M.TECH. (FULL TIME)
MOBILE AND PERVASIVE COMPUTING
CURRICULUM AND SYLLABUS
2018 – 2019

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
SRM NAGAR, KATTANKULATHUR – 603 203

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.Tech- MOBILE AND PERVASIVE COMPUTING
CURRICULUM–2018-19

COURSE CODE	COURSE NAME	L	T	P	C
	SEMESTER I				
CS2031	Mobile Architecture and Programming	3	0	2	4
CS2032	Algorithms for Distributed Networks	4	0	0	4
CS2033	Wireless Communications and Technologies	3	0	2	4
CAC2001	Career Advancement Course For Engineers - I	1	0	1	1
	Program Elective- I	3	0	0	3
	Program Elective- II	3	0	0	3
	TOTAL	**17**	**0**	**5**	**19**
	Total Contact Hours: 22				
	SEMESTER II				
CS2034	Wireless Sensor Protocols and Programming	3	0	2	4
CS2035	Wireless Communication Protocols	3	0	2	4
CS2036	Advanced Mobile Computing	4	0	0	4
CAC2002	Career Advancement Course For Engineers - II	1	0	1	1
	Program Elective- III	3	0	0	3
	Program Elective- IV	3	0	0	3
	TOTAL	**17**	**0**	**5**	**19**
	Total Contact Hours:22				
	SEMESTER III				
	Program Elective- V	3	0	0	3
	Program Elective- VI	3	0	0	3
CAC2003	Career Advancement Course For Engineers - III	1	0	1	1
CS2047	Seminar	0	0	2	1
CS2049	**Project Phase I**	0	0	12	6
	TOTAL	**7**	**0**	**15**	**14**
	Total Contact Hours:22				
	SEMESTER IV				
CS2050	**Project Phase II**	0	0	32	**16**
	Semester I-III				
	Supportive course (1 course of 3 credits in I or II or III sem.)	3	0	0	3
	Interdisciplinary Elective (1course of 3 credits in I or II or III sem.)	3	0	0	3
	TOTAL	**6**	**0**	**0**	**6**

COURSE CODE	COURSE NAME	L	T	P	C
	TOTAL CREDITS	**74**			

Total credits to be earned for the award of M.Tech degree – 74 credits

PROGRAM ELECTIVES

Course Code	Name of the course	L	T	P	C
CS2131	Embedded Systems	3	0	0	3
CS2132	Quantum Computing	3	0	0	3
CS2133	Digital Signal Processing	3	0	0	3
CS2134	Mobile User Interface Design	3	0	0	3
CS2135	Design of Distributed Systems	3	0	0	3
CS2136	Computational Optimization	3	0	0	3
CS2137	Advanced Network Technologies	3	0	0	3
CS2138	Advanced Digital Communication	3	0	0	3
CS2139	Smart Convergent Technologies	3	0	0	3
CS2140	Cryptography and Wireless Network Security	3	0	0	3
CS2141	M-commerce	3	0	0	3
CS2142	Ad-hoc Mobile Wireless Networks	3	0	0	3
CS2143	Advanced Optimization Techniques	3	0	0	3
CS2144	Big Data Analytics	3	0	0	3
CS2115	Service Oriented Architecture	3	0	0	3
CS2145	Fog Computing	3	0	0	3
CS2146	Internet of Things and Computing	3	0	0	3
CS2147	Mobile and Cellular Network Security	3	0	0	3

SUPPORTIVE COURSES

Course Code	Name of the course	L	T	P	C
MA2013	Mathematical Foundations of Computer Science	3	0	0	3
MA2010	Graph Theory and Optimization Techniques	3	0	0	3
MA2011	Stochastic Processes and Queueing Theory	3	0	0	3

NOTE:
Students have to register for the courses as per the following guidelines:

Sl. No.	Category	Credits				
		I Semester	II Semester	III Semester	IV Semester	Category total
1	Core courses	12 (3 courses)	12 (3 courses)	---	---	24
2	Program Elective courses	18 (in I to III semesters)			---	18
3	Interdisciplinary elective courses (any one program elective from other programs)	3 (One course to be taken in Semester I or II or III)				3
4	Supportive courses - mandatory	3 (One course to be taken in Semester I or II or III)			---	3
5	Career Advancement Courses	1	1	1	-	3
6	Seminar	---	---	1	---	1
7	Project work	---	---	06	16	22
	Total					74

Legend:
L - Number of lecture hours per week
T - Number of tutorial hours per week
P - Number of practical hours per week
C - Number of credits for the course

SEMESTER I

CS2031	**MOBILE ARCHITECTURE AND PROGRAMMING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	0	2	4
	Prerequisite				
	Nil				

PURPOSE	
The purpose of this course is to impart knowledge on design concepts and design of mobile architecture with programming.	
INSTRUCTIONAL OBJECTIVES	
1.	To learn of the concepts, principles of mobile networking
2.	To understand the issues involved in GSM, CDMA and mobile networking.
3.	To design mobile application with Android and Windows Framework

UNIT I: MOBILE NETWORKS **15Hours**

Cellular Network Concepts - Frequency and Interface in Cells - Access Channels - Mobile Network Architecture - Mobile Station - Base Station Subsystems - Network Switching Subsystems - Mobile Network Protocol Stacks - Core Networks - PLMN (Public Land Mobile Network) - Mobile Network Fundamentals - Mobility - Registration - Handoff - Roaming - Mobile Network Fundamentals (SMS) - SMS (Short Message Service) - SMS Network Architecture - SMS Network Elements - SMS Protocols - SMS Applications & Short Codes.

UNIT II: INTRODUCTION TO NETWORKS **15Hours**

The GSM Network - Services - The architecture of the network - Communication management - The GPRS Network - Services - Network architecture - Radio interface - The UMTS Network - services - architecture of the network - HSPA evolutions - The NGN - Network architecture - The EPS Network - Network architecture.

UNIT III: GSM and CDMA NETWORKS **15Hours**

GSM History - GSM RF Channels - GSM Protocol Stack - GPRS Standards - CS and PS Domains - GPRS Architecture - GPRS Network Architecture - GPRS Protocols - CDMA Evolution - 3GPP2 Network Architecture - Mobile IP - UMTS Spectrum - UMTS Radio Access Network - UMTS Protocol Stacks - UMTS Multiple Access Network Architecture.

UNIT IV: FRAMEWORK AND APPLICATION IN ANDRIOD 15Hours

Java for Android - Type System - Scope - Idioms - Android components - Eclipse for Android software development - About the Android framework: Building a view - Fragments and Multiplatform support - A Framework for a well-behaved application - Using and exploring Content providers - Multimedia - Location and Mapping.

UNIT V: WINDOWS COMMUNICATION FOUNDATION 15Hours

Windows Communication Foundation - WCF Terminology - WCF in the .Net Connect Framework - Creating a WCF Service - Creating a WCF Client in Windows Mobile - WCF Client Namespaces and Assemblies - WCF Client & Proxy - WCF Service - WCF Client Sample.

REFERENCES

1 Mobile Networks Architecture by Andre Perez, Wiley, March 2012
2 Wireless and Mobile Network Architectures by Yi-Bang Lin and ImrichChlamtac, Wiley-India, 2008
3 Programming Android by ZigurdMednieks, Laird Dornin, G. Blake Meike, and Masumi Nakamura, Published by O'Reilly Media, Inc. 2011
4 Programming .NET Compact Framework 3.5 By Paul Yao, David Durant, 2nd , Kindle Edition, 2009
5 Mobile Computing – Technology, Application & Service Creation by Asoke. K Talukder, Roopa R. Yavagal, Asoke K. Talukder, Tata McGraw-Hill, 2005

CS2032	ALGORITHMS FOR DISTRIBUTED NETWORKS	L	T	P	C
	Total contact Hours-60	4	0	0	4
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to impart knowledge on distributed networks and algorithms, study their computations and implementations.

INSTRUCTIONAL OBJECTIVES

At the end of the course, student will be able to

1.	To learn about the fundamentals of distributed networks and algorithm analysis techniques to solve a problem and learn to find the asymptotic efficiency of an algorithm
2.	To expertise with synchronous network algorithms including fault tolerant and time bounds for consensus
3.	To learn asynchronous distributed computing and various asynchronous shared-memory algorithms
4.	To learn asynchronous shared-memory systems and asynchronous shared-memory algorithms.
5.	To study various Transactional Memory, Self-stabilizing and Timing-based algorithms

UNIT IFUNDAMENTALS OF ALGORITHM AND DISTRIBUTED NETWORKS

12Hours

Introduction to distributed Systems –Types of networks- architecture-Synchronous–Asynchronous distributed networks. Algorithm analysis- Recurrence relations-Substitution method- Recurrence tree method- Masters Method.

UNIT II SYNCHRONOUS NETWORKS **12 Hours**

Leader election in synchronous ring networks-Leader election in rings. Basic computational tasks in general synchronous networks: leader election- Breadth-first search- Broadcast and converge cast- Shortest paths- Spanning trees- Minimum spanning trees- Maximal Independent Set.

Fault-tolerant consensus- Link failures- Process failures: stopping, Byzantine - Algorithms for agreement with stopping and Byzantine failures - Exponential information gathering algorithms. k-set-agreement- Approximate agreement-Distributed commit: Two Phase commit-Three Phase Commit.

UNIT III ASYNCHRONOUS DISTRIBUTED COMPUTING 12Hours

Asynchronous distributed computing -I/O automata-operations on automata- Proving correctness of distributed algorithms. Asynchronous network algorithms - Leader election- breadth-first search- shortest paths- broadcast and convergecast- Spanning trees-GHS algorithm-proving correctness for GHS Algorithm.

Synchronizers- Synchronizer applications. Time, clocks, and the ordering of events. Stable property detection- Distributed termination- Global snapshots- Deadlock detection.

UNIT IV ASYNCHRONOUS SHARED-MEMORY 12Hours

Asynchronous shared-memory systems- Mutual exclusion algorithms-Dijkstra's Mutual exclusion-Lockout –Free mutual exclusion- single-Writer shared registers-Bakery algorithms- Bounds on shared memory. Resource allocation- the Dining Philosophers problem- Practical mutual exclusion algorithms Reading/writing locks. Atomic object-Atomic snapshot algorithms- Atomic read/write register algorithms.

List algorithms: locking algorithms, optimistic algorithms, lock-free algorithms, lazy algorithms.

UNIT V TRANSACTIONAL MEMORY 12Hours

Transactional memory- obstruction-free and lock-based implementations -Wait-free computability-Boosting fault-tolerance. Asynchronous network model vs. asynchronous shared-memory model- Impossibility of consensus in asynchronous networks.-Failure detectors and consensus- Paxos consensus algorithm. Self-stabilizing algorithms. Timing-based algorithms for mutual exclusion and consensus-Clock synchronization.

REFERENCES

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-852j-distributed-algorithms-fall-2009/lecture-notes/
2. Nancy Lynch, "Distributed Algorithms", Morgan Kaufmann Publishers, 2005.
3. Gerard Tel, "Introduction to Distributed Algorithms", 2nd Edition, Cambridge University Press.
4. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems Concepts And Design", 5th Edition, Pearson
5. Richard Johnsonbaugh, Marcus Schaefer, "Algorithms", Pearson Education.

