

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
M.E. MOBILE AND PERVASIVE COMPUTING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

1. To enable graduates to understand and gain knowledge in mobile applications and to have a successful career in academia or industries associated with mobile pervasive computing and services or develop as entrepreneurs.
2. To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.
3. To bring in advanced thinking to students to meet the emerging futuristic needs using modern techniques like IoT.
4. To prepare students to critically analyze existing problems and ethically develop innovative and research oriented methodologies to solve the problems identified.

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OBJECTIVES (PSOs):

1. To learn the concepts of mobile communication technologies and protocols.
2. To analyze, design and develop efficient mobile and pervasive systems and applications using advanced technique and tools.
3. To apply IoT principles, interoperability and security principles for developing secured systems and services for various applications.
4. To innovate ideas and provide smart solutions for the futuristic needs of pervasive systems and services.

Provide mapping of 1) POs to PEOs and 2) PSOs to PEOs.
Use the following marking:

Contribution 1: Reasonable 2: Significant 3: Strong

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	2	3	2							
2	3				3		2			1
3			2	2		2		1	1	
4		3		2	2	2	2	3	2	

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

Y E A R	SEME STER	SUBJECTS	PROGRAMME OUTCOMES										
			PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
I Y E A R	SEM I	Applied Mathematics for Pervasive Computing	3	1		1							
		Internet of Things		2	2	2	3	2	1	1			
		Design of Embedded Systems		1	3	1	2		1		1	2	
		Wireless Communication Networks	2		3		2	1	2				
		Distributed Systems	1		2	1	2			2	2	2	
		Advances in Mobile Computing and Communication	2	1	2		2	2	2				
		Embedded Systems Laboratory		2	3	1	2		1		1	2	
		Wireless Networking Laboratory	3		3		2	1	2				
	SEM II	Wireless Adhoc and Sensor Networks	2	1	2		2	2	2	1			
		Real Time Systems	1		1	3	2		2		1	2	
		Security Practices				1	2			3	2	2	
		Smart Technologies for Pervasive Computing	2	1	2		2	2	2	1	1	1	
Smart Computing Laboratory		2	1	2	2	3	2	2	1		2		
Mobile Application Development Laboratory			2	3	2	2		1		2			

		Professional Elective I											
		XML and Web Services		1	3	2	2		1		1	1	
		Service Oriented Architecture and Design		2	2	3	2		1	1			
		Data Warehousing and Data Mining	2	2	2	1	1					1	
		Human Computer Interaction		1	3	1	2		1	1			
		Professional Elective II											
		Big Data Analytics	2	2	2	3	1				1		
		Biometric Image Processing	1	1	2		2	3	1				
		Fault Tolerant Computing			2	2	2				1		
		Energy Aware Computing		3		2	2		2	1	1	1	
II Y E A R	SEM III	Context Aware Computing			3				2	1	1	1	
		Project Work (Phase I)		3	2		2	1			2		
		Soft Computing Techniques	2	2	3		2		1		1	1	
		Machine Learning Techniques	2	2	2	3	2		1	1		1	
		Autonomous Computing	1	2	2		2		1		1		
		Haptic Technology				3	2	2	1	1	1		
		Professional Elective IV											
		Cloud Computing and Services		1	2	2	3	1		1			2
		Bio Informatics		2	3	2		1	1	1			
		Social Networks		2	3	3	2	2	1	1	1	1	1
	Cognitive Computing	1	2	3		2		2	2	2	1	1	
SEM IV		Project Work Phase II		2	3	3	2	1	2	1	2	1	

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
M.E. MOBILE AND PERVASIVE COMPUTING
REGULATIONS – 2017
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI

SEMESTER - I

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA5158	Applied Mathematics for Pervasive Computing	FC	4	4	0	0	4
2.	CP5292	Internet of Things	PC	3	3	0	0	3
3.	MP5101	Design of Embedded Systems	PC	3	3	0	0	3
4.	MP5102	Wireless Communication Networks	PC	3	3	0	0	3
5.	MP5103	Distributed Systems	PC	3	3	0	0	3
6.	MP5104	Advances in Mobile Computing and Communications	PC	3	3	0	0	3
PRACTICALS								
7.	MP5111	Embedded Systems Laboratory	PC	4	0	0	4	2
8.	MP5112	Wireless Networking Laboratory	PC	4	0	0	4	2
TOTAL				27	19	0	8	23

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CU5097	Wireless Adhoc and Sensor Networks	PC	3	3	0	0	3
2.	MP5291	Real Time Systems	PC	3	3	0	0	3
3.	CP5291	Security Practices	PC	3	3	0	0	3
4.	MP5201	Smart Technologies for Pervasive Computing	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	MP5211	Smart Computing Laboratory	PC	4	0	0	4	2
8.	MP5212	Mobile Application Development Laboratory	PC	4	0	0	4	2
TOTAL				26	18	0	8	22

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MP5391	Context Aware Computing	PC	3	3	0	0	3
2.		Professional Elective III	PE	3	3	0	0	3
3.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
4.	MP5311	Project Work Phase I	EEC	12	0	0	12	6
TOTAL				21	9	0	12	15

