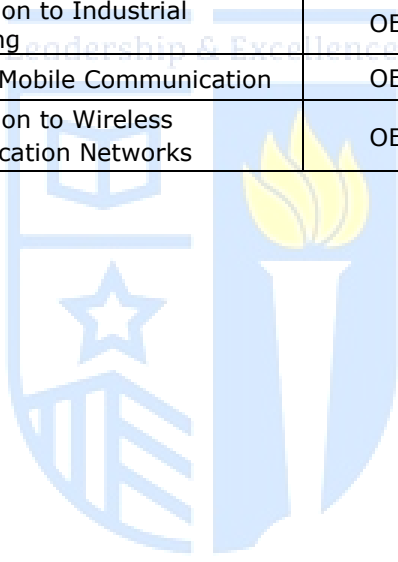


**B.E.COMPUTER AND COMMUNICATION ENGINEERING**  
**Regulation 2019**  
**OPEN ELECTIVES (OE)**

**(Offered by Department of Computer and Communication Engineering)**

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	U19CC601	Multi-Core Architecture and Programming	OE	3	3	0	0	3
2	U19CC602	Service Oriented Architecture	OE	3	3	0	0	3
3	U19CC603	Network Protocols	OE	3	3	0	0	3
4	U19CC604	Software Defined Networks	OE	3	3	0	0	3
5	U19CC605	GPU Architecture and Programming	OE	3	3	0	0	3
6	U19CC606	High Speed Networks	OE	3	3	0	0	3
7	U19CC607	Introduction to Industrial Networking	OE	3	3	0	0	3
8	U19CC608	Basics of Mobile Communication	OE	3	3	0	0	3
9	U19CC609	Introduction to Wireless Communication Networks	OE	3	3	0	0	3



<b>U19CC601</b>	<b>MULTI - CORE ARCHITECTURE AND PROGRAMMING</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Outcomes</b>	After completion of this course, the students will be able to						
	<b>CO1</b>	Visualize Multi-core Processors and its different architectures					K1
	<b>CO2</b>	Express knowledge about the synchronization primitives in challenges in parallel program					K2
	<b>CO3</b>	Observe to develop shared memory programming with Open MP					K2
	<b>CO4</b>	Apply distributed memory programming with MPI					K3
	<b>CO5</b>	Illustrate parallel architecture for real time scenarios					K2
<b>MODULE-I</b>	<b>INTRODUCTION TO MULTI-CORE PROCESSORS</b>						<b>9</b>
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.							
<b>MODULE-II</b>	<b>PARALLEL PROGRAM CHALLENGES</b>						<b>9</b>
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).							
<b>MODULE III</b>	<b>SHARED MEMORY PROGRAMMING WITH OpenMP</b>						<b>9</b>
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.							
<b>MODULE IV</b>	<b>DISTRIBUTED MEMORY PROGRAMMING WITH MPI</b>						<b>9</b>
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation							
<b>MODULE V</b>	<b>PARALLEL PROGRAM DEVELOPMENT</b>						<b>9</b>
Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.							
<b>TOTAL : 45 Hours</b>							
<b>TEXTBOOKS</b>							
1	Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kaufman/Elsevier, 2011.						
2	Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011 (unit 2)						
<b>REFERENCES</b>							
1	Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2012.						
2	William Stalling, "Computer Organization and Architecture, Designing for Performance", Pearson Education, New Delhi, 2013.						

U19CC602	SERVICE ORIENTED ARCHITECTURE		L	T	P	C
			3	0	0	3
<b>Outcomes</b>	After completion of this course, the students will be able to					
	<b>CO1</b>	Recall XML fundamentals and build applications based on XML				K1
	<b>CO2</b>	Summarize the the key principles and services of SOA to perform the service composition				K2
	<b>CO3</b>	Compare the different web services and WS standards				K2
	<b>CO4</b>	Choose web services extensions to develop solutions for real time application				K3
	<b>CO5</b>	Model and design a service-oriented system using architectural principles, development methods with SOA and service-related technologies systematically and effectively				K3
<b>MODULE-I</b>	<b>XML</b>					<b>9</b>
XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery						
<b>MODULE-II</b>	<b>SERVICE ORIENTED ARCHITECTURE (SOA) BASICS</b>					<b>9</b>
Fundamental SOA, Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures –Principles of Service Orientation – Service layers						
<b>MODULE III</b>	<b>WEB SERVICES (WS) AND STANDARDS</b>					<b>9</b>
Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography						
<b>MODULE IV</b>	<b>WEB SERVICES EXTENSIONS</b>					<b>8</b>
WS-Addressing – WS-Reliable Messaging – WS-Policy – WS-Coordination – WS -Transactions – WS-Security – Examples						
<b>MODULE V</b>	<b>SERVICE ORIENTED ANALYSIS AND DESIGN</b>					<b>10</b>
SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines – Service design – Business process design – Case Study						
<b>TOTAL : 45 Hours</b>						
<b>TEXTBOOKS</b>						
1	Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design ", Pearson Education, 2007					
2	Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004					
<b>REFERENCES</b>						
1	James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", Elsevier, 2003.					
2	Ron Schmelzer et al."XML and Web Services", Pearson Education, 2002.					
3	Frank P.Coyle, "XML, Web Services and the Data Revolution ", Pearson Education, 2002.					
4	Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education,2005.					