CS2033	**WIRELESS COMMUNICATIONS AND TECHNOLOGIES**	**L**	**T**	**P**	**C**
	Total Contact Hours-75	3	0	2	4
	Prerequisite:				
	NIL				

PURPOSE	
To impart knowledge on various wireless communication concepts.	
INSTRUCTIONAL OBJECTIVES	
At the end of the course, student will be able to	
1.	To gather knowledge about wireless communication networks and 5G mobile networks
2.	To familiar with various cells for wireless networks
3.	To acquire knowledge about 5G architecture
4.	To learn about the 5G radio access methodologies and spectrum

UNIT - I DRIVERS FOR 5G **15 Hours**

Introduction – Historical trend of wireless communication – Evolution of LTE Technology to Beyond 4G.THE 5G INTERNET – Internet of Things and context – Awareness – Network Reconfiguration and Virtualization support – Mobility – quality of Service Control – Emerging approach for resource over provisioning

UNIT-II **15 Hours**

SMALL CELLS FOR 5G MOBILE NETWORKS- Introduction – Small Cells – Capacity limits and Achievable gains with densification – Mobile data demand – Demand vs Capacity – small cell challenges. CO-OPERATION FOR NEXT GENERATION WIRELESS NETWORKS – Introduction – cooperative diversity and relaying strategies – PHY Layer Impact – MAC protocol analysis.

UNIT - III **15 Hours**

5G ARCHITECTURE – Introduction – High level requirements for 5G architecture – Fundamentals architecture and 5G flexibility – Physical Architecture and 5G deployment.

DEVICE TO DEVICE D2D COMMUNICATION – D2D: from 4G to 5G – Radio resource management for mobile brand D2D – Multihop D2D communications for proximity and emergency services – Multi-operator D2D communications.

UNIT - IV **15 Hours**

THE 5G RADIO ACCESS METHODOLOGIES Access design principles for multiuser communications – Multicarrier with filtering; a waveform – Non – orthogonal schemes

for efficient multiple access – Radio access for dense deployments – Radio access for V2x communication – Radio access for massive machine type communications.

UNIT - V **15 Hours**

SPECTRUM – Introduction – 5G spectrum landscape and requirements – Spectrum access modes and sharing scenarios.5G spectrum technologies – value of spectrum for 5G : a techno – economic perspectives

THE 5G WIRELESS PROPAGATION CHANNEL MODE – Introduction – Modeling requirements and scenarios – the METIS channel models

REFERENCES

1. Fundamentals of 5G mobile Networks, edited by Jonathan RodisQuez and Wiley
2. 5G Mobile and Wireless Communications Technologyby AfifOsseiran(ed.) ; Jose F. Monserrat(ed.) ; Patrick Marsch(ed.) ; Mischa Dohler(other) ; Takehiro Nakamura(other) june 2016.
3. William Stallings, "*Wireless Communication and Networks*", Pearson Education,2003.
4. Singhal, "*WAP-Wireless Application Protocol*", Pearson Education, 2003.
5. LotherMerk, Martin.S.Nicklaus and Thomas Stober, "*Principle of Mobile Computing*", Second Edition, Springer, 2003.
6. William C.Y.Lee, "*Mobile Communication Design Fundamentals*", John Wiley,1993
7. Roy Blake, "Wireless Communication Technology", India edition, Cengage learning. 2010.
8. UpenaDalal "Wireless Communication",Oxford Higher education, First Edition, 2009.
9. Raj Kamal, "Mobile Computing",Oxford Higher education, Second Edition, 2002.
10. J.Schiller, "*Mobile Communication*", Addison Wesley, 2000.

	ELECTIVE - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
Students to choose one Elective course from the list of courses mentioned in the curriculum					

	ELECTIVE - II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
Students to choose one Elective course from the list of courses mentioned in the curriculum					

	SUPPORTIVE COURSE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
Students to choose one course from the list of supportive courses mentioned in the curriculum either in I, II or III semester					

	INTERDISCIPLINARY ELECTIVE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
Students to choose one Elective course from the list of Post Graduate courses specified under the Faculty of Engineering and Technology other than courses under M.Tech (CSE), M.Tech (IOT), M.Tech (SDN) , M.Tech(Mobile and Pervasive Computing) curriculum either in I, II or III semester					

SEMESTER II

CS2034	**WIRELESS SENSOR PROTOCOLS AND PROGRAMMING**	**L**	**T**	**P**	**C**
	Total contact Hours:75	3	0	2	4
	Prerequisite				
	Nil				

PURPOSE	
This course provides a broad coverage of challenges and research issues to the design and management of wireless sensor networks	
INSTRUCTIONAL OBJECTIVES	
At the end of the course, student will be able to	
1.	Understand basic sensor network concepts
2.	Know physical layer issues, understand and analyze Medium Access Control Protocols
3.	Comprehend network and transport layer characteristics and protocols and implement conventional protocols
4.	Understand the network management and Middleware services

UNIT I – FUNDAMENTALS OF SENSOR NETWORKS **15Hours**

Introduction to computer and wireless sensor networks and Overview of the syllabus- Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem-communication interfaces- prototypes, Application of Wireless sensors-Introduction of Tiny OS Programming and TOSSIM Simulator.

UNIT II- COMMUNICATION CHARACTERISTICS AND DEPLOYMENT MECHANISMS **15Hours**

Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization-Clock and the Synchronization Problem - Basics of time synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization

UNIT III- MAC LAYER **15Hours**

Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols- characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols-Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC-Data gathering MAC- Case study –Implementation and Analysis of MAC player protocol in TinyOS.

UNIT IV- ROUTING IN WIRELESS SENSOR NETWORKS 15Hours

Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing- Geographical Based Routing- Transport layer- Transport protocol Design issues- Performance of Transport Control Protocols. Case study- Implementation and analysis of Routing protocol or transport layer protocol in Tiny OS

UNIT V - MIDDLEWARE AND SECURITY ISSUES 15 Hou

WSN middleware principles-Middleware architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security. Case study- Handling attacks in Tiny OS

REFERENCES

1. WaltenegusDargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011
2. KazemSohraby, Daniel manoli,"Wireless Sensor networks- Technology, Protocols and Applications", Wiley InterScience Publications 2010.
3. BhaskarKrishnamachari , " Networking Wireless Sensors", Cambridge University Press, 2005
4. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati,"Wireless Sensor Networks", Springer Science 2004.

CS2035	WIRELESS COMMUNICATION PROTOCOLS	L	T	P	C
	Total Contact Hours 75	3	0	2	4
	Prerequisite				
	Nil				

PURPOSE

To understand the principles behind the data transfer mechanisms over the conventional wireless network.

INSTRUCTIONAL OBJECTIVES

At the end of the course, student will be able to

1.	Understand the principles behind the data transfer mechanisms over the wireless network systems.
2.	Ability to configure algorithms for wireless communication systems.
3.	Understand the data traversal through various cross points in wireless sub systems.
4.	Design routing algorithms for wireless networks
5.	Understand the various trending wireless communication technologies.

UNIT I: FUNDAMENTALS OF WIRELESS COMMUNICATION 15 Hours

Wireless Network Generations – Comparison Of Wireless Systems – Evolution to Next Generation Networks – Radio Paths and Propagation – Propagation Mechanisms - Free-space loss - Plane earth loss model – Okumura-Hata model - COST-231–Hata model – Doppler Fading – Atmospheric Effects – Case Study: Simulation Modeling for Path loss and Propagation mechanisms.

UNIT II: MEDIUM ACCESS CONTROL 15 Hours

Multiplexing - Modulation - Spread spectrum - Motivation for a specialized MAC for Wireless Systems - SDMA - TDMA - FDMA - CDMA – OFDMA - Comparison Multiple Access Techniques - Random multiple access - Erlang capacity in uplink - Protocol design for wireless networks - Quality of service - Case Study: MAC Protocol design for Wireless Transmissions

UNIT III: ROUTING PROTOCOLS 15 Hours

Routing Protocol, Routing Algorithm, and Routing Table - Routing Information Representation and Protocol Messages - Distance Vector Routing Protocol - Link State Routing Protocol - Path Vector Routing Protocol AD HOC Routing - Architecture - Routing metrics -Proactive protocols - Reactive protocols - Hybrid protocols - Mesh Routing: Architecture- Routing metrics - Ad-hoc-based protocols - Controlled flooding protocols - Opportunistic protocols - Traffic-aware protocols - Vehicular Routing - Sensor Routing - Case Study: Simulation analysis of Routing Protocols for Wireless Transmissions

UNIT IV: SECURED TRANSPORT LAYER PROTOCOLS AND POWER MANAGEMENT **15 Hours**

Introduction, Issues, Design Goals, Classification of Transport Layer Solutions - TCP over Ad Hoc Wireless Networks - Other Transport Layer Protocols for Ad Hoc Wireless Networks - Security in Ad Hoc Wireless Networks - Secured Routing in Ad Hoc wireless Networks - Energy Management In Ad Hoc Wireless Networks - Introduction, Need for Energy Management, Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes - Case Study: Simulation of Energy Efficient Transport and Routing Protocols for Wireless Transmissions.

UNIT V: TRENDS IN WIRELESS COMMUNICATION SYSTEMS **15 Hours**

Ultra-Wide-band Radio – MIMO – Cognitive Radio Networks – Relay Assisted Wireless Networks – Biologically Inspired Paradigms in Wireless Networks – Positioning in Wireless Networks – Network Formation Games.

REFERENCES

1. Siva Ram Murthy C, Manoj B.S., Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall, 2005.
2. Savo G. Glisic Advanced Wireless Communications and Internet: Future Evolving Technologies, 3rd Edition
3. Miguel Elias MitreCampista, Rubinstein Marcelo Gonçalves Rubinstein Advanced Routing Protocols for Wireless Networks June 2014, Wiley-ISTE
4. D.Medhi and K.Ramasamy, Network Routing: Algorithms, Protocols and Architectures, Morgan Kaufmann Publishers, 2007.

CS2036	ADVANCED MOBILE COMPUTING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite				
	Nil				

PURPOSE

To impart knowledge on various Mobile computing concepts, techniques and their Applications

INSTRUCTIONAL OBJECTIVES

1.	To learn mobile computing techniques
2.	To be familiar with mobile computing trends and wireless application protocol
3.	To learn about the mobile Internet
4.	To study about various application languages and mobile application development platforms

UNIT I MOBILE COMMUNICATIONS: AN OVERVIEW 12 Hours

Mobile communication-Mobile computing-Mobile Computing Architecture-Mobile devices-Mobile System Networks – Data dissemination – Mobile management-security. MOBILE DEVICES AND SYSTEMS- Mobile phones – digital Music players – Handheld Pocket computers – Handheld devices – Smart systems – Limitations of mobile devices – Automotive systems

UNIT II GSM AND SIMILAR ARCHITECURES 12 Hours

GSM – services and architectures – Radio interfaces – Protocols – Localization – Calling – Handover – Security – New data services – General packet radio service-High speed circuit switched data – DECT. WIRELESS MEDIUM ACCESS CONTROL BASED COMMUNICATION-Medium Access Control – Introduction to CDMA –based Systems – Spread spectrum in CDMA Systems – coding methods in CDMA – IS-95 cdmOne System – IMT – 2000 – i-mode – OFDM

UNIT III MOBILE IP NETWORK LAYER AND MOBILE TRANSPORT LAYER 12 Hours

IP and mobile Network layers – Packet Delivery and Handover Management – Location management – Registration – Tunnelling and Encapsulation - Route Optimization - Dynamic Host Configuration Protocol. Conventional TCP/IP Transport Layer Protocols – Indirect TCP – Snooping TCP – Mobile TCP – Other methods of mobile TCP – layer transmission – TCP over 2.5G/3G Mobile networks

UNIT IV MOBILE DEVICES: SERVER AND MANAGEMENT 12 Hours

Mobile agent – Application server – Gateways – Portals -Service Discovery – Device management – Mobile file systems-Security.MOBILE AD HOC AND WIRELESS

SENSOR NETWORKS-Introduction to mobile Ad hoc network – MANET –Wireless Sensor Networks –Applications

UNIT V WIRELESS LAN, MOBILE INTERNET CONNECTIVITY, AND PERSONAL AREA NETWORK 12 Hours

WirelessLAN(WiFi) Architecture and Protocol layers- WAP 1.1 and WAP 2.0 Architecture – XHTML-MP (Extensible HyperText Markup Language Mobile Profile) - Bluetooth enabled devices network – layers in Bluetooth protocol- security in Bluetooth protocol- IrDA – ZigBees - Mobile application languages and mobile application development platforms

REFERENCES

1. Raj Kamal, "Mobile Computing",Oxford Higher education, Second Edition, 2007
2. J.Schiller, "Mobile Communication", Addison Wesley, 2000.
3. William Stallings, "Wireless Communication and Networks", Pearson Education,2003.
4. Singhal, "WAP-Wireless Application Protocol", Pearson Education, 2003.
5. LotherMerk, Martin.S.Nicklaus and Thomas Stober, "Principle of Mobile Computing",Second Edition, Springer, 2003.
6. William C.Y.Lee, "Mobile Communication Design Fundamentals", John Wiley,1993.