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	MP5411	Project Work Phase II	EEC	24	0	0	24	12
TOTAL				24	0	0	24	12

TOTAL NO. OF CREDITS:72

FOUNDATION COURSES (FC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA5158	Applied Mathematics for Pervasive Computing	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CP5292	Internet of Things	PC	3	3	0	0	3
2.	MP5101	Design of Embedded Systems	PC	3	3	0	0	3
3.	MP5102	Wireless Communication Networks	PC	3	3	0	0	3
4.	MP5103	Distributed Systems	PC	3	3	0	0	3
5.	MP5104	Advances in Mobile Computing and Communications	PC	3	3	0	0	3
6.	MP5111	Embedded Systems Laboratory	PC	4	0	0	4	2
7.	MP5112	Wireless Networking Laboratory	PC	4	0	0	4	2
8.	CU5097	Wireless Adhoc and Sensor Networks	PC	3	3	0	0	3
9.	MP5291	Real Time Systems	PC	3	3	0	0	3
10.	CP5291	Security Practices	PC	3	3	0	0	3
11.	MP5201	Smart Technologies for Pervasive Computing	PC	3	3	0	0	3
12.	MP5211	Smart Computing Laboratory	PC	4	0	0	4	2
13.	MP5212	Mobile Application Development Laboratory	PC	4	0	0	4	2
14.	MP5391	Context Aware Computing	PC	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSE (EEC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MP5311	Project Work Phase I	EEC	12	0	0	12	6
2.	MP5411	Project Work Phase II	EEC	24	0	0	24	12

**PROFESSIONAL ELECTIVES (PE)*
SEMESTER II
ELECTIVE I**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MP5001	XML and Web Services	PE	3	3	0	0	3
2.	SE5091	Service Oriented Architecture and Design	PE	3	3	0	0	3
3.	MU5071	Data Warehousing and Data Mining	PE	3	3	0	0	3
4.	MP5091	Human Computer Interaction	PE	3	3	0	0	3

**SEMESTER II
ELECTIVE II**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CP5293	Big Data Analytics	PE	3	3	0	0	3
2.	BC5251	Biometric Image Processing	PE	3	3	0	0	3
3.	MP5002	Fault Tolerant Computing	PE	3	3	0	0	3
4.	IF5091	Energy Aware Computing	PE	3	3	0	0	3

**SEMESTER III
ELECTIVE III**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MP5092	Soft Computing Techniques	PE	3	3	0	0	3
2.	CP5191	Machine Learning Techniques	PE	3	3	0	0	3
3.	MP5003	Autonomous Computing	PE	3	3	0	0	3
4.	MP5004	Haptic Technology	PE	3	3	0	0	3

**SEMESTER III
ELECTIVE IV**

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MP5005	Cloud Computing and Services	PE	3	3	0	0	3
2.	CP5075	Bio Informatics	PE	3	3	0	0	3
3.	MP5006	Social Networks	PE	3	3	0	0	3
4.	MP5007	Cognitive Computing	PE	3	3	0	0	3

REFERENCES :

1. Bronson, R. "Matrix Operations", Schaum's outline series, 2nd Edition, McGraw Hill, 2011.
2. Lewis, D.W. "Matrix Theory", Allied Publishers, Chennai, 1995.
3. Narasingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall India, 1997.
4. Rao, S. S. "Engineering Optimization, Theory and Practice", 4th Edition, John Wiley and Sons, 2009.
5. Taha H .A. "Operations Research: An Introduction", 9th Edition, Pearson Education Asia, New Delhi, 2016.
6. Walpole R.E., Myer R.H., Myer S.L., and Ye, K., "Probability and Statistics for Engineers and Scientists ", 7th Edition, Pearson Education, Delhi, 2002.

CP5292

INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

UNIT I INTRODUCTION TO IoT

9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II IoT ARCHITECTURE

9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT III IoT PROTOCOLS

9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security.

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO

9

Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS

9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to:

- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Raspberry Pi
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

REFERENCES:

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
4. Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatias , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012

MP5101

DESIGN OF EMBEDDED SYSTEMS

**L T P C
3 0 0 3**

OBJECTIVES:

- To learn the internal architecture of an embedded processor including timers and interrupts
- To quantize the core specifications of an embedded processor
- To introduce interfacing I/O devices to the processor
- To provide exposure on Microcontroller programming and Real time operating system features.
- To run and debug programs in an IDE
- To enable design of embedded systems.

UNIT I EMBEDDED COMPUTING

9

Embedded processors –8051 Microcontroller – Architecture, Instruction set and programming. Programming parallel ports, Timers and serial port – Memory and I/O devices interfacing – Interrupt handling.

UNIT II EMBEDDED C PROGRAMMING

9

Programming embedded systems in C – Implementing Timers, Interrupts and Serial communication in embedded C- Multi-state systems-Programming Tools and Techniques

UNIT III LOW POWER EMBEDDED PROCESSOR

9

ARM7 TDML processing core - Architecture, ARM and Thumb instruction sets programming – Intel ATOM/Quark Processor – Architecture – Programming- PIC and other Advanced Low Power Processor- Introduction to IoT

UNIT IV REAL TIME SYSTEMS**9**

Introduction to Real – Time Operating Systems – Need and issues-Tasks - process & threads, interrupt routines in RTOS , Scheduling policies – Interprocess communication mechanisms – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: VxWorks, 4C/OS-II, RT Linux.