U19CC603	NETWORK PROTOCOLS			L	T	P	C
				3	0	0	3
<b>Outcomes</b>	After completion of this course, the students will be able to						
	<b>CO1</b>	Understand the Basics of Protocols, Addressing and its Functions in Computer Networks.					K2
	<b>CO2</b>	Identify the Different Types of IP Addressing and its Functions in the Networks.					K2
	<b>CO3</b>	Summarize Functionalities of Internet Protocol and its Elements.					K1
	<b>CO4</b>	Describe and Analysis the Basics of TCP Protocol Design and Operations.					K4
	<b>CO5</b>	Identify the Different Types TCP/IP Family of Network Protocols within the Network.					K2
<b>MODULE-I</b>	<b>PROTOCOLS AND STANDARDS</b>						<b>10</b>
Protocols and Standards- Internet Standards-Protocol Layers-OSI Reference Model-TCP/IP Protocol Suite-Addressing: Physical, Logical, Application And Port Addressing.							
<b>MODULE-II</b>	<b>IP ADDRESSING</b>						<b>8</b>
Address Space- Notation- Range of Addresses-Classful Addressing: Classes And Blocks- Two-Level Addressing- Subnetting And Supernetting-Classless Addressing: Variable-Length Blocks- Two-Level Addressing- Block Allocation.							
<b>MODULE III</b>	<b>INTERNET PROTOCOL</b>						<b>8</b>
TCP/IP Protocol Suite -Datagram-Fragmentation-Options- Checksum-Security: Packet Sniffing, Packet Modification, IP Spoofing-IP Packaging-Internet Control Message Protocol: Messages and Formats- Error Reporting-Query- Checksum- Internet Control Message Protocol Design.							
<b>MODULE IV</b>	<b>TRANSMISSION CONTROL PROTOCOL</b>						<b>9</b>
Process To Process Communication -TCP Services -Segment -Options- Checksum-Flow Control- Error Control- TCP Timers-Connection-State Transition Diagram-Congestion Control-TCP Operation- TCP Design.							
<b>MODULE V</b>	<b>TCP/IP FAMILY PROTOCOLS</b>						<b>10</b>
User Datagram Protocol: UDP Services-UDP Applications-File Transfer Protocol: Connections-Communication-Command Processing-File Transfer-Anonymous FTP-Security For FTP- Hypertext Transfer Protocol: HTTP Overview-Message Formats- HTTP Connections-Security.							
<b>TOTAL : 45 Hours</b>							
<b>TEXTBOOKS</b>							
1	Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill Publishing Company, New Delhi, 2010.						
2	DOUGLAS E. COMER, "Internetworking With TCPI/IP Principles, Protocols, and Architecture", Pearson, 2015.						
<b>REFERENCES</b>							
1	Achyut S. Godbole, AtulKahate, "Data Communications and Networks",Tata McGraw Hill Publishing Company, New Delhi, 2011.						
2	William Stallings "Data and Computer Communications", Pearson Prentice-Hall, New Delhi, 2011.						
3	W. Richard Stevens, "TCP/IP Illustrated: The Protocols", Addison-Wesley Professional, 2011.						