	ELECTIVE - III	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
Students to choose one Elective course from the list of courses mentioned in the curriculum					

	ELECTIVE - IV	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
Students to choose one Elective course from the list of courses mentioned in the curriculum					

SEMESTER III

	ELECTIVE - V	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
Students to choose one Elective course from the list of courses mentioned in the curriculum					

	ELECTIVE - VI	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
Students to choose one Elective course from the list of courses mentioned in the curriculum					

CS2047	SEMINAR	L	T	P	C
		0	0	2	1
PURPOSE	To train the students in preparing and presenting technical topics.				
INSTRUCTIONAL OBJECTIVE					
The student shall be capable of identifying topics of interest related to the program of study and prepare and make presentation before an enlightened audience.					

The students are expected to give at least two presentations on their topics of interest which will be assessed by a committee constituted for this purpose. This course is mandatory and a student has to pass the course to become eligible for the award of degree. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations

CS2049		L	T	P	C

	PROJECT PHASE I (III SEMESTER)	**0**	**0**	**12**	**6**
CS2050	**PROJECT PHASE II (IV SEMESTER)**	**0**	**0**	**32**	**16**
PURPOSE	To undertake research in an area related to the program of study				
INSTRUCTIONAL OBJECTIVES					
The student shall be capable of identifying a problem related to the program of study and carry out wholesome research on it leading to findings which will facilitate development of a new/improved product, process for the benefit of the society.					

M.Tech projects should be socially relevant and research oriented ones. Each student is expected to do an individual project. The project work is carried out in two phases – Phase I in III semester and Phase II in IV semester. Phase II of the project work shall be in continuation of Phase I only. At the completion of a project the student will submit a project report, which will be evaluated (end semester assessment) by duly appointed examiner(s). This evaluation will be based on the project report and a viva voce examination on the project. The method of assessment for both Phase I and Phase II is shown in the following table:

Assessment	Tool	Weightage
In- semester	I review	10%
	II review	15%
	III review	35%
End semester	Final viva voce examination	40%

Student will be allowed to appear in the final viva voce examination only if he / she has submitted his / her project work in the form of paper for presentation / publication in a conference / journal and produced the proof of acknowledgement of receipt of paper from the organizers / publishers.

PROGRAM ELECTIVES

CS2131	EMBEDDED SYSTEMS	L	T	P	C
	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				

PURPOSE:	
To familiarize the student with the architecture of embedded systems in general and introduce the design concepts of distributed embedded systems.	
INSTRUCTIONAL OBJECTIVES:	
1.	To learn the rationale and concepts for designing embedded systems.
2.	To understand the design principles of distributed embedded systems.
3.	To understand the real time environment, task management and scheduling.
4.	To emphasize on programming embedded systems.

UNITI- INTRODUCTION TO EMBEDDED SYSTEMS **9 Hours**

Embedded system model – embedded standards – block diagrams – powering the hardware - embedded board using von Neuman model. EMBEDDED processors: ISA architecture models – application specific ISA models – general purpose ISA models – instruction level parallelism.

UNIT II - REAL-TIME ENVIRONMENT **9 Hours**

Real-time computer system requirements – classification of real time systems – simplicity – global time – internal and external clock synchronization – real time model. Real – time communication – temporal relations – dependability.

UNIT III - REAL-TIME OPERATING SYSTEMS **9 Hours**

Real –time communication – event triggered – rate constrained – time triggered. Inter component communication – task management – dual role of time – inter task interactions – process input/output – agreement protocols – error detection.

UNIT IV -SYSTEM DESIGN **9 Hours**

Scheduling problem - static & dynamic scheduling – system design – validation – time–triggered architecture.

UNIT V – CASE STUDY ON PROGRAMMING EMBEDDED SYSTEMS **9 Hours**

Building the blinking LED program-eCos Examples-Embedded linux examples-Extending functionality-optimization techniques.

REFERENCES

1. Tammy Noergaard, “Embedded system architecture”, 2nd Edition ,Elsevier, 2012
2. Hermann Kopetz, “Real–Time systems – Design Principles for distributed Embedded Applications”, 2nd Edition, Springer 2011
3. Michael Barr, Anthony Massa,” Programming Embedded Systems-With C and GNU Development Tools”, 2nd Edition, O'Reilly Media,2009.
4. Raj Kamal , “Embedded Systems – Architecture Programming and Design,””, Tata McGraw Hill, 2nd Edition, 2011.
5. https://www.elsevier.com/books/embedded-systems-architecture/noergaard/978-0-12-382196-6#maincontent
6. https://link.springer.com/book/10.1007%2F978-1-4419-8237-7
7. http://stepsmail.com/download/Career-In-Embedded-System.PDF

CS2132	QUANTUM COMPUTING	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course presents a thorough exposition of quantum computing and the underlying concepts of quantum physics, explaining all the relevant mathematics

INSTRUCTIONAL OBJECTIVES

At the end of the course, student will be able to

1.	Understand how information theory and quantum mechanics joined together to produce a new view of computing and information
2.	Understand how quantum information processing explores the implications of using quantum mechanics instead of classical mechanics to model information and its processing
3.	Understand how the fundamental unit of computation depends on the quantum bit or qubit.
4.	To gain a fluent understanding of quantum computing

UNIT I INTRODUCTION **9Hours**

Overview of quantum computing – Single qubit quantum systems – The quantum mechanics of photonpolarization-Single quantum bits- Single qubit measurements-A quantum key distribution protocol– The state space of single qubit system-The multiple qubit system-Quantum state spaces- Entangled state-Basic of multiple qubit system-Quantum key distribution using entangled states

UNIT II MEASUREMENT OF MULTIPLE QUBIT STATES **9 Hours**

Dirac notation for linear transformation-Projection operators for measurements-Hermition operator-The measurement postulate-EPR Paradox and Bells Theorem-Set-Up for Bell'sTheorem-Bell inequality-Unitary transformations-The impossible Transformations-The No-Cloning principle-Some Simple quantum Gates-The Pauli transformation-The Hadamard transformations-Multiple qubit transformation from single qubit transformation-Applications of simple Gates-RealizingUnitary transformations as quantum circuits-A universally approximating set of Gates

UNIT IIIQUANTUMVERSIONS OF CLASSICAL COMPUTATIONS **9Hours**

From reversible computations to quantum computations-Reversible implementations of classical circuits-A language for quantum implementation-Some examples for arithmetic operations-Quantum algorithms-Notations of complexity-A simple quantum algorithm-Quantum subroutines-Few simple quantum algorithms-Machine models and complexity classes

UNIT-IV SHOR´S AND GROVER´S ALGORITHMS **9Hours**

Shor´s factoring algorithm-An example-The efficiency of Shor´s algorithm-Generalizations-Grover´s algorithm and generalizations-Amplitude amplification-Optimality of Grover´s algorithm-De-randomization of Grover´s algorithm and amplitude amplification

UNIT–VQUANTUMCOMPUTATIONAL COMPLEXITY AND ERRORCORRECTION **9Hours**

Computational complexity – black-box model – lower bounds for searching – generalblack-box lower bounds – polynomial method – block sensitivity – adversary methods –classical error correction – classical three-bit code – fault tolerance – quantum errorcorrection – three- and nine-qubit quantum codes – fault-tolerant quantum computation

REFERENCES

1. Eleanor G.Rieffel,Wolfgang H.Polak, "Quantum Computing:A Gentle Introduction"Kindle Edition,2011
2. P. Kaye, R. Laflamme, and M.Mosca, "An introduction toQuantumComputing",Oxford University Press, 1999.
3. V. Sahni, "QuantumComputing", Tata McGraw-HillPublishing Company, 2007.
4. https://www.eecis.udel.edu/~saunders/courses/879-03s/quantumComputers.ppt
5. http://qudev.phys.ethz.ch/content/courses/QSIT09/QSIT09_V04_slides.pdf
6. https://www.cs.wmich.edu/~elise/courses/cs6800/osama-quantum-computing.ppt
7. homepages.cwi.nl/~rdewolf/warsaw2short.pdf
8. www.cse.cuhk.edu.hk/~syzhang/talks/QC-Phy09.ppt

CS2133	DIGITIAL SIGNAL PROCESSING	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To obtain the basic knowledge of signal processing systems and design of various digital filters

INSTRUCTIONAL OBJECTIVES

At the end of the course, student will be able to

1.	To learn the theory and practice of Digital Signal Processing
2.	To design and implement FIR and IIR digital filters
3.	To study the architecture and features of DSP Processor
4.	To learn practical applications of Digital Signal Processing

UNIT-I OVERVIEW OF DIGITAL SIGNAL PROCESSING 9 Hours

Signals and Signal Processing**:** Prehistory of DSP-Need for Digital Signal Processing-Signal Processing Operations- Classification of Signals- Examples of Typical Signals-Noise in signals-Applications of DSP.