UNIT V EMBEDDED SOFTWARE**9**

Challenges of Embedded Systems – Embedded system design process- Meeting real time constraints – Multi-state systems and function sequences. Embedded software development tools – Emulators and debuggers. Design methodologies – Phases & Modeling of the EDLC-choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems- Complete design of example embedded systems- Case studies

TOTAL : 45 PERIODS**OUTCOMES:****At the end of the course the students will be able to**

- Design a simple embedded application
- Explore various embedded processor
- Design and deploy timers and interrupts
- Design an embedded processor based system for a real-time application
- Debug and verify a design using a simulator and microcontrollers.
- Make use of embedded software tools

REFERENCES:

1. Andrew N Sloss, D. Symes, C. Wright, " Arm system developers guide", Morgan Kaufman/ Elsevier, 2006.
2. ArshdeepBahga, Vijay Madiseti, " Internet of Things: A Hands-on-Approach" VPT First Edition, 2014
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things" Wiley Publication, First edition, 2013
4. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, 2009.
5. Jonathan W.Valvano,"Embedded Microcomputer Systems ,Real Time Interfacing",Cengage Learning,3rd edition,2012
6. Michael J. Pont, "Embedded C", Pearson Education , 2007.
7. Muhammad Ali Mazidi , SarmadNaimi, SepehrNaimi, "The AVR Microcontroller and Embedded Systems: Using Assembly and C" Pearson Education, First edition, 2014
8. Muhammed Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second edition, 2007
9. Steve Heath, "Embedded System Design", Elsevier, 2005
10. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.

MP5102**WIRELESS COMMUNICATION NETWORKS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of wireless communication.
- To make the students to know about the various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To study about Wireless networks, protocol stack and standards.

UNIT I	WIRELESS CHANNEL PROPAGATION AND MODEL	9
Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering- Small scale fading- channel classification- channel models – COST -231 Hata model, Longley-Rice Model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading –shadowing Distributions, Link power budget Analysis		
UNIT II	DIVERSITY & EQUALISATION	9
Capacity of flat and frequency selective fading channels-Realization of independent fading paths, Receiver Diversity: selection combining, Threshold Combining, Maximum-ratio Combining, Equal gain Combining. Transmitter Diversity: Channel known at transmitter, channel unknown at the transmitter. Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms		
UNIT III	MIMO COMMUNICATIONS & MULTI USER SYSTEMS	9
Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain:Beamforming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC,STTC, Spacial Multiplexing and BLAST Architectures. Multiple Access : FDMA,TDMA, CDMA,SDMA, Hybrid techniques, Random Access: ALOHA,SALOHA,CSMA, Scheduling, power control, uplink downlink channel capacity, multiuser diversity, MIMO-MU systems		
UNIT IV	WIRELESS NETWORKS	9
3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, 4G features and challenges, Technology path, IMS Architecture - Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer		
UNIT V	TRANSPORT & NETWORK LAYER	9
Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6 - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP .		
TOTAL :		45 PERIODS

OUTCOMES:

At the end of the course the student should be able to:

- Compare the type and Choose appropriate modulation techniques of wireless fading channel based on the system parameters and the property of the wireless medium
- Construct the appropriate transmitter and receiver design of multi-antenna systems and calculate the overall capacity of wireless fading channel.
- Develop wireless network environment for any application using latest wireless protocols and standards
- Analyze the TCP protocol performance under limited network resources

REFERENCES:

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.
2. Rappaport. T.S., "Wireless communications", Pearson Education, 2003.
3. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.
4. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
5. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.
6. Vijay Garg, "Wireless Communications and networking", First Edition, Elsevier 2007.

MP5103

DISTRIBUTED SYSTEMS

L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand foundations of Distributed Systems.
- Introduce the idea of peer to peer services and file system.
- Understand in detail the system level and support required for distributed system.
- Understand the issues involved in studying process and resource management.

UNIT I INTRODUCTION

7

Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. **Case study:** World Wide Web.

UNIT II COMMUNICATION IN DISTRIBUTED SYSTEM

10

System Model – Inter process Communication - the API for internet protocols – External data representation and Multicast communication. **Network virtualization:** Overlay networks. **Case study:** MPI **Remote Method Invocation And Objects:** Remote Invocation – Introduction - Request-reply protocols - Remote procedure call - Remote method invocation. **Case study:** Java RMI - Group communication - Publish-subscribe systems - Message queues - Shared memory approaches - Distributed objects - Case study: Enterprise Java Beans -from objects to components.

UNIT III PEER TO PEER SERVICES AND FILE SYSTEM

10

Peer-to-peer Systems – Introduction - Napster and its legacy - Peer-to-peer – Middleware - Routing overlays. **Overlay case studies:** Pastry, Tapestry- Distributed File Systems –Introduction - File service architecture – Andrew File system. **File System:** Features-File model -File accessing models - File sharing semantics **Naming:** Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

UNIT IV SYNCHRONIZATION AND REPLICATION

9

Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks - Global states – Coordination and Agreement – Introduction - Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control - Timestamp ordering – Atomic Commit protocols -Distributed deadlocks – Replication – Case study – Coda.