<b>U19CC604</b>	<b>SOFTWARE DEFINED NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Outcomes</b>	After completion of this course, the students will be able to				
	<b>CO1</b>	Understand the fundamentals of software defined networks.			K2
	<b>CO2</b>	Implement the operation of SDN control plane with different controllers.			K3
	<b>CO3</b>	Apply the use of SDN in the current networking scenario.			K3
	<b>CO4</b>	Utilize the Interfaces and tools for SDN Programming.			K3
	<b>CO5</b>	Design and develop various applications of SDN.			K5
<b>MODULE-I</b>	<b>FUNDAMENTALS OF SOFTWARE DEFINED NETWORKS</b>				<b>9</b>
Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.					
<b>MODULE-II</b>	<b>OPEN FLOW &amp; SDN CONTROLLERS</b>				<b>9</b>
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.					
<b>MODULE III</b>	<b>DATA CENTERS</b>				<b>9</b>
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE.					
<b>MODULE IV</b>	<b>SDN PROGRAMMING</b>				<b>9</b>
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.					
<b>MODULE V</b>	<b>APPLICATIONS</b>				<b>9</b>
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring.					
<b>TOTAL : 45 Hours</b>					
<b>TEXT BOOKS</b>					
1	William Stallings, "Foundations of Modern Networking", Pearson Ltd.,2016.				
2	Paul Goransson and Chuck Black, –Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.				
<b>REFERENCES</b>					
1	Thomas D. Nadeau, Ken Gray, –SDN: Software Defined Networks, O'Reilly Media, 2013.				
2	SiamakAzodolmolky, –Software Defined Networking with Open Flow, Packet Publishing, 2013.				
3	Vivek Tiwari, –SDN and Open Flow for Beginnersll, Amazon Digital Services, Inc., 2013.				
4	Fei Hu, Editor,- Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.				

U19CC605	GPU ARCHITECTURE AND PROGRAMMING			L	T	P	C	
				3	0	0	3	
<b>Outcomes</b>	After completion of this course, the students will be able to							
	<b>CO1</b>	Identify GPU Architecture.					K3	
	<b>CO2</b>	Make use of programs using CUDA, identify issues and debug them.					K3	
	<b>CO3</b>	Experiment with efficient algorithms in GPUs for common application kernels, such as matrix multiplication					K3	
	<b>CO4</b>	Build simple programs using OpenCL					K3	
	<b>CO5</b>	Interpret efficient parallel programming patterns to solve problems					K2	
<b>MODULE-I</b>	<b>FUNDAMENTALS OF GPU ARCHITECTURE AND PROGRAMMING</b>						<b>9</b>	
Evolution of GPU architectures – Understanding Parallelism with GPU – Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA								
<b>MODULE-II</b>	<b>MULTI GPU AND CUDA</b>						<b>9</b>	
Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.								
<b>MODULE III</b>	<b>ISSUES IN PROGRAMMING CUDA</b>						<b>9</b>	
Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.								
<b>MODULE IV</b>	<b>OPENCL</b>						<b>9</b>	
OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – OpenCL Examples.								
<b>MODULE V</b>	<b>ALGORITHMIC IMPLEMENTATION OF GPU</b>						<b>9</b>	
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.								
<b>TOTAL : 45 Hours</b>								
<b>TEXTBOOKS</b>								
1	Shane Cook, CUDA Programming: –A Developer’s Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.							
2	David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, –Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.							
<b>REFERENCES</b>								
1	Nicholas Wilt, –CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison – Wesley, 2013.							
2	Jason Sanders, Edward Kandrot, –CUDA by Example: An Introduction to General Purpose GPU Programming, Addison – Wesley, 2010.							
3	David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.							

U19CC606	HIGH SPEED NETWORKS			L	T	P	C	
				3	0	0	3	
<b>Outcomes</b>	After completion of this course, the students will be able to							
	<b>CO1</b>	Understand the Basics of Architecture of ATM and High Speed LANs.					K2	
	<b>CO2</b>	Able to Understand and Analyse the Congestion Control in Various Scenarios within the Packet Switching Networks.					K2	
	<b>CO3</b>	Describe and Analysis the a Range of Traffic Managements In ATM.					K4	
	<b>CO4</b>	Explain the Basic Taxonomy in High Speed Wireless LANs and Architecture Implementation.					K2	
	<b>CO5</b>	Compare and Select Appropriate Modes in Wireless ATM Networks.					K4	
<b>MODULE-I</b>	<b>HIGH SPEED NETWORKS</b>						<b>9</b>	
Asynchronous Transfer Mode – ATM Protocol Architecture, ATM Logical Connection – ATM Cell – ATM Service Categories – AAL. High Speed LANs – Fast Ethernet – Gigabit Ethernet – Fibre Channel – Wireless LAN’s Applications, Requirements – Architecture Of IEEE 802.11.								
<b>MODULE-II</b>	<b>QUEUING ANALYSIS AND CONGESTION CONTROL</b>						<b>9</b>	
Single Server Queues – Multiserver Queues – Queues with Priorities – Networks of Queues –Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.								
<b>MODULE III</b>	<b>ATM CONGESTION CONTROL</b>						<b>9</b>	
Traffic and Congestion Control in ATM – Requirements – Attributes – Traffic Management Frame Work – Traffic Control – ABR Traffic Management – ABR Rate Control – RM Cell Formats – ABR Capacity Allocations – GFR Traffic Management.								
<b>MODULE IV</b>	<b>HIGH SPEED WIRELESS LAN</b>						<b>8</b>	
Classification Of Wireless LANs: Radio LANs-Direct Sequence Spread Spectrum-Frequency Hopping Spread Spectrum-Comparison-Infrared LANs-Wireless LAN Implementation-Components-Protocol Architecture-LAN Topologies-Deployment- Performance Of Wireless LANs.								
<b>MODULE V</b>	<b>WIRELESS ATM Networks</b>						<b>10</b>	
ATM Technology: Comparison of Transfer Modes, ATM vs IP- Need for Wireless ATM-Wireless Communication using ATM-Multimedia Communications using Wireless ATM.								
<b>TOTAL : 45 Hours</b>								
<b>TEXTBOOKS</b>								
1	William Stallings, “High-speed Networks and Internet”, Pearson Education, 2nd Edition, 2002.							
2	Benny Bing, “High-Speed Wireless ATM and LANs”, Artech House Publishers, 2000.							
<b>REFERENCES</b>								
1	Jean Warland, PravinVaraiya, “High-performance Communication Networks”, Jean Harcourt Asia Private Limited, 2nd Edition, 2000.							
2	Abhijit S. Pandya, ErcanSen, “ATM Technology for Broadband Telecommunications Networks”, CRC Press, 2004.							
3	William Stallings, “High-speed Networks: TCP/IP and ATM Design Principles”, PHI, 2nd Edition, 2008.							