UNIT-IISIGNAL PROCESSING SYSTEMS 9 Hours

Systems- Filters: Linear and Nonlinear –Correlation: Cross correlation and Autocorrelation, Correlation and Prediction-Correlation and Convolution-Signal Comparison and Detection-Wiener Filter, Wiener-Khintchine Theorem-Linear Predictive Coding-Adaptation: Adaptive Noise and Echo Cancellation-Adaptive Equalization

UNIT-III DIGITAL FILTERS IMPLEMENTATION 9 Hours

Graphical Techniques: Graph Theory-DSP Flow Graphs and Manipulation-RAX Internals andExternals. The Fast Fourier Transform:Complexity of DFT-Derivation of DIT FFT-Other common FFTAlgorithms-MATLAB Exercise: Implementation of FFT AlgorithmsFIR and IIR Digital Filter Implementation:Computation of Convolutions-FIR Filtering in theFrequency Domain-FIR Structures-Polyphase Filters-FIR versus IIT- MATLAB Exercises: Implementation of FIR and IIR Digital Filters

UNIT-IV DSP PROCESSOR FUNDAMENTALS 9 Hours

Architecture and features: Features of DSP Processors-DSP Processor packaging-Fixed point versus Floating point DSP Processor data paths-Memory Architecture of a DSP Processor-Addressing modes-Pipelining-TMS320 family of DSPs

UNIT-VAPPLICATIONS OF DSP 9 Hours

Speech Signal Processing: LPC Speech synthesis - Speech Analysis- Speech Compression-Applications: Case Study 1: Image Enhancement using DSP TMS320C6713 - Case Study 2: Adaptive Noise Cancellation

REFERENCES

1. Jonathan (Y) Stein, "*Digital Signal Processing: A Computer Science Perspective*" John Wiley & Sons, 2000
2. Sanjit .K. Mitra, "*Digital Signal Processing: A Computer based approach*", Tata McGraw Hill Edition, ISBN 0-07-044705-5, 2001.
3. Steven W. Smith, "*The Scientist and Engineer's Guide to Digital SignalProcessing*",Second Edition, 1999.
4. B.Venkataramani, M Bhasker, "*Digital Signal Processors*", Tata McGraw-Hill Publishing Company limited, ISBN 0-07-047334-X, 2002
5. John .G.Proakis, "*Digital Signal Processing: Principles, Algorithms and Applications*", Addison – Wesley ISBN-81-203-1129-9, 2002.
6. Emmanuel C.Ifeachor, "*Digital Signal Processing: A Practical Approach*", Pearson Education Asia, ISBN 81-7808-609-3, 2002.
7. *https://www.ijsr.net/archive/v4i5/SUB154577.pdf* (Available online)
8. *http://openaccess.city.ac.uk/7405/1/The_industrial_application.pdf* (Available online)

CS2134	MOBILE USER INTERFACE DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course is designed to provide students with a working knowledge of Mobile User Interface Design. In addition to This course introduces tools and techniques for the design and development of application software for portable devices. Students will learn skills for creating and deploying mobile applications, with emphasis on different phases of the software life cycle. This course will also cover global-scale and context-aware mobile applications.

INSTRUCTIONAL OBJECTIVES

1.	To acquire knowledge of Portable devices and its basic principles
2.	Ability to use commercial software for Mobile User interface
3.	Ability to set up Hardware ,software platforms
4.	To apply the concepts of Interface design techniques on applications

UNIT I – INTRODUCTION PORTABLE DEVICES 9 Hours

Overview: Overview of Portable Devices –HW & SW for Portable Devices-Applications of Portable Devices-Evaluation Components – logistics- HW and SW Quality attributes, HW/SW Architectures and their use in specific areas.

UNIT II – HARDWARE & SOFTWARE PLATFORMS 9 Hours

Various HW Platforms -Processors, Peripheral devices, Sensors-HW Platforms – Mobile Phones + Wireless,Internet of things (IoT) + Wireless-complete hardware designand their processors- Mobile operating systems- Architecture and framework of different mobile- Development platforms and development tools.

UNIT III– USER INTERFACE DESIGN 9 hours

UI Design & Layouts for various devices**-**UI fundamentals, UI Design constraints and Views-Intents and Broadcasts- Programming languages- Simulator and emulator-Typical Development Life Cycle of Applications, Application Architecture Patterns (MVC)

UNIT IV– APPLICATIONS USING ANDROID 9 hours

Android UI, UI Layouts and views across various devices (Mobile phones, tabs etc.)-Android and use of various intents-UI Layout- Android – Connecting to internet resources- Data persistence – techniques, saving and loading of data- files, state and preferences.

UNIT V – DATABASE AND CONTENT PROVIDERS **9 Hours**

SQLite Database Introduction- Query and Search Capabilities- Use of native store – media, contacts and calendar- Location Based Services and Applications- SMS and Messaging

REFERENCES

1. Professional Android 4 Application Development, by Reto Meier, WROX Press, Wiley Publishing
2. Android Application Development, Programming with the Google SDK, by, Rick Rogers, John Lombardo, ZigurdMednieks, Blake Meike, SPD, Oreilly, ISBN10: 81-8404-733-9, ISBN13:978-81-8404-733-2
3. Hello Android, Introducing Google's Mobile Development Platform, 3rd Edition, by Ed Burnette, Pragmatic Programmers, LLC.ISBN-10: 1-934356-56-5, ISBN-13: 978-1-934356-56-2

CS2135	DESIGN OF DISTRIBUTED SYSTEMS	L	T	P	C
	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				

PURPOSE:	
To familiarize the student with the architecture of distributed systems in general and introduce the management of client server model systems.	
INSTRUCTIONAL OBJECTIVES	
1.	To learn the rationale and concepts for designing distributed systems.
2.	To understand the Distributed Resource Management concepts.
3.	To understand the Client/Server Transaction Processing and working With Distributed Objects.
4.	To learn about synchronization with distributed algorithms.

UNIT - I INTRODUCTION TO DISTRIBUTED SYSTEMS 9 Hours

Introduction – Examples of Distributed Systems – Resource Sharing and the Web – Challenges- System Models - Introduction – Architectural Models – Functional Models-Characterization of Distributed Systems – Client-Server Communication – Distributed Objects and Remote Invocation – Communication Between Distributed Objects – Remote Procedure Call – Events and Notifications.

UNIT – II DISTRIBUTED RESOURCE MANAGEMENT 9 Hours

Distributed Resource Management - Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory – Architecture – Algorithm – Protocols - Design Issues. Distributed Scheduling – Issues – Components – Algorithms.

UNIT-III CLIENT/SERVER TRANSACTION PROCESSING 9 Hours

Client/Server Transaction Processing: The basics of Transactions - TP Monitors: Managing Client/Server Transactions - TP-Lite or TP-Heavy - TP Monitors - existing commercial and open source solutions. Client/Server Groupware: Client/Server Groupware - Groupware: Existing commercial and open source solutions

UNIT-IV CLIENT/SERVER WITH DISTRIBUTED OBJECTS 9 Hours

Client/Server with Distributed Objects: Distributed Objects and Components- CORBA: From ORBs to Enterprise Beans - COM+: The Other Component Bus - Object Databases - Distributed Objects: existing commercial and open source solutions Client/Server and the Internet: The Hypertext Era - Web Client/Server: The Interactive Era - Web Client/Server: The Distributed Object Era - Web Client/Server: existing commercial and open source solutions

UNIT-V DISTRIBUTED ALGORITHMS **9 Hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models. Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a synchronous Ring, Algorithms in a General Synchronous Networks, Distributed Consensus with Link Failures, Distributed Consensus with Process failures, More Consensus problems.

REFERENCES

1. George Coulouris, Jean Dellimore and Tim KIndberg,Gordon Blair, "Distributed Systems Concepts and Design", Pearson Education-Addison Wesley, 5th Edition, 2012
2. MukeshSinghal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", Tata McGraw-Hill Education, 2001
3. Robert Orfali, Dan Harkey and Jeri Edwards, "Client/server Survival Guide", 3rd Edition, Wiley India Pvt Ltd, 1999
4. Nancy A. Lynch, Distributed Algorithms, Morgan Kaufmann Publishers, 1996.
5. https://azmuri.files.wordpress.com/2013/09/george-coulouris-distributed-systems-concepts-and-design-5th-edition.pdf
6. https://books.google.co.in/books?id=nel4vdeLcqkC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
7. http://as.wiley.com/WileyCDA/WileyTitle/productCd-0471316156.html
8. https://www.elsevier.com/books/distributed-algorithms/lynch/978-1-55860-348-6

CS2136	COMPUTATIONAL OPTIMIZATION	L	T	P	C
	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				

PURPOSE:	
To impact knowledge in dynamic programming , linear programming, random sampling and apply them in optimization techniques	
INSTRUCTIONAL OBJECTIVES:	
1.	To learn about approximation algorithms
2.	To understand random sampling and linear programming concepts
3.	To learn about cut and merits

UNIT-IINTRODUCTION **9 Hours**

Approximation algorithms, what's and why's of approximation algorithms, a deterministic rounding algorithm, primal dual method, randomized rounding algorithm. Greedy algorithms and local search. The K-center problem, scheduling jobs on identical parallel machines, travelling sales man problem, finding minimum degree spanning trees, edge coloring.

U**NIT- II ROUNDING DATA AND DYNAMIC PROGRAMMING** **9 Hours**

The knapsack problem, scheduling jobs on identical parallel machines, the bin packing problem. The deterministic rounding of linear programs. Minimizing the sum of completion times on a single machine, minimizing the weighted sum of completion times on a single machine. Solving large linear programs in polynomial time via ellipsoid method. The prize collecting Steiner tree problem, the un-capacitated facility location problem, the bin-packing problem.

UNIT-III RANDOM SAMPLING AND RANDOMIZED ROUNDING OF LINEAR PROGRAMS **9 Hours**

Simple algorithms for MAX SAT and MAX CUT, de-randomization, flipping biased coins, randomized rounding, choosing the better of two solutions. Nonlinear randomized rounding, the prize collecting Steiner tree problem, the un-capacitated facility location problem, scheduling single machine with release dates, Chernoff bounds.

UNIT-IV RANDOMIZED ROUNDING OF SEMI DEFINITE PROGRAMS AND PRIMAL DUAL METHOD **9 Hours**

A brief introduction to semi definite programs, finding large cuts, approximating quadratic programs, finding a correlation clustering. Coloring- 3-colorable graphs. Primal dual method-the set cover problem, the shortest s-t path problem, the generalized Steiner tree problem, minimum knapsack problem.Lagrangean relaxation and k-median problem .

UNIT-V CUTS AND METRICS **9 Hours**

The multi-way cut problem and a minimum cut based algorithm- The multi way cut problemand an LP rounding algorithm-The multi cut problems-Balanced cuts-Probabilistic approximation of metrics by tree metrics- An application of tree metrics-Buy-at-bulk network design. Spreading metrics, tree metrics, and linear arrangement.

REFERENCES

1. David P.Williamson,and David B.Shimos,"The design of approximation algorithms",Cambridge University press,2011.

2. Michael R. Garey and David S. Johnson, "Computers and Intractability. A Guide to the Theory of NP-Completeness Freeman, 1979.

CS2137	**ADVANCED NETWORK TECHNOLOGIES**	**L**	**T**	**P**	**C**
	Total contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE	
This course gives an overview of computer networks, TCP/IP protocols and also covers security and network management aspects	
INSTRUCTIONAL OBJECTIVES	
At the end of the course, student will be able to	
1.	Become familiar with the application of Networking,IPV4,IPV6 protocols routing
2.	Understand and analyze various TCP/IP protocols and the working of ATM and its performance
3.	Explore on network authentication algorithms, Integrated and Differentiated Services
4.	Model the networking scenario

UNIT - I LAN TOPOLOGIES **9hours**

Introduction - Local Area Network - LAN Topologies- MAC Protocols - Taking turns- Ethernet - Ethernet Frame Structure- Ethernet Version-Platform required to run network simulator - Backend Environment of Network Simulator- Basics of Tcl Programming for NS-2 |- gents and applications - Tracing- Simulating a LAN using Network Simulator 2

UNIT II- HIGH SPEED NETWORKS **9hours**

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LAN's.