UNIT V PROCESS & RESOURCE MANAGEMENT**9**

Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. **Resource Management:** Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

TOTAL: 45 PERIODS**OUTCOMES:****At the end of the course, the student should be able to:**

- Discuss trends in Distributed Systems.
- Apply network virtualization.
- Apply remote method invocation and objects.
- Design process and resource management systems.

REFERENCES:

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
3. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.
4. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
5. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.

MP5104	ADVANCES IN MOBILE COMPUTING AND COMMUNICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the basic concepts of mobile computing.
- Be familiar with the network protocol stack.
- Learn the basics of mobile telecommunication system.
- Be exposed to 4G and 5G Networks.
- Gain knowledge about Energy-Efficient for 4G LTE.

UNIT I INTRODUCTION**9**

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture-Wml scripts and applications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

UNIT II OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM**9**

Introduction. LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE-Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA.

UNIT III ADVANCES IN 4G COMMUNICATION NETWORKS: A 5G PERSPECTIVE**9**

Introduction - Evolution toward 5G Networks - Challenges in 5G Networks - Emerging Trends in 5G Networks - LTE/LTE-A 4G and Beyond Technology - MIMO Enhancements: 3D -Beamforming, Full-Dimension - MIMO, and Massive MIMO - Millimeter-Wave Communication Technology - Channel State Information Feedback Concepts of 3GPP LTE - Channel State Information Feedback Concepts for 5G.

UNIT IV MULTICELLULAR HETEROGENEOUS NETWORKS: A 5G PERSPECTIVE 9
Introduction - OFDM and OFDMA Techniques in HetNets - Dense HetNets - Components of Multi-Cellular Heterogeneous Networks - Software-Defined Cellular Networks - Mobile Cloud Computing in Multi-Cellular HetNets - Multi-Tier Architecture of Cloud RAN for Efficient Data Management in HetNets - Internet of Things in LTE/HetNets - Inband/Outband Vehicular Communication in Small Cell HetNets.

UNIT V ENERGY-EFFICIENT FOR 4G AND BEYOND USING HETNETS 9
Introduction - 4G and 5G HetNets System Design Components and Considerations - Radio Resource Management Schemes for HetNets - Energy-Efficient Schemes for HetNets Proposed Energy-Efficient RRM Design for HetNets - Energy Efficiency Improvements Using HetNets - Numerical Results

TOTAL : 45 PERIODS

OUTCOMES:

- Explain the basics of mobile telecommunication system
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Knowledge about 4G and 5G.

REFERENCES:

1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
2. Juha Korhonen, "Introduction to 4G Mobile Communications", Artech House Publishers, 2014.
3. M. Bala Krishna, Jaime Lloret Mauri, "Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks", CRC 2016
4. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.
5. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata Mc Graw Hill Edition ,2006.

MP5111

EMBEDDED SYSTEMS LABORATORY

**L T P C
0 0 4 2**

OBJECTIVES:

- To learn tools relevant to Embedded Systems
- To explore Embedded C Program for different embedded processor
- To write and interpret simple assembly programs that use various features of the processor.
- To analyze and design various Microcontroller applications.

I. 8051 ASSEMBLY LANGUAGE EXPERIMENTS (KIT AND SIMULATOR) BASED ON:

- Data transfer programs
- Arithmetic and logical programs
- Conversions and sorting
- Timers and Interrupts
- Serial Communication
- I/O interfacing: Traffic Generator ,DAC, ADC, Stepper Motor
- Basic and Interfacing Programs Using Embedded C
- Real time system programs (Embedded C)

- KEIL software example programs

II ADVANCED MICROCONTROLLER BASED APPLICATION DEVELOPMENT:

1. Programs to practice data processing instructions.
2. Interfacing programs
3. Program that uses combination of C and ARM/Atom assembly code.
4. Embedded Programming on PIC microcontrollers using C/ASM

III. EMBEDDED APPLICATION DEVELOPMENT ON PLATFORMS LIKE BLUEMIX.

TOTAL : 60 PERIODS

OUTCOME:

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

- Develop Applications based on Embedded Systems
- Write an Embedded C Program, Debug and interpret the Results
- Write and implement simple assembly programs that use various features of the processor.
- Able to do an experiment that senses an analog signal, process and control [e.g., Keypad, Display].

MP5112

WIRELESS NETWORKING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To learn to implement CDMA network and GPS monitoring using various Trainer.
- To learn to create a WPAN using Bluetooth.
- To learn to use RFID tool kit.
- To learn to implement simple smart wireless applications.