U19CC607	INTRODUCTION TO INDUSTRIAL NETWORKING		L	T	P	C
			3	0	0	3
<b>Outcomes</b>	After completion of this course, the students will be able to					
	<b>CO1</b>	Understand the basic concepts of data networks				K2
	<b>CO2</b>	Familiarise the basics of inter networking and serial communications				K3
	<b>CO3</b>	Understand the details on HART and Field buses				K2
	<b>CO4</b>	Understand on MODBUS, PROFIBUS and other communication protocol				K2
	<b>CO5</b>	Understand the industrial Ethernet and wireless communication				K2
<b>MODULE-I</b>	<b>DATA NETWORK FUNDAMENTALS</b>					<b>9</b>
Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing - CSMA/CD, TCP/IP						
<b>MODULE-II</b>	<b>INTERNET WORKING and RS 232, RS 485</b>					<b>9</b>
Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Devicenet						
<b>MODULE III</b>	<b>HART AND FIELDBUS</b>					<b>9</b>
Introduction - Evolution of signal standard - HART communication protocol - HART networks - HART commands - HART applications - Field bus - Introduction - General Field bus architecture - Basic requirements of Field bus standard - Field bus topology - Interoperability - Interchangeability - Introduction to OLE for process control (OPC).						
<b>MODULE IV</b>	<b>MODBUS AND PROFIBUS PA/DP/FMS AND FF</b>					<b>9</b>
MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation field bus - Data Highway						
<b>MODULE V</b>	<b>INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION</b>					<b>9</b>
Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.						
<b>TOTAL : 45 Hours</b>						
<b>TEXTBOOKS</b>						
1	Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting’ Newnes Publication, Elsevier First Edition, 2004					
2	A. Behrouz Forouzan, Data Communications & Networking ,3RD edition, Tata Mc Graw hill,2006.					
<b>REFERENCES</b>						
1	Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.					
2	Theodore S Rappaport, Wireless Communication: Principles and Practice, Prentice Hall of India 2nd Edition, 2001.					
3	William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.					