UNIT III- WIFI and WIMAX NETWORKS **9hours**

Wi-Fi Networks - IEEE 802.11 Standards - MAC Protocols - Use of RTS/CTS to Exchange Data -Issues in Wi-Fi Networks - Simulating a Wi-Fi using Network Simulator 3-WiMAX Network - Standards - Comparison of Wi-Fi and WiMAX - How WiMAX works? - Limitations of WiMAX

UNIT IV-MOBILE ADHOC NETWORKS **9hours**

Mobile Ad-hoc Network (MANET)- Routing in MANET | Routing protocols –DSDV and DSR Simulating a MANET using Network Simulator 2Wireless Sensor Networks- Basic Characteristics of WSNs- Operating Systems for WSNs- Routing protocols for WSNs- Clusters and Cluster heads in WSNs- The LEACH Protocol | -Simulating a

WSN using Network Simulator 2

UNIT V –BLUETOOTH and ZIGBEE NETWORKS **9hours**

Bluetooth Network-- Bluetooth vs Wi-Fi | Bluetooth - Networking of Bluetooth | How to connect Bluetooth? | Simulating Bluetooth Network with NS-2ZigBee Network- IEEE 802.15.4 and ZigBee - ZigBee vs. Bluetooth - Features & Characteristic of ZigBee Technology - Application of ZigBee Technology - Component of IEEE 802.15.4 LR-WPAN - Network Topologies- ZigBee Architecture- The Super frame structure - Nodes Configuration - Energy Model

REFERENCES

1. Leon Garcia and Widjaja ," Communication networks: Fundamental concepts and key architectures", McGraw Hill, Inc., NY, USA, 2006 William Stallings, "*High Speed Networks and Internet*", Pearson Education, Second Edition, 2012.
2. Prakash.C.Guptha, "*Data Communication and Computer Networks*", PHI , 6th printing 2012.
3. Larry L. Peterson and Bruce S Davis , "*Computer Network A System Approach*", Elsevier,5th edition 2010.
4. IrvanPepelnjk, Jim Guichard and Jeff Apcar, "*MPLS and VPN Architecture*", Cisco Press, Volume 1 and 2, 2003
5. Andrew S Tanenbaum, David J Wetherall, "COPUTER NETWORKS", 5THEdtion, Pearson Education, 2013
6. Charles E. Perkins, "Adhoc Networking", Addision-Wesley, 2001.
7. Bluetooth Technology: and its applications with java and j2me, C.S.R.Prabhu, A.PrathapReddi, phi learning pvt. Ltd.

CS2138	**ADVANCED DIGITAL COMMUNICATION**	**L**	**T**	**P**	**C**
	Total contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE	
To learn the principles of Digital Communication, Informational Sources and various codes and Equalization techniques	
INSTRUCTIONAL OBJECTIVES	
At the end of the course, student will be able to	
1.	To understand the different block codes and graph based codes used in digital communication.
2.	To understand the different Equalization techniques.
3.	To learn about the band limited channels.

UNIT-IINTRODUCTION TO DIGITAL COMMUNICATION 9 Hours

Elements of a Digital Communication System-Communication Channels and Their Characteristics-Mathematical Models for Communication Channels-Deterministic and Random Signal Analysis **-**Bandpass and Lowpass Signal Representation ,Signal Space Representation of Waveforms ,Orthogonal Expansions of Signals, Gram-Schmidt Procedure-Digital Modulation Schemes-Representation of Digitally Modulated Signals,Memoryless Modulation Methods,**AWGN Channels-**Waveform and Vector AWGN Channels,LimitedSignalingOptimal Detection in Presence of Uncertainty:Non-coherentDetection,

UNIT-II INFORMATION THEORY 9 Hours

Mathematical Models for Information Sources-A Logarithmic Measure of Information-Lossless Coding of Information Sources-Lossy Data Compression-Channel Models and Channel Capacity- Achieving Channel Capacity with Orthogonal Signals-The Channel Reliability Function

UNIT-III LINEAR BLOCK CODES 9 Hours

Basic Definitions-General Properties of Linear Block Codes-Linear Block Codes-Optimum Soft Decision Decoding of Linear Block Codes -Modified Linear Block Codes -Cyclic Codes-Bose-Chaudhuri-Hocquenghem (BCH) Codes-Reed-Solomon Codes-Coding for Channels with Burst Errors-*Product Codes-Concatenated Codes*

UNIT-IV TRELLIS AND GRAPH BASED CODES 9 Hours

Structure of Convolutional Codes-Decoding of Convolutional Codes- Distance Properties of Binary Convolutional Codes -Punctured Convolutional Codes-Decoding Algorithms for Convolutional Codes-Practical Considerations in the Application

ofConvolutional Codes -Nonbinary Dual-*k* Codes and Concatenated Codes-Maximum a Posteriori Decoding of ConvolutionalCodes—The BCJR Algorithm-Turbo Codes and Iterative Decoding -Factor Graphs and the Sum-Product Algorithm -Low Density Parity Check Codes.

UNIT-V DIGITAL COMMUNICATION THROUGH BAND-LIMITEDCHANNELS **9 Hours**

Characterization of Band-Limited Channels-Signal Design for Band-Limited Channels-Optimum Receiver for Channels with ISI and AWGN -Linear Equalization - Decision-Feedback Equalization -Reduced Complexity ML Detectors-Iterative Equalization and Decoding—Turbo Equalization

REFERENCES

1. John G. Proakis, MasoudSalehi," Digital Communications", McGraw Hill, 2008
2. Robert W. Heath, Jr.,"Introduction to Wireless Digital Communication: A Signal Processing Perspective",Pearson Education,2017.
3. Simon Haykin," Digital Communication Systems",Wiley 2013
4. Christoph Meinel, Harald Sack,"Digital Communication: Communication, Multimedia, Security"Springer Berlin Heidelberg, 2016
5. Nelson Carter,"Digital Communications and Networks"Willford Press, 2016.

CS2139	**SMART CONVERGENT TECHNOLOGIES**	**L**	**T**	**P**	**C**
	Total Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

Purpose	
This course provides the cutting edge technologies using IOT	
Instructional Objectives	
1.	Describe the various technologies used in telecommunications
2.	Explain the application of technologies, architectures, and protocols used in the telecommunications industry.
3.	Describe 1G, 2G, 3G, 4G, LTE, WiMAX and their role in present and future Mobility.

UNIT- I INTRODUCTION TO TELECOMMUNICATIONS AND TRANSMISSION

9 Hours

Human–Machine Interactions - Embedded Devices - Intelligent Wearable- TrafficPatterns - The Electromagnetic Spectrum - Analog and Digital, Multiplexing Media: Twisted-Pair - Coaxial Cable- Microwave – Satellites - Fiber Optics - Data Communication Traffic - Data Transmission - OSI and TCP/IP Reference Models.

UNIT– IIINTRODUCTION TO THE INTERNET AND IP TELEPHONY 9 Hours

Internet and Routing Protocols- Internet Architecture, and Infrastructure - Sub netting: IPv4, IPv6; DNS, QoS- Service Providers - IPT Network Architecture, QoS - VoIP Call Signaling Protocols - Digital Voice, ENUM- VPNs: Layer 3, 2, Security- Unified communications- IP voice and IPTV- The Broadband Infrastructure - Quality of Service-Virtualization- Cloud Computing.

UNIT - IIIFIBRE OPTIC NETWORKS, WIRED AND WIRELESS BROADBAND

9 Hours

Optical Networking Elements: Switches, Edge, Core - DSL - Cable TV Networks, Packet Cable- Fiber Solutions- Wireless Broadband- HANs PANs, CANs, MANs- Broadband PLT - Antennas- Wireless Bandwidth - Spectrum Utilization- Spread Spectrum.

UNIT - IV CELLULAR SERVICES AND STANDARDS 9 Hours

Cellular: 2G, 2,5G, 3G, 4G. 5G - WiMAX,LTE - mobile security - Digital Cellular Radio -Enhanced Data Services - Broadband Wireless 3G Standards : : UMTS, TD-SCDMA,
CDMA Solutions

UNIT -V WIRELESS NETWORK ARCHITECTURE, WIRELESS AND MOBILITY

9 Hours

BFWA- WLANs -IEEE 802.11a,b,g,n - IEEE 802.16, WiMax, WiBro and Mobile-Fi - VoWLAN - Integration of WLANs and Cellular Networks, RFIDMesh Networks - Mobile IP, IP Multimedia Subsystem - Applications, Mobile Video,Mobile TV, and Content

REFERENCES

1. LIDO Telecommunications Essentials: by Lillian Goleniewski, 2nd edition, Addison-Wesley Professional, Copyright: 2007.

	CRYPTOGRAPHY AND WIRELESS NETWORK SECURITY	L	T	P	C
CS2140	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				

PURPOSE	
To understand the various cryptographic algorithms and the mechanisms used to mitigate the security risks.	
INSTRUCTIONAL OBJECTIVES:	
At the end of the course, student will be able to	
1.	Ability to understand the application of mathematics in cryptography
2.	Understand the mechanism used in the classical encryption system and different type of block cipher mode of operation.
3.	Ability to encrypt/decrypt a message using Secret Key and Public Key Cryptography
4.	Understand the various types of authentication algorithm
5.	Understand the security measure taken over Internet security.
6.	Understand the various types of vulnerabilities and detection system

UNIT – ICRYPTOGRAPHY AND ITS APPLICATIONS 9 Hours

Introduction: Secure communications - Cryptographic applications - Different types of ciphers: - shift ciphers - affine ciphers- vignere cipher- substitution ciphers- Block ciphers, binary numbers and ASCII, one time pads. LFSR sequences - Basic Number theory, Congruence. Chinese Remainder theorem, Modular exponentiation- Fermat and Euler's theorem, Legendre and Jacobi symbols.

UNIT – IIPUBLIC KEY CRYPTOGRAPHY 9 Hours

Simple DES - Differential cryptanalysis- DES - Modes of operation – AES – Primality test –RSA - Pseudorandom number generation and stream ciphers - Elliptic curve Arithmetic – Elliptic curve cryptography.

UNIT – IIIHASH FUNCTIONS 9 Hours

Discrete Logarithms - Computing discrete logs - Diffie-Hellman key exchange - ElGamal Public key cryptosystems - Hash functions - Secure Hash Algorithm – SHA-3 - Birthday attacks – HMAC – HMAC- Digital Signature Algorithm.

UNIT – IVSECURITY ISSUES IN MOBILE COMMUNICATION 9 Hours

Mobile communication History - Security issues in wireless and mobile communications - Security for mobile applications - Advantages and disadvantages of application – level security - Mobile devices security requirements, mobile wireless

network level security- Applications of WLANs, wireless threats- Security for 2g Wi-Fi applications - Recent Security Schemes for Wi-Fi Applications.

UNIT – VSECURITY FOR MOBILE COMMERCE APPLICATIONS 9 Hours

M-commerce applications - Security challenges in mobile e-commerce - Types of attacks on mobile e-commerce - A secure M-commerce model based on wireless local area network - Some of M-commerce security solutions.

REFERENCES

1. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with codingtheory", 2nd edition, Pearson, 2007.
2. Wireless & Mobile Network Security: PallapaVenkataram, Satish Babu, TMH, 2010.
3. William Stallings, "Cryptography and network security principles and practice", 6th edition 2014.
4. AtulKahate "Cryptography and Network Security", Tata McGraw Hill Publication Company Limited, 2006.
5. Charlie Kaufman et al "Network Security – Private Communication in a Public World", Second Edition, PHI Learning Private Limited, 2011.
6. Charles P. Pfleeger et al "Security in Computing ", Third Edition, Pearson Education, 2004.

CS2141	M-COMMERCE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to impart knowledge on M-commerce services, security and handling the applications in it.

INSTRUCTIONAL OBJECTIVES

1.	To learn of the concepts, principles and technologies of M - commerce
2.	To understand M – commerce security and research technology.
3.	To handle mobile commerce in wireless networks, image and video

UNIT – IINTRODUCTION TO M – COMMERCE **9 Hours**

M-Commerce – Framework – Business Models – Impact of M-Commerce – Services – Applications – Technology of M-Commerce – Mobile Payments Mode – Types – Security & Privacy Issue – Legal Aspects.