LIST OF EXPERIMENTS:

1. Using CDMA Spread Spectrum Trainer
 - (1) Embedded wireless solutions using CDMA network
 - (2) GPS integrated GSM modules using SMS for in tracking & remote monitoring applications.
2. Using GPS Trainer
 - (3) Embedded GPS modules interfaced with other embedded modules for location based applications.
 - (4) GPS integrated GSM modules using SMS for in tracking & remote monitoring applications.
3. Using GSM Trainer.
 - (5) Developing GSM board+ SIM card based applications emulating mobile phones (Eg. Mobile ATM Vans).
 - (6) SMS based remote monitoring/control applications using existing GSM network.
4. Using Bluetooth Trainer
 - (7) Bluetooth based wireless personal area networking (WPAN) – printers, mouse, keypads, and mobiles.
 - (8) Combining RFID and Bluetooth.
5. Mobile Communication Trainer MT2000
 - (9) Can be used as stand alone or full product development kit in 49 MHz ISM Band.
6. RFID Development Kit.

UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS 9
 Security in Ad-Hoc and Sensor networks – Key Distribution and Management – Software based Anti-tamper techniques – water marking techniques – Defense against routing attacks - Secure Adhoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to

- Identify different issues in wireless ad hoc and sensor networks.
- To analyze protocols developed for ad hoc and sensor networks.
- To identify and address the security threats in ad hoc and sensor networks.
- Establish a Sensor network environment for different type of applications.

REFERENCES:

1. Adrian Perrig, J. D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Springer, 2006.
2. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal "Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011.
3. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.
4. C.K.Toth, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.
5. Erdal Çayırıcı , Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.
6. Holger Karl, Andreas willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc .2005.
7. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.
8. Walteneus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010.

MP5291	REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn real time operating system concepts, the associated issues & techniques.
- To understand design and synchronization problems in Real Time System.
- To explore the concepts of real time databases.
- To understand the evaluation techniques present in Real Time System.

UNIT I REAL TIME SYSTEM AND SCHEDULING 9
 Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

UNIT II SOFTWARE REQUIREMENTS ENGINEERING 9
 Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modelling language – organizing the requirements document – organizing and writing documents – requirements validation and revision.

UNIT III INTERTASK COMMUNICATION AND MEMORY MANAGEMENT 9

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

UNIT IV REAL TIME DATABASES 9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT V EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION 9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault–Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to:

- Apply principles of real time system design techniques to develop real time applications.
- Make use of database in real time applications.
- Make use of architectures and behaviour of real time operating systems.
- Apply evaluation techniques in application.

REFERENCES:

1. Allen Burns, Andy Wellings, “Real Time Systems and Programming Languages”, Pearson Education, 2003
2. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, McGraw-Hill International Editions, 1997
3. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, 2004
4. R.J.A Buhur, D.L Bailey, “An Introduction to Real-Time Systems”, Prentice Hall International, 1999
5. Rajib Mall, “Real-time systems: theory and practice”, Pearson Education, 2009
6. Stuart Bennett, “Real Time Computer Control-An Introduction”, Prentice Hall of India, 1998

CP5291

SECURITY PRACTICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the core fundamentals of system and web security concepts
- To have through understanding in the security concepts related to networks
- To deploy the security essentials in IT Sector
- To be exposed to the concepts of Cyber Security and encryption Concepts
- To perform a detailed study of Privacy and Storage security and related Issues.

UNIT I SYSTEM SECURITY 9

Building a secure organization- A Cryptography primer- detecting system Intrusion- Preventing system Intrusion- Fault tolerance and Resilience in cloud computing environments- Security web applications, services and servers.

UNIT II NETWORK SECURITY 9
 Internet Security - Botnet Problem- Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security- Optical Network Security- Optical wireless Security.

UNIT III SECURITY MANEGEMENT 9
 Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System - Intrusion and Detection and Prevention System.

UNIT IV CYBER SECURITY AND CRYPTOGRAPHY 9
 Cyber Forensics- Cyber Forensics and Incidence Response - Security e-Discovery - Network Forensics - Data Encryption- Satellite Encryption - Password based authenticated Key establishment Protocols.

UNIT V PRIVACY AND STORAGE SECURITY 9
 Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course the student will be able to

- Understand the core fundamentals of system security
- Apply the security concepts related to networks in wired and wireless scenario
- Implement and Manage the security essentials in IT Sector
- Able to explain the concepts of Cyber Security and encryption Concepts
- Able to attain a through knowledge in the area of Privacy and Storage security and related Issues.

REFERENCES:

1. John R.Vocca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.
2. Micheal E. Whitman, Herbert J. Mattor, Principal of Information Security, Fourth Edition, Cengage Learning, 2012.
3. Richard E.Smith, Elementary Information Security, Second Edition, Jones and Bartlett Learning, 2016.

MP5201 SMART TECHNOLOGIES FOR PERVASIVE COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To study about Preserving in cloud computing
- To study the Basic concepts of IoT.
- Knowledge about multilevel Architecture and RW-LMP algorithm
- To study about smart medical devices and Ubiquitous services.

