques for Wireless Networks, Diversity Techniques, Coding, Equalization, Power Control, Multisubcarrier Modulation, The Cellular Concept, Mobility Issues: Location and Handoff, The Ad Hoc and Semi Ad Hoc Concepts, Network Topology Determination, Connectivity Maintenance, Packet Routing, The Semi Ad Hoc Concept, Wireless Services: Circuit and Data (Packet) Mode, Circuit Switching, Packet Switching, Data Delivery Approaches, Pull and Hybrid Systems, Push Systems, The Adaptive Push System, Overview of Basic Techniques and Interactions Between the Different Network Layers,
3.	**First Generation (1G) Cellular Systems:** Advanced Mobile Phone System (AMPS), AMPS Frequency Allocations, AMPS Channels, Nordic Mobile Telephony (NMT), NMT Architecture, NMT Frequency Allocations, NMT Channels, Network Operations: Mobility Management, Network Operation, NMT Security,
4.	**Second Generation (2G) Cellular Systems:** Introduction, Speech Coding, Radio Transmission Characteristics, Channels, IS-136, cdmaOne (IS-95), cdmaOne Protocol Architecture, Network Architecture-Radio Transmission, Channels, Network Operations, GSM, Network Architecture, Speech Coding, Radio Transmission Characteristics, Channels, Network Operations, GSM Authentication and Security, IS-41, Network Architecture, Inter-system Handoff, Automatic Roaming, Data Operations, CDPD, HCSD, GPRS, D-AMPS1, cdmaTwo (IS-95b), TCP/IP on Wireless-Mobile IP, WAP

5.	**Third Generation (3G) Cellular Systems:** 3G Concerns, 3G Spectrum Allocation, Spectrum Requirements, Enabling Technologies, Third Generation Service Classes and Applications, Third Generation Service Classes, Third Generation Applications, Third Generation Standards, Standardization Activities: IMT-2000, Radio Access Standards, Fixed Network Evolution
6.	**Future Trends:** Fourth Generation (4G) Systems and Beyond, Orthogonal Frequency Division Multiplexing (OFDM), 4G Services and Applications, Predicting the Future of Wireless Systems, Trends for Next-generation Wireless Networks
7.	**Satellite Networks:** Introduction, Historical Overview, Satellite Communications Characteristics Spectrum Issues, Applications of Satellite Communications, Satellite Systems, Low Earth Orbit (LEO), Medium Earth Orbit (MEO), Geosynchronous Earth Orbit (GEO), Elliptical Orbits, VSAT Systems, Examples of Satellite-based Mobile Telephony Systems, Iridium, Globalstar, Satellite-based Internet Access, Architectures, Routing Issues, TCP Enhancement
8.	**Fixed Wireless Access Systems** Wireless Local Loop versus Wired Access, Wireless Local Loop, Multichannel Multipoint Distribution Service (MMDS), Local Multipoint Distribution Service (LMDS), Wireless Local Loop Subscriber Terminals (WLL), Wireless Local Loop Interfaces to the PSTN, IEEE 802.16 Standards
9.	**Wireless Local Area Networks:** Introduction , Benefits of Wireless LANs, Wireless LAN Applications, Wireless LAN Concerns, Wireless LAN Topologies ,Wireless LAN Requirements, The Physical Layer, The Infrared Physical Layer, Microwave-based Physical Layer Alternatives,The Medium Access Control (MAC) Layer,The HIPERLAN 1 MAC Sublayer, The IEEE 802.11 MAC Sublayer, 802.11a,802.11b, 802.11g
10.	**Wireless ATM and Ad Hoc Routing:** Introduction, ATM, Wireless ATM, Wireless ATM Architecture, The Radio Access Layer, Mobile ATM, HIPERLAN 2: An ATM Compatible WLAN, Network Architecture, The HIPERLAN 2 Protocol Stack, Routing in Wireless Ad Hoc Networks, Table-driven Routing Protocols, On-demand Routing Protocols
11.	**Personal Area Networks (PANs):** Introduction to PAN Technology and Applications, Historical Overview, PAN Concerns, PAN Applications, Commercial Alternatives: Bluetooth ,The Bluetooth Specification, The Bluetooth Radio Channel, Piconets and Scatternets Inquiry, Paging and Link Establishment, Packet Format, Link Types, Power Management, Security, Commercial Alternatives: HomeRF, HomeRF Network Topology, The HomeRF Physical Layer, The HomeRF MAC Layer
12.	**Security Issues in Wireless Systems** :

	The Need for Wireless Network Security, Attacks on Wireless Networks, Security Services, Wired Equivalent Privacy (WEP) Protocol, Mobile IP, Weaknesses in the WEP Scheme,Virtual Private Network (VPN), Point-to-Point Tunneling Protocol (PPTP), Layer-2 Transport Protocol (L2TP),Internet Protocol Security (IPSec)
13.	**Simulation of Wireless Network Systems:** Basics of Discrete-Event Simulation, Subsystem Modeling, Variable and Parameter Estimation,Selection of a Programming Language/Package, Verification and Validation (V&V), Applications and Experimentation, Simulation Models, Common Probability Distributions Used in Simulation, Random Number Generation, Linear-Congruential Generators (LCG), Midsquare Method, Tausworthe Method, Extended Fibonacci Method, Testing Random Number Generators, Random Variate Generation, The Inverse Transformation Technique, Rejection Method, Composition Technique, Convolution Technique, Characterization Technique,
14.	**Economics of Wireless Networks:** Introduction, Scope of the Chapter, Economic Benefits of Wireless Networks, The Changing Economics of the Wireless Industry, Terminal Manufacturers, Role of Governments 384 Infrastructure Manufacturers, Mobile Carriers, Wireless Data Forecast, Enabling Applications Technological Alternatives and their Economics, Charging Issues, Mobility Charges, Roaming Charges, Billing: Contracts versus Prepaid Time, Charging.

Reference Books:

1. Wireless Networks By P. Nicopolitidis, M. S. Obaidat, G. I. Papadimitriou, A. S. Pomportsis John Wiley & Sons
2. Wireless Networks: Research, Technology and Applications By Jia Feng, Nova Science Publishers, Incorporated