UNIT - II M - COMMERCE: PAYMENTS & SERVICES **9 Hours**

Overview of M-Commerce - M-commerce and Technology Acceptance Model(TAM) - M-commerce and trust - concept of m-payment - importance of m-commerce and m-payment in global business - Innovativeness, trust, demographic characteristics on mobile services - analyzed Factor analysis, regression analysis and ANOVA's - m-services adoption

UNIT – IIIM- COMMERCE: SECUIRTY **9 Hours**

SWOT Analysis of M-commerce – Fraudulent Activities through M-commerce – Security& Its prevention – mobile payments for conducting M-commerce – Architecture and transaction model in securing M-commerce – Regulatory frameworks of M-commerce - Security risks of M-commerce – Comparative analysis of M-commerce and E-commerce

UNIT - IV M- COMMERCE:COMPUTING & TECHNOLOGY **9 Hours**

User Context-Aware Advertising Framework - Normal and Abnormal ECG Rhythm Analysis - Mobile Commerce Deployment - Peer-to-Peer Service Sharing on Mobile Platforms - Scripting Mobile Devices with AmbientTalk - Interrupt Handling in Symbian and Linux Mobile OperatingSystems - Web Page Adaptation and Presentation - Technologies and Systems for Web Content Adaptation

UNIT - V HANDHELD in WIRELESS NETWORKS &VIDEO **9 Hours**

Positioning and Privacy in Location-Based Services - Survivability in RFID Systems - Mobile and Handheld Security - Design and Performance Evaluation of a Proactive Micro Mobility Protocol - Internet Connectivity Revenue Models - Distributed Video Coding - Fast Mode Decision in H.264/AVC - Mobile Video Streaming.

REFERENCES

1. Wen-Chen Hu, YanjunZuo, “Handheld Computing for Mobile Commerce: Applications, Concepts and Technologies”, Information science reference, 2010
2. Sushila Madan, JyotiBatra Arora, “Securing Transactions and Payment Systems for M-Commerce”, Business Science Reference (an imprint of IGI Global), 2016
3. KARABI BANDYOPADHYAY, “Mobile Commerce”, PHI Learning Private Limited, 2013
4. Dr.Pandey , Saurabh Shukla “E-commerce and Mobile commerce Technologies” , Sultan Chand ,2011
5. E.BrianMennecke, J.TroyStrader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IRM press, 2003.

	AD-HOC MOBILE WIRELESS NETWORKS	L	T	P	C
CS2142	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				

PURPOSE:	
To train the students in the technological developments of MANET systems and standards.	
INSTRUCTIONAL OBJECTIVES:	
At the end of the course, student will be able to	
1.	To introduce the characteristic features of Ad-hoc wireless networks and their applications to the students.
2.	To enable the student to understand the functioning of different access and routing protocols that can be
3.	To enable the student to understand the Mobility in MANETs.

UNIT – I INTRODUCTION TO MANETS AND MAC LAYER PROTOCOLS9 Hours

Fundamentals of Wireless Networks– IP Limitations-Mobile Internet Protocol (IP)- Issues in Mobile IP- Differences between Cellular and Ad Hoc Wireless Networks- Issues in Ad Hoc Wireless Networks-Classification of Ad-hoc Networks-MANET applications- Important Issues and the Need for Medium Access Control (MAC) Protocols.- Classification of MAC Protocols- Multiple-Channel MAC Protocols.

UNIT – II ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS9 Hours

Design Issues of Routing Protocols for Ad Hoc Networks- Classification of Routing Protocols- Proactive Routing- WRP, DSDV, OLSR Protocol- Reactive Routing- AODV, DSR, TORA, CBRP Protocol- Hybrid Routing.- ZRP, ZHLS

UNIT – III QUALITY OF SERVICE (QOS) IN AD HOC NETWORKS 9 Hours

Introduction to QoS-Issues and Challenges Involved in Providing QoS-Classification of QoS Solutions- Medium Access Control (MAC)-Layer QoS Solutions- Network-Layer QoS Solutions- QoS Model-QoS Frameworks- INSIGNIA Protocol Commands-INSIGNIA Protocol Operations- Reservation Establishment- QoS Reporting- Flow Restoration-Flow Adaptation-Intelligent Optimization Self-Regulated adjustment(INORA)- Coarse-Feedback Scheme-Class-Based Fine Feedback Scheme.

UNIT – IV ENERGY MANAGEMENT SYSTEMS IN AD HOC WIRELESS NETWORKS 9 Hours

Classification of Energy Management Schemes- Overview of Battery Technologies-Principles of Battery Discharge- Impact of Discharge Characteristics on Battery

Capacity- Battery Modeling- Battery-Driven System Design- Energy-Efficient Routing Protocol- Transmission Power Management Schemes- Transmission Power Control

UNIT – V MOBILITY MODELS FOR MANET **9 Hours**

Mobility Model Classifications-Formulation of Mobility Models- Mobility Metrics - Impact of Mobility Models on MANET- **Random Walk Mobility-** Notation, Characteristics of Random Walk Mobility, Stationary Distribution of Random Walk Mobility, Limitations of Random Walk Mobility Model - **Random Waypoint Mobility-** Notation ,Random Waypoint Stochastic Process, Transition Length and Duration, Limitations- **Smooth Random Mobility-** Notation, Characteristics of Smooth Random Mobility Model, Speed Control,DirectionControl, Correlation Between Direction and Speed Change

REFERENCES

1. Subir Kumar Sarkar, T.G. Basavaraju, C. Puttamadappa," Ad Hoc Mobile Wireless Networks: Principles, Protocols, andApplications",Secondedition,AUERBACH PUBLICATIONS,,2013.
2. Radhika RanjanRoy ,"Handbook of Mobile Ad HocNetworks for MobilityModels", Springer Science+Business Media, LLC 2011
3. Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz,"Mobile Ad Hoc Networks: Current Status and Future Trends"CRC Press,2012.
4. B. V. V. S. PRASAD,"ROUTING ISSUES IN MANETs",Educreation Publishing-2016

CS2143	ADVANCED OPTIMIZATION TECHNIQUES	L	T	P	C
	Total contact hours: 45	3	0	0	3
	Prerequisite				
	Nil				

Purpose	
This course enables us to understand the concepts of advanced optimization techniques in modern practice	
Instructional objectives:	
1	To appreciate the necessity of optimization in engineering
2	To learn and apply the genetic algorithm
3	To understand the basics of simulated annealing
4	To study the basics of PSO and its variants
5	To be familiar with ant colony optimization and its trends

UNIT - I INTRODUCTION **9Hours**

Introduction-historical development-engineering applications of optimization-Classification of Optimization Problems-Optimization Techniques- Engineering Optimization Literature

UNIT – IIGENETIC ALGORITHMS **9Hours**

History and evolution of genetic algorithm -Elements of genetic algorithm-a simple genetic algorithm-genetic algorithm and traditional search methods- two armed pundit problem- genetic algorithms in problem solving--implementing a genetic algorithm-applications of genetic algorithm

UNIT - III STIMULATED ANNEALING **9Hours**

Introduction - Procedure - Algorithm - Features of the Method –practical issues of stimulated annealing-numerical example –adaptive stimulated annealing- Simulated quenching**-**Applications of simulates annealing

UNIT - IV PARTICLE SWARM OPTIMIZATION **9Hours**

Introduction- Computational Implementation of PSO –variants of PSO-Improvement to the Particle Swarm Optimization Method - Solution of the Constrained Optimization Problem –applications of PSO

UNIT - V ANT COLONY OPTIMIZATION **9Hours**

Introduction-Ant searching behavior-algorithm-variants of ACO-applications of ant colony optimization-advantages and disadvantages of ACO- Current trends in ACO

REFERENCES

1. Singiresu S. Rao , "Engineering optimization- Theory and practice", 4th Edition, John Wiley & Sons, Inc., 2009
2. Melanie Mitchell, "An introduction to Genetic algorithm", MIT Press, London, 1998
3. Ant Colony Optimization: A Tutorial Review (http://mriu.edu.in/mrijet/index.php/mrijet/article/viewFile/51/47)
4. https://www.researchgate.net/publication/235426530_Adaptive_Simulated_Annealing
5. *www23.homepage.villanova.edu/varadarajan.komanduri/PSO_meander-line.ppt*
6. https://courses.cs.washington.edu/courses/cse473/05au/notes/SimulatedAnnealing.ppt
7. https://books.google.co.in/books?id=0eznlz0TF-IC&printsec=frontcover#v=onepage&q&f=false.

CS2144	BIG DATA ANALYTICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE	
This course provides a way to understand the concepts and the basics of Big Data and using an open source data analytics tool – R for analytics	
INSTRUCTIONAL OBJECTIVES	
1.	To learn the concepts of data analytics.
2.	To perform data analytics using R.
3.	To implement machine learning algorithms using R

UNIT – IINTRODUCTION TO R PROGRAMMING LANGUAGE 9 Hours

The Era of Big Data - R – The unsung Big Data hero - Learning R - R data structures- Exporting R data objects- Applied data Science with R – traditional limitations of R – memory limits

UNIT – IIParallel R, Hadoop and Map Reduce Framework 9 Hours

Big Memory to faster computations– future of parallel processing in R – Hadoop architecture –A single node Hadoop in cloud- A multi node Hadoop cluster

UNIT – IIIR WITH RELATIONAL DATABASES 9 Hours

Relational Database Management Systems- SQL- MariaDB with R – PostgreSQL with R

UNIT – IVR WITH NON-RELATIONAL DATABASES 9 Hours

Introduction to NoSQL databases – MongoDB with R- Introduction, Installation – Processing of Big Data using MongoDB with R

UNIT - V MACHINE LEARNING METHODS AND FUTURE OF R 9 Hours

Machine learning Algorithms –Big Data Machine Learning Tools- Naïve Bayes and Neural Network on Hadoop with R - Current state of Big Data analytics with R – Big, fast and Smart Data – future of R.

REFERENCES

1. Simon Walkowiak, "Big Data Analytics with R", Packet Publishing, 2016
2. Roger. D. Peng, " R Programming for Data Science", LeanPub, 2015
3. https://www.tutorialspoint.com/r/.
4. Colin Gillespie," Efficient R programming", Robin Lovelace, O'Reily Publishing, 2017.
5. http://adv-r.had.co.nz/.

CS2115	**SERVICE ORIENTED ARCHITECTURE**	**L**	**T**	**P**	**C**
	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				
PURPOSE:					
To learn the fundamentals and techniques of Service Oriented.					
INSTRUCTIONAL OBJECTIVES:					
At the end of the course, student will be able to					
1.	Service Oriented Architecture Concepts.				
2.	Web Services and Service Orientation.				

UNIT I - INTRODUCTION **9 Hours**

Fundamental SOA-Common characteristics of contemporary SOA- Common misperceptions about SOA-Common tangible benefits of SOA- Common pitfalls of adopting SOA-The Evolution of SOA**-**An SOA timeline (from XML to Web services to SOA)- The continuing evolution of SOA (standards organizations and contributing vendors)- The roots of SOA (comparing SOA to past architectures)-Web Services and Primitive SOA- The Web services framework- Services (as Web services)-Service descriptions (with WSDL)-Messaging (with SOAP).