UNIT I PRESERVING PRIVACY IN CLOUD COMPUTING USING TOR 9
 Introduction - Overview of cloud computing - An overview of ToR - ToR in cloud computing- Self-adaptive overlay networks - Introduction - Background/literature review/context - Self-adaptive overlays - Hybrid peer-to-peer systems

LIST OF EXPERIMENTS

1. The definition of the Internet of Things, main assumptions and perspectives.
Platform for IoT devices
Device architectures.
Conventional and renewable power sources for resource-constrained devices.
Operating systems for resource-constrained devices.
2. The data link layer for IoT
Wireless communication technologies.
Wire communication technologies.
Manet Networks.
3. The network layer for IoT
6lowPAN adaptation layer for devices with limited resources.
Dynamic routing protocols for wireless ad-hoc network 2 / 4
4. Communication protocols for IoT
Service oriented protocols (COAP).
Communication protocols based on the exchange of messages (MQTT).
Service discovery protocols.
5. The data processing for IoT
Organization of data processing for the Internet of things.
Cloud computing.
Fog computing.
Applications
Smart Grid. Home Automation. Smart City.
6. Interacting with device peripherals
(using GPIO , ADC , servos)
7. Connecting to the Internet
(eg. the device showing the current weather forecast)
8. Exposition of device functionality as services (1)
(COAP protocol)
9. Machine-to-machine communication
(broadcast communication protocols)
10. Machine-to-machine communication
(communication based on the message exchange – MQTT protocol)

RECOMMENDED LITERATURE AND TOOLS RESOURCES:

1. Arduino, <http://www.arduino.cc/>
2. Intel Galileo, <http://www.intel-software-academic-program.com/pages/courses#diy>
3. Moduł Copernicus, <http://galaxy.agh.edu.pl/~tszydlo/copernicus/>
4. Jean-Philippe Vasseur and Adam Dunkels. Interconnecting Smart Objects with IP – The Next Internet, Morgan Kaufmann, 2010.
5. Zach Shelby, Carsten

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Practices with Open source tool for IoT
- Experimenting Arduion and Intel Galileo components for IoT
- Experimenting Advance computing and smart automation for Digital world

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

(Please include only Open Source Software wherever possible.)

MP5212	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Know the components and structure of mobile application development frameworks like Android /windows /ios
- Understand how to work with various mobile application development frameworks.
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand the capabilities and limitations of mobile devices.
- Write applications for the platforms used, simulate them, and test them on the mobile hardware where possible

LIST OF EXPERIMENTS:

1. Develop an application that uses Layout Managers
2. Develop an application that uses event listeners
3. Develop an application that uses Adapters ,Toast
4. Develop an application that makes use of database
5. Develop an application that makes use of RSS Feed
6. Implement an application that implements Multi threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card
9. Implement an application that creates an alert upon receiving a message
10. Develop a game application

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Install and configure Android application development tools.
- Design and develop user Interfaces for the Android platform.
- Apply Java programming concepts to Android application development.
- Familiar with technology and business trends impacting mobile applications
- competent with the characterization and architecture of mobile applications

OBJECTIVES:

- To understand the concept of context, representation and modeling of context, context ontology and architecture.
- To know the technologies for sensing context, location tracking services.
- To understand the need for and categories of context aware middleware systems.
- To know the UI techniques for contextual information, reconfiguration based on context, context triggered actions.
- Case study based learning on how to apply context aware computing to ubiquitous applications and context data change management.

UNIT I **10**
 Context Definition. Types of Context -Identity (Who), - Activity (What), Time (When), Location (Where), reasoning (Why). Representation of Context. Modeling of context: key-value, graphical, object oriented, logic based, and ontology based models. Context ontology - SOCAM architecture .Context Interpreter.

UNIT II **8**
 Sensing location information. Location tracking: Technologies- GPS, GSM, Assisted GPS, Wi-Fi, Ultra wideband. Metrics- accuracy, reliability, security considerations- buying new devices, coordinating service with infrastructure, Killer app. Sensing user’s state and surroundings.

UNIT III **9**
 Context Aware Middleware- Categorizing Middleware Taxonomy of Context-Aware Middleware. Middleware Systems: Categorization of Context-Aware Middleware Systems- Mobi PADS, Middle Where. Gaia meta Operating Systems-Context File System.

UNIT IV **9**
 Proximate Selection Contextual Info -UI techniques. Automatic Contextual Reconfiguration- Add, removes, or alters components based on context. Contextual Commands- parameterize commands with context-filtered values- universal remote control. Context-triggered Actions- Expressiveness of language for rules, Accuracy of context information.

UNIT V **9**
 Case study-How does context-aware computing fit in with ubicomp. What sensors, infrastructure, are necessary. Fallback condition. How to describe the context that you are in now- location, physiological state, emotional state, etc. Challenges in Implementing a Context-Aware System- How to represent context internally- Storage, Data structures and algorithms. How frequently does the system need to be updated on context changes- How often to poll? How often to change behavior.

TOTAL : 45 PERIODS

OUTCOMES :

- Understand the concept of context, representation and modeling of context, context ontology and architecture.
- Gain knowledge on communication the technologies for sensing and transporting context data and location tracking services.
- Understand the categories of context aware middleware systems to realize mobile services
- Gain knowledge on UI techniques for contextual information, reconfiguration and context triggered actions
- Able to apply context aware computing to ubiquitous applications and implement context data change management.

REFERENCES

1. Anind K Dey, "Context Aware computing", IEEE 2009.
2. Bill Schilit, Norman Adams, and Roy, "Context-Aware Computing Applications", Want, IEEE Mobile Computing Systems and Applications, 1994.
3. Satyanarayana, Challenges in Implementing a Context-Aware System, CMU, 2001.
4. Satyanarayanan "Pervasive computing: Vision and challenges", - IEEE Personal Communications, 2001.
5. T.J.Watson Tom Erickson, "Context-aware computing", IBM Research Center, 2002.
6. Walteneagus Dargie, "Context Aware Computing and self Managing Systems", CRC Press, 2009.

MP5001

XML AND WEB SERVICES

L T P C
3 0 0 3

OBJECTIVES:

- To acquire knowledge on XML and its DTD structure.
- To study XSLT documents and different custom markup languages.
- To analyze and design a web service based application.
- To learn the security features of web services and service composition.

UNIT I XML FUNDAMENTALS

9

XML Markup introduction - XML Schema – Structuring with schema DTD -XML Processing DOM – SAX – DOM with JavaScript – DOM components – Traversing the DOM – SAX-based parsers – Events – Simple SAX program – DOM versus SAX

UNIT II EXTENSIBLE STYLESHEET LANGUAGE TRANSFORMATION (XSLT) 9

Templates – Creating elements and attributes – Iteration and sorting – Conditional processing – Combining stylesheets – Variables – Transformation XSLT – Introduction to Custom Markup Languages: Mathematical Markup Language (MathML) - Chemical Markup Language (CML) - Wireless Markup Language (WML) - NewsML -XPath – XQuery

UNIT III WEB SERVICES

9

Web Services – Definition – Web Services and EAI – Web Services Technologies – web services Architecture – SOAP – WSDL – UDDI – WS-Addressing – WS-Routing – WS-Security – WS-Policy – Web Service invocation framework - web services using java – WS using .NET.

UNIT IV XML SECURITY 9
 XML Security and meta framework - XML signature – XML Encryption – SAML – XKMS – WS- Security – RDF – semantic Web service.

UNIT V SERVICE COMPOSITION 9
 Service Coordination and Composition coordination protocols – WS-Coordination – WS-Transaction – RossttaNet – ebXML –WSCI – Service Composition – Service Composition Models – Dependencies between coordination and composition – BPEL – Current trends.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to:

- Experiment XML document validation using DTD and schema
- Conduct experiments on XML documents using DOM / SAX parsers
- Transform XML documents to HTML using XSLT and review other custom markup languages
- Develop web services using different technologies
- Compose set of web services using BPEL.

REFERENCES:

1. Cliff Binstock, "The XML Schema Complete Reference", Addison-Wesley Professional, 2003.
2. Freunk p.coyle, "XML, web Services and the Data Revolution", Pearson, 2002.
3. Gystavo Alonso, Fabio casasi, Hareemi kuno, vijay machiraju, "Web Services – Concepts, Architecture and Applications", Springer, 2004
4. H.M. Deitel, P.J. Deitel, T.R. Nieto, T.M. Lin, and P. Sadhu, "XML How to program", Pearson Education India, 2001
5. Ron Schmelzer etal, "XML and Web Services", Pearson Education, 2002
6. Sandeep Chatterjee and James Webber, "Developing Enterprise web services: An Architect's and Guide", Practice Hall, 2004

SE5091	SERVICE ORIENTED ARCHITECTURE AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the SOA architecture
- To understand the service oriented analysis and design
- To understand the development of deployment of web services
- To understand the security issues of SOA

UNIT I SOA FUNDAMENTALS 9

Principles of Service Orientation - Client-Server Architecture - Distributed Internet Architecture - SOA Characteristics - Anatomy of SOA - Components - Interaction - Technical and Business Benefits - Multi-channel access - Business Process Management

UNIT II SOA AND WEB SERVICES**9**

Web Service Platform - Web Service Description - Service Contracts - Service Level Data Model - Service Discovery - Service Level Security - Service Level Interaction Patterns: SOAP basics - Messaging with SOAP - Message Exchange Patterns - Web WSDL basics, Writing a Java Web Service, writing a Java Web Service Client ,Describing Web Services: WSDL, Representing Data Types - XML Schema, Communicating Object Data, SOAP Related Technologies

UNIT III SERVICE ORIENTED ANALYSIS AND DESIGN**9**

Design principles - Business Centric SOA - Deriving Business services - Service Modeling - Coordination - Atomic Transaction - Business activities - Web Service Orchestration Business Process Execution Language (BPEL) - Choreography - Metadata Management- Entity centric business service design - Application Service design - Task centric business service design

UNIT IV WEB SERVICES DEVELOPMENT AND DEPLOYMENT**9**

XML and Web Services - WSDL basics - SOA support in J2EE - Java API for XML-based Web Services (JAX-WS) - Java Architecture for XML Binding (JAXB) - Java API for XML Registries (JAXR) - Web Services Interoperability Technologies - SOA support in .NET - Common Language Runtime - ASP.NET - Web forms - ASP.NET Web Services - Web Services Enhancements

UNIT V SOA APPLICATIONS AND SECURITY**9**

Security Overview: e-commerce based security (public key cryptography) – Public key encryption – Security issues in XML document – SOAP security issue – XML Security framework: XML Digital Signature (Enveloped, enveloping and detached) – Signature validation - XML Encryption – Types – Canonicalization - XML Key management.