U19CC608	BASICS OF MOBILE COMMUNICATION	L	T	P	C
		3	0	0	3
<b>Outcomes</b>	After completion of this course, the students will be able to				
	<b>CO1</b>	<b>(Understand)</b> Understand the wireless communication and medium used for cellular systems.			<b>K2</b>
	<b>CO2</b>	<b>(Understand)</b> Understand the basics of mobile telecommunication system and the architecture			<b>K2</b>
	<b>CO3</b>	<b>(Understand)</b> Understand the architecture of Wireless LAN technologies			<b>K2</b>
	<b>CO4</b>	<b>(Understand)</b> Determine the functionality of network layer and transport layer and illustrate the generations of wireless networks			<b>K2</b>
	<b>CO5</b>	<b>(Understand)</b> Know the functionalities of application layer and associated languages and operating system in mobile communications			<b>K2</b>
<b>MODULE-I</b>	<b>WIRELESS TRANSMISSION AND CHANNEL</b>				<b>9</b>
Introduction: Applications, History of wireless communication. Wireless Transmission: Frequencies for radio transmission, Signal Propagation, Cellular Systems. Medium Access Control: Motivation for a specialized MAC, SDMA, FDMA, TDMA and CDMA.					
<b>MODULE-II</b>	<b>MOBILE COMMUNICATION SYSTEMS</b>				<b>9</b>
Mobile Communication systems: GSM Mobile services, System Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, New Data services. Satellite systems: Overview and applications. Broadcast systems: Overview, DAB and DVB, Convergence of Broadcasting and Mobile communication.					
<b>MODULE III</b>	<b>WIRELESS LAN</b>				<b>8</b>
Wireless LAN: Infra red vs. radio transmission, Infrastructure and ad-hoc network, IEEE 802.11, HIPERLAN, Bluetooth.					
<b>MODULE IV</b>	<b>MOBILE NETWORK LAYER AND TRANSPORT LAYER</b>				<b>9</b>
Mobile Network Layer and Transport Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile ad-hoc networks, Traditional and classical TCP and TCP over 2.5/3G wireless networks.					
<b>MODULE V</b>	<b>APPLICATION LAYER</b>				<b>10</b>
Application Layer: Wireless Application Protocol, Architecture, Wireless datagram protocol, wireless transport layer security, wireless transaction protocol, wireless session protocol, wireless application environment, wireless mark-up language, WMLScript, I-mode, SuncML, WAP2.0, Mobile Application Languages: Mobile application Development, XML, JAVA, Java 2 Micro Edition, Java card, Mobile Operating system: Window Mobile and CE, Android.					
<b>TOTAL : 45 Hours</b>					
<b>TEXTBOOKS</b>					
1	Jochen Schiller, "Mobile communications" Pearson, 2 <sup>nd</sup> edition 2009				
2	Clint Smith, Daniel Collins, "Wireless Networks", Third Edition, McGraw Hill Publications, 2014.				
<b>REFERENCES</b>					
1	Raj Kamal, "Mobile Computing" Ocford University Press 2 <sup>nd</sup> Edition				
2	Prasanth Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd., New Delhi, 2012				

U19CC610	INTRODUCTION TO WIRELESS COMMUNICATION NETWORKS			L	T	P	C	
				3	0	0	3	
Outcomes	Upon completion of this course, students will be able to							
	CO1	<b>(Understand)</b> Understand the basics of wireless communication systems					K2	
	CO2	<b>(Understand)</b> Explore and study cellular system concepts based on resource availability					K2	
	CO3	<b>(Analyze)</b> Analyze the performance of various modulation schemes.					K4	
	CO4	<b>(Understand)</b> Understand the concepts of various MIMO systems.					K2	
	CO5	<b>(Understand)</b> Understand the basic wireless networking concepts.					K2	
<b>MODULE I</b>	<b>SERVICES AND TECHNICAL CHALLENGES</b>						<b>9</b>	
Types of Services, Requirements for the services and Technical Challenges of wireless communication-Multipath propagation, Spectrum Limitations, Noise and Interference limited systems.								
<b>MODULE II</b>	<b>CELLULAR COMMUNICATION CONCEPTS</b>						<b>9</b>	
Introduction - frequency reuse - channel assignment - handoff - coverage and capacity improvement, Multiple Access techniques – TDMA,FDMA,CDMA, SDMA.								
<b>MODULE III</b>	<b>WIRELESS TRANSCIVERS</b>						<b>9</b>	
Structure of a wireless communication link, Modulation and demodulation – Quadrature Phase Shift Keying, pi/4-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Binary Frequency Shift Keying, Minimum Shift Keying, Gaussian Minimum Shift Keying, OFDM Principles.								
<b>MODULE IV</b>	<b>MULTIPATH MITIGATION AND MIMO SYSTEMS</b>						<b>9</b>	
Equalization – Adaptive equalization, Linear and Non-Linear equalization. Diversity – Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver. MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming.								
<b>MODULE V</b>	<b>WIRELESS NETWORKS</b>						<b>9</b>	
Introduction-IEEE 802.11 project – Bluetooth – WiMAX- IEEE project 802.16 – Cellular Telephony – Generations, satellite communication Networks- GEO satellite, MEO Satellites, LEO Satellites.								
							<b>TOTAL: 45 HOURS</b>	
<b>TEXTBOOK:</b>								
1	Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2 <sup>nd</sup> Edition.							
<b>REFERENCES:</b>								
1	Rappaport,T.S., “Wireless communications”, Second Edition, Pearson Education, 2010.							
2	Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011							
3	Simon Haykin& Michael Moher, “Modern Wireless Communications”, Pearson Education, 2007.							
4	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.							