UNIT II - WEB SERVICES AND CONTEMPORARY SOA INTRODUCTION ANDISSUES **9 Hours**

Messageexchangepatterns-Serviceactivity-coordination-Atomictransactions-Business activities-Orchestration-Choreography- Addressing- Reliable messaging-Correlation-Policies- Metadata exchange- Security- Notification and eventing

UNIT III - SOA AND SERVICE-ORIENTATION **9 Hours**

Principles of Service-Orientation-Service-orientation and the enterprise- Anatomy of a service-oriented architecture- Common principles of service-orientation- How service-orientation principles inter-relate-Section-Service-orientation and object-orientation-Native Web service support for service-orientation principles-Service Layers-Service orientationandcontemporary SOA- Service layer abstraction-application service layer-Business service layer- Orchestration service layer-Agnostic services- Service layer configuration scenarios.

UNIT IV - BUILDING SOA (PLANNING AND ANALYSIS) **9 Hours**

SOA Delivery Strategies- SOA delivery lifecycle phases- The top-down strategy- The bottom-up strategy- The agile strategy- Service-Oriented Analysis - Introduction service-oriented analysis- Benefits of a business-centric SOA- Deriving business services-Service-Oriented Analysis- Service modeling (a step-by-step process)-

Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches (an example)

UNIT V - SERVICE-ORIENTED DESIGN **9 Hours**

Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface design tools- Stepsto composing SOA-Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions -Overview-Service design of business service, application service, task centric service and guidelines - Service-Oriented Design (Business Process Design)-WS-BPEL language basics-WS-Coordination overview- Service-oriented business process design (a step-by-step process).

REFERENCES

1. Thomas Erl, "*Service-Oriented Architecture: Concepts,Technology & Design*", Pearson Education Pvt. Ltd 2008.
2. Thomas Erl, "*SOA Principles of Service Design*", Pearson Education, 2007.
3. Tomas Earl and Grady Booch,"*SOA Design Patterns*", Prentice Hall 2008.

CS2145	FOG COMPUTING	L	T	P	C
	Total contact Hours45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course gives an overview of Fog Computing and its architecture, challenges and applications in different context.

INSTRUCTIONAL OBJECTIVES

At the end of the course, student will be able to

1.	Become familiar with the concepts of Fog
2.	Understand the architecture and its components and working of components and its performance
3.	Explore Fog on security , multimedia and smart data
4.	Model the fog computing scenario

UNIT-I INTRODUCTION TO FOG COMPUTING **9 Hours**

Fog Computing-Definition-Characteristics-Application Scenarios - Issues -Fog Computing and Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT, FOG, Cloud-Benefits

UNIT-II ARCHITECTURE **9 Hours**

Working Procedure -Performance Evaluation Components- Software Systems – Architecture-Modeling and Simulation -Challenges

UNIT-III FOG PROTOCOLS **9 Hours**

Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols

UNIT-IV MANAGEMENT OF DATAANDSECURITY ANALYSIS **9 Hours**

Smart Management of Big Data-Smart Data-Structure of Smart Data- Smart Data Life Cycle-System Architecture-Multi-dimensional Payment Plan- -Security and Privacy Issues-Multimedia Fog Computing-Architecture-Deduplication-Hybrid Secure Deduplication- Security Challenges-Security Requirements.

UNIT-V CASE STUDY **9 Hours**

Case Study: Wind Farm - Smart Traffic Light System, Wearable Sensing Devices , Wearable Event Device ,Wearable System, Demonstrations , Post Application Example Event Applications Example .

REFERENCES

1. Ivan Stojmenovic, Sheng Wen ," The Fog Computing Paradigm: Scenarios and Security Issues" Proceedings of the 2014 Federated Conference on Computer Science and Information Systems pp. 1–8
2. Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne
3. Multi-Dimensional payment Plan in Fog Computing with Moral Hazar,YanruZhang,Nguyen H. Tran,DusitNiyato, and Zhu Han,IEEE,2016
4. FarhoudHosseinpour,JuhaPlosila,HannuTenhunen,"An Approach for Smart management of Big Data in the Fog ConputingContext",IEEE 8th International Conference on Cloud Computing Technology and Science,2016
5. Hua-Jun Hong, Jo-Chi Chuang and Cheng-HsinHsu,"Animation Rendering on Multimedia Fog computing Platforms", IEEE 8th International Conference on Cloud Computing Technology and Science,2016
6. Dongyoung Koo, Youngjoo Shin, Joobeom Yun, junbeomHur,"A Hybrid deduplicaton for secure and Efficiet data Outsourcing n Fog Computing", IEEE 8th International Conference on Cloud Computing Technology and Science,2016
7. Fog Computing: A Platform for Internet of Things and Analytics, FlavioBonomi, Rodolfo Milito, Preethi Natarajan and Jiang Zhu, Big Data and Internet of Things: A Roadmap for Smart Environments, Studies in Computational Intelligence 546, DOI: 10.1007/978-3-319-05029-4_7, © Springer International Publishing Switzerland 2014
8. Fog Computing and Its Role in the Internet of Things,FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012 ACM 978-1-4503-1519-7/12/08... $15.00.
9. A Survey of Fog Computing: Concepts, Applications and Issues,Shanhe Yi, Cheng Li, Qun Li, Mobidata'15, June 21, 2015, Hangzhou, China. Copyright c 015 ACM 978-1-4503-3524-9/15/06 ...$15.00. DOI: http://dx.doi.org/10.1145/2757384.2757397.
10. Security and Privacy Issues of Fog Computing: A Survey,Shanhe Yi, Zhengrui Qin, and Qun Li
11. IEEE INTERNET OF THINGS JOURNAL, VOL. XX, NO. X, JUNE 2017 1 LoDPD: A Location Difference-based Proximity Detection Protocol for Fog Computing Yan Huo∗, Member, IEEE,Chunqiang Hu†, Member, IEEE,,Xiaowei Qi∗ , Tao Jing∗.
12. Fog Protocol and FogKit: A JSON-Based Protocol and Framework for Communication Between Bluetooth-Enabled Wearable Internet of Things Devices Spencer Lewson,by Spencer Lewson June 2015.

CS2146	INTERNET OF THINGS AND COMPUTING	L	T	P	C
	Total Contact Hours 45	3	0	0	3
	Prerequisite:Nil				

PURPOSE	
To understand the middleware IOT, protocols and its applications	
INSTRUCTIONAL OBJECTIVES	
At the end of the course, student will be able to	
1.	Understand the principles behind the Modern Network approaches such as IoT
2.	Ability to analyze topologies and architectures in IoT environment
3.	Understand the data traversal over virtualized environment for IoT
4.	Design algorithms for enabling IoT
5.	Understand the various types of key techniques used in modern networks.

UNIT - I THE INTERNET OF THINGS **9 Hours**

Rise of the Machines- Defining Internet of Things- IoT: A Web 3.0 View- Panoramic View of IoT Applications- Telematics and Intelligent Transport Systems- Smart Grid and Electric Vehicles- Smarter Planet and Smart Buildings- The Horizontal, Verticals, and Four Pillars- M2M: The Internet of Devices

UNIT - II THE DNA OF IOT **9 Hours**

RFID: The Internet of Objects- WSN: The Internet of Transducers- SCADA: The Internet of Controllers- DCM: Device, Connect, and Manage- Device: Things That Talk- Connect: Via Pervasive Networks-Wired Networks- Wireless Networks- Satellite IoT- Manage: To Create New Business Value

UNIT - III MIDDLEWARE FOR IOT **9 Hours**

An Overview of Middleware- Communication Middleware for IoT- MTC/M2M Middleware- SCADA Middleware- RFID Middleware- WSN Middleware- LBS and Surveillance Middleware- IoT Protocol Standardization Efforts- Unified Data Standards: A Challenging Task

UNIT - IV THE TOOLKIT APPROACH FOR END-USER PARTICIPATION IN THE INTERNET OF THINGS **9 Hours**

From Internet to Internet of Things- Towards a Participatory Approach- Innovations to Users via Toolkits- Existing Toolkits- From the Internet of Things to the Web of Things- Designing RESTful Smart Things- Web-enabling Constrained Devices- Physical Mashups: Recomposing the Physical World- Advanced Concepts: The Future Web of Things

UNIT – VA SERVICE-ORIENTED, SEMANTIC APPROACH TO DATA INTEGRATION FOR AN INTERNET OF THINGS 9 Hours

Item-level Information Management Approaches- Enterprise Application Integration Approaches- Logistics Systems Integration Targets- Integrating Intelligent Logistics Objects- IoT Security- The Patching Vulnerability- IoT Security and Privacy Requirements Defined by ITU-T- An IoT Security Framework- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework

REFERENCES

1. HonboZhou, "the internet of things in the cloud: a middleware perspective", CRC press, 2012.
2. Architecting the internet of things editors: dieter Uckelmann, Mark Harrison, Florian MichahellesISBN: 978-3-642-19156-5 (print).
3. "Foundations of modern networking: SDN, NFV, QOE, IOT, and cloud" William Stallings publisher: Addison-Wesley 2015 ISBN: 9780134175393.
4. Network Function virtualization with a touch of sdnby Paresh Shah, Syed Farrukh Hassan, RajendraChayapathi.
5. Software Defined Networks a Comprehensive Approach IST Edition by Paul Goransson Chuck Black.

CS2147	**MOBILE AND CELLULAR NETWORK SECURITY**	**L**	**T**	**P**	**C**
	Total contact hours:45	3	0	0	3
	Prerequisite:				
	Nil				
PURPOSE:					
To understand the various cryptographic algorithms and the mechanisms used to mitigate the security risks.					
INSTRUCTIONAL OBJECTIVES:					
At the end of the course, student will be able to					
1.	Ability to understand the basics of mobile cellular networks.				
2.	Understand the mechanism used in the classical encryption system and different type of block cipher mode of operation.				
3.	Ability to encrypt/decrypt a message using Cryptography.				

UNIT - I INTRODUCTION TO CELLULAR MOBILE SYSTEM 9 Hours

A basic cellular system - Performance criteria - Uniqueness of mobile radio environment - Operation of cellular systems - Concept of Frequency reuse channels- Different cellular systems.

UNIT - II APPLICATION LEVEL SECURITY IN CELLULAR NETWORKS 9 Hours

Generations of Cellular networks - Security issues and attacks in cellular networks - GSM security for applications - GPRS, UMTS security for applications, - 3G security for applications- Some of security and authentication solutions.

UNIT – IIIMOBILE HTML SECURITY & Wireless LAN Security 9 Hours

Mobile HTML Basics - Authentication on Mobile HTML sites – Encryption - Application attacks on mobile HTML sites - Mobile browser weakness - Enterprise security on Mobile OS – Wireless LAN Security.

UNIT – IVMOBILE MALWARE AND TESTING TOOLS 9 Hours

Mobile malware - Threat scenarios - Mitigating mobile malware mayhem-Mobile platform attack tools and utilities - Browser extensions - Networking tools -Web application tools.

UNIT - V MOBILE SECURITY FRAMEWORK 9 Hours

Security framework for mobile environment - Mobile agents and its application - Mobile web security, Security of mobile VOIP communications - Emerging trends in mobile security.