TOTAL : 45 PERIODS**OUTCOMES:****Upon completion of this course, the student should be able to**

- Develop and deploy simple and composite web services with SOA design principles considering the security issues
- Use the standards and technologies of modern web service implementations
- Efficiently use leading development tools to create and consume web services
- Implement a service oriented application

REFERENCES:

1. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2004.
2. Frank Cohen, "Fast SOA", Morgan Kaufmann, 2010.
3. Mark O' Neill, "Web Services Security", Tata McGraw-Hill Edition, 2003.
4. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services", Pearson Education, 2003.
5. Shankar Kambhampaly, "Service Oriented Architecture for Enterprise Applications", Wiley India Pvt Ltd, 2008.
6. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2006.

MU5071

DATA WAREHOUSING AND DATA MINING

L T P C
3 0 0 3

OBJECTIVES:

- Understanding data warehousing and OLAP Concepts
- Understanding of the value of data mining in solving real-world problems.
- Understanding of foundational concepts underlying data mining.
- Understanding of algorithms commonly used in data mining tools

UNIT I DATA WAREHOUSING 9

Introduction – Basic Concepts, Data Warehouse Modeling: Data Cube an OLAP, Data Warehouse Design and Usage, Implementation, Data Generalization, Data Cube Technology, Concepts, Computation methods, query Processing, Multidimensional Data Analysis

UNIT II INTRODUCTION TO DATA MINING 9

Need for Data Mining, Kinds of Data, Kinds of patterns, Kinds of Applications, Issues, Data Objects and Attribute types, Statistical Descriptions of Data, Data Visualization, Measuring data similarity and dissimilarity, Data Preprocessing

UNIT III ASSOCIATION MINING 9

Concepts, Frequent Item set Mining Methods, Pattern Evaluation Methods, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data, Mining Compressed Patterns, Pattern Exploration and Application

UNIT IV CLASSIFICATION 9

Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Bagging and Boosting, Random Forests, Bayesian Belief Networks, Backpropagation, SVM, Associative Classification, Lazy learners, Genetic algorithms, Rough Set Approach, Fuzzy Set Approaches, Multi class classification, Semi-supervised classification, Active Learning, Transfer Learning

UNIT V CLUSTERING 9

Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation, Advanced Cluster Analysis, Outlier Detection, Applications and Trends in Data Mining

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to

- Demonstrate multidimensional modelling of data in a data warehouse
- Display a comprehensive understanding of different data mining tasks and the algorithms most appropriate for addressing them.
- Evaluate models/algorithms with respect to their accuracy.
- Demonstrate capacity to perform a self-directed piece of practical work that requires the application of data mining techniques.
- Conceptualise a data mining solution to a practical problem.

REFERENCES:

1. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007
2. David J. Hand, Heikki Mannila and Padhraic Smyth "Principles of Data Mining" (Adaptive Computation and Machine Learning), 2005
3. Ian H.Witten, Eibe Frank and Mark A. Hall,"Data Mining, Practical Machine Learning Tools and Techniques", Third Edition, The Morgan Kaufmann Series in Data Management Systems, 2011,Elsevier Publications
4. Jiawei Han, Micheline Kamber , Jian Pei, "Data Mining: Concepts and Techniques", Third Edition (The Morgan Kaufmann Series in Data Management Systems), 2012.
5. Margaret H Dunham, "Data Mining: Introductory and Advanced Topics", 2003
6. Soman, K. P., Diwakar Shyam and Ajay V. "Insight Into Data Mining: Theory And Practice", PHI, 2009.

MP5091	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know how to analyze and consider user's need in the interaction system
- To understand various interaction design techniques and models
- To understand the theory and framework of HCI
- Understand and analyze the cognitive aspects of human – machine interaction

UNIT I INTRODUCTION 9

Foundation – Human – Computer – Interaction – Paradigms – What is HCI – Components – Cognitive Framework – Perception and Representation – Attention and Memory Constraint – Knowledge and Mental Model – Interface Metaphors – Input – Output

UNIT II DESIGN PROCESS 9

Interaction Styles – Interaction Design Basics – HCI in the Software Process – Design Rules - Designing Windowing Systems - User Support and On-Line Information - Designing For Collaborative Work and Virtual Environments - Principles and User-Centred Design - Methods for User-Centred Design

UNIT III IMPLEMENTATION AND EVALUATION PROCESS 9

Implementation issues – Implementation Support - Evaluation techniques – Universal Design – User Support

UNIT IV MODELS 9

Cognitive models – Communication and collaboration models: Models of the system – Models of the System – Modeling Rich Interaction

UNIT V APPLICATIONS 9

Socio – organization issues and stakeholder requirements - Ubiquitous Computing - Context – aware User Interfaces - Hypertext, multimedia and the World Wide Web

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to

- To develop good design for human machine interaction system
- Analyze the user's need in interaction system
- To design new interaction model to satisfy all types of customers
- Evaluate the usability and effectiveness of various products
- To know how to apply interaction techniques for systems

REFERENCES:

1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Pearson Education, 2004
2. Dix, Finlay, Abowd and Beale. "Human – Computer Interaction", Second edition, Prentice Hall, 1998.
3. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. "Human – Computer Interaction", Addison