REFERENCES

1. C. Y. Lee and William, “Mobile Cellular Telecommunications”, 3rd Ed, McGraw Hill. 2001.
2. Wireless & Mobile Network Security: PallapaVenkataram, Satish Babu, TMH, 2010.
3. Mobile Application Security, HimanshuDviwedi, Chris Clark and David Thiel, 1st Edition 2010.
4. Wireless LAN Security - http://www.cisco.com/c/en/us/products/collateral/wireless/aironet-1200-access-point/prod_white_paper09186a00800b469f.html

SUPPORTIVE COURSES

MA2013	**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE	
To impart analytical ability and to solve real life problems pertaining to branches of Computer Science and Engineering.	
INSTRUCTIONAL OBJECTIVES	
1	To be exposed with logic
2	To be thorough in mathematical induction
3	To understand algebraic systems such as relations
4	To be familiar with the basic concepts of lattices

UNIT I – LOGIC **9 hours**

Logic - Statements - Connectives - Truth tables - Normal forms - Predicate calculus - Inference Theory for Statement calculus and predicate calculus.

UNIT II – COMBINATORICS **9 hours**

Combinatory - Mathematical Induction - Pigeonhole principle - Principle of inclusion and exclusion.

UNIT III - RECURSIVE FUNCTIONS **9 hours**

Recursive Functions- Recurrence relation - Solution of recurrence relation using characteristic polynomial and using generating function - Recursive functions - Primitive recursive functions, Computable and non computable functions.

UNIT IV - ALGEBRAIC STRUCTURES **9 hours**

Algebraic Structures - Groups - Definition and examples only - Cyclic groups Permutation group (Sn and Dn) - Subgroups - Homomorphism and Isomorphism - Cosets - Lagrange's Theorem - Normal subgroups - Cayley's representation theorem.

UNIT V – LATTICES **9 hours**

Lattices - Partial order relations, Poset - Lattices, Hasse diagram - Boolean algebra.

REFERENCES

1. Tremblay J.P. and Manohar R., "*Discrete Mathematical Structures withapplications to Computer Science*", McGraw Hill International Edition, 1987
2. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 4th Edition, Tata McGraw Hill, 2002.
3. Venkataraman M.K. etal., "*Discrete Mathematics*", National Publishing Co.,2000.
4. Prof. Sundaresan V., Ganapathy Subramanian K.S.andGanesan K., "*DiscreteMathematics*", New Revised Edition, 2001.
5. Alan Doerr and Kenneth Levasseur, "*Applied Discrete Structures for ComputerScience*", Galgotia Publications (P) Ltd.,1992.
6. Liu C.L., "*Elements of Discrete Mathematics*", 2nd Edition, McGraw Hill Publications, 1985.
7. Gersting. J.L. , "*Mathematical Structures for Computer Science*", 3rd Edition, W.H. Freeman and Co., 1993.
8. Lidl and Pitz, "*Applied abstract Algebra*", Springer - Verlag, New York, 1984.

	GRAPH THEORY AND OPTIMIZATION TECHNIQUES	L	T	P	C
MA2010	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To develop analytical capability and to impart knowledge in graphs, linear programming problem and statistical methods and their applications in Engineering & Technology and to apply their concepts in engineering problems they would come across

INSTRUCTIONAL OBJECTIVES

1	Student should be able to understand graphs ,linear programming problems and statistical concepts.
2	Students should be able to apply the concepts in solving the Engineering problems

UNIT I - BASICS OF GRAPH THEORY **9 hours**

Graphs - Data structures for graphs - Subgraphs - Operations on Graphs Connectivity – Networks and the maximum flow - Minimum cut theorem - Trees - Spanning trees - Rooted trees – Matrix representation of graphs.

UNIT II - CLASSES OF GRAPHS **9 hours**

Eulerian graphs and Hamiltonian graphs - Standard theorems - Planar graphs - Euler's formula - Five colour theorem - Coloring of graphs - Chromatic number (vertex and edge) properties and examples - Directed graphs

UNIT III- GRAPH ALGORITHM **9 hours**

Computer Representation of graphs - Basic graph algorithms - Minimal spanning tree algorithm - Kruskal and Prim's algorithm - Shortest path algorithms - Dijsktra's algorithm - DFS and BFS algorithms.

UNIT IV - OPTIMIZATION TECHNIQUES **9 hours**

Linear programming – Graphical methods – Simplex method (Artificial variables not included) – Transportation and assignment problems.

UNIT V – STATISTICS **9 hours**

Tchebyshev's inequality – Maximum likelihood estimation – Correlation – Partial correlation – Multiple correlations.

REFERENCES

1. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", PHI 1974.
2. Rao S.S., "Engineering Optimization: Theory and Practice", New Age International Pvt. Ltd., 3rd Edition 1998.

MA2011	**STOCHASTIC PROCESSES AND QUEUEING THEORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE
To impart knowledge on probability concepts to study their applications in stochastic processes & queueing theory

INSTRUCTIONAL OBJECTIVES	
1	Compute the characteristics of the random variable given the probabilities
2	Understand and apply various distribution
3	Solve cases of different Stochastic processes along with their properties.
4	Use discrete time finite state Markov chains
5	Gain sufficient knowledge in principles of queueing theory

UNIT I - RANDOM VARIABLES **9 hours**

One dimensional and two dimensional Random Variables – Characteristics of Random Variables : Expectation, Moments.

UNIT II - THEORETICAL DISTRIBUTIONS **9 hours**

Discrete : Binomial, Poisson, Negative Binomial, Geometric, Uniform Distributions. Continuous: Uniform, Exponential, Erlang and Gamma, Weibull Distributions.

UNIT III - STOCHASTIC PROCESSES **9 hours**

Classification of Stochastic Processes – Bernoulli process – Poisson process – Pure birth process – Birth and Death process.

UNIT IV - MARKOV CHAINS **9 hours**

Introduction – Discrete-Parameter Markov Chains – Transition Probability Matrix – Chapman Kolmogorov Theorem – State classification and limiting distributions.

UNIT V- QUEUING THEORY **9 hours**

Introduction – Characteristics of Markovian Single server and Multi server queuing models [(M/M/1) : (∞ / FIFO), (M/M/1) : (N / FIFO), (M/M/s) : (∞ /FIFO)] – M/G/1 Queuing System – PollaczekKhinchin formula.

REFERENCES

1. Kishore.S.Trivedi, "Probability & Statistics with Reliability, Queuing and Computer Science Applications", PHI, New Delhi, 1995.
2. Veerajan T, "Probability, Statistics and Random Processes", 3rd Edition Tata McGraw Hill, New Delhi, 2002.
3. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 9th revised edition, Sultan Chand & Co., New Delhi 2003.
4. Gross.D and Harris.C.M. "Fundementals of Queuing theory", John Wiley and Sons, 1985.
5. Allen.A.O., "Probability, Statistics and Queuing Theory", Academic Press, 1981.

SEMESTER I

CAC2001	**CAREER ADVANCEMENT COURSE FOR ENGINEERS – I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE	
To enhance holistic development of students and improve their employability skills	
INSTRUCTIONAL OBJECTIVES	
1	To improve aptitude, problem solving skills and reasoning ability of the student.
2	To collectively solve problems in teams & group.
3	Understand the importance of verbal and written communication in the workplace
4	Understand the significance of oral presentations, and when they may be used.
5	Practice verbal communication by making a technical presentation to the class
6	Develop time management Skills

UNIT I–BASIC NUMERACY

- Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II-ARITHMETIC – I

Percentages, Profit & Loss, Equations

UNIT III-REASONING - I

- Logical Reasoning

UNIT IV-SOFT SKILLS - I

- Presentation skills, E-mail Etiquette

UNIT V-SOFT SKILLS - II

- Goal Setting and Prioritizing

ASSESSMENT

Soft Skills (Internal)
Assessment of presentation and writing skills.

Quantitative Aptitude (External)
Objective Questions- 60 marks
Descriptive case lets- 40 marks*
Duration: 3 hours
*****Engineering problems will be given as descriptive case lets.

REFERENCE:

1. Quantitative Aptitude by Dinesh Khattar – PearsonsPublicaitons
2. Quantitative Aptitude and Reasoning by RV Praveen – EEE Publications
3. Quantitative Aptitude by AbijithGuha – TATA Mc GRAW Hill Publications
4. Soft Skills for Everyone by Jeff Butterfield – Cengage Learning India Private Limited
5. Six Thinking Hats is a book by Edward de Bono - Little Brown and Company
6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd – Meerut

SEMESTER II

CAC2002	**CAREER ADVANCEMENT COURSE FOR ENGINEERS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE	
To enhance holistic development of students and improve their employability skills	
INSTRUCTIONAL OBJECTIVES	
1	To improve aptitude, problem solving skills and reasoning ability of the student.
2	To collectively solve problems in teams & group.
3	Understand the importance of verbal communication in the workplace
4	Understand the significance of oral presentations, and when they may be used.
5	Understand the fundamentals of listening and how one can present in a group discussion
6	Prepare or update resume according to the tips presented in class.

UNIT I-ARITHMETIC – II

- Ratios & Proportions, Mixtures & Solutions

UNIT II - MODERN MATHEMATICS

- Sets & Functions, Data Interpretation, Data Sufficiency

UNIT III – REASONING - II

- Analytical Reasoning

UNIT IV – COMMUNICATION – I

- Group discussion, Personal interview

UNIT V - COMMUNICATION - II

- Verbal Reasoning test papers

ASSESSMENT

Communication (Internal)

- Individuals are put through formal GD and personal interviews.
- Comprehensive assessment of individuals' performance in GD & PI will be carried out.

Quantitative Aptitude (External)

Objective Questions- 60 marks (30 Verbal +30 Quants)
Descriptive case lets- 40 marks*
Duration: 3 hours
*Engineering problems will be given as descriptive case lets.

REFERENCES

1. Quantitative Aptitude by Dinesh Khattar – PearsonsPublicaitons
2. Quantitative Aptitude and Reasoning by RV Praveen – EEE Publications
3. Quantitative Aptitude by AbijithGuha – TATA Mc GRAW Hill Publications
4. General English for Competitive Examination by A.P. Bharadwaj – Pearson Educaiton
5. English for Competitive Examination by Showick Thorpe - Pearson Educaiton
6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd - Meerut
7. Verbal Ability for CAT by Sujith Kumar - Pearson India
8. Verbal Ability & Reading Comprehension by Arun Sharma - Tata McGraw – Hill Education

SEMESTER III

CAC2003	**CAREER ADVANCEMENT COURSE FOR ENGINEERS – III**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE	
To develop professional skills abreast with contemporary teaching learning methodologies	
INSTRUCTIONAL OBJECTIVES	
1	Acquire knowledge on planning, preparing and designing a learning program
2	prepare effective learning resources for active practice sessions
3	facilitate active learning with new methodologies and approaches
4	create balanced assessment tools
5	hone teaching skills for further enrichment

UNIT I- DESIGN **(2 hrs)**

- Planning &Preparing a learning program.
- Planning & Preparing a learning session

UNIT II – PRACTICE **(2 hrs)**

- Facilitating active learning
- Engaging learners

UNIT III – ASSESSMENT **(2 hrs)**

- Assessing learner's progress
- Assessing learner's achievement

UNIT IV – HANDS ON TRAINING **(10 hrs)**

- Group activities – designing learning session
- Designing teaching learning resources
- Designing assessment tools
- Mock teaching session

UNIT V – TEACHING IN ACTION **(14 hrs)**

- Live teaching sessions
- Assessments

ASSESSMENT (Internal)

Weightage:
Design - 40%
Practice – 40%
Quiz – 10%
Assessment – 10%

REFERENCES

Cambridge International Diploma for Teachers and Trainers Text book by Ian Barker - Foundation books
Whitehead, Creating a Living Educational Theory from Questions of the kind: How do I improve my Practice? Cambridge J. of Education

AMENDMENTS

S.No.	Details of Amendment	Effective from	Approval with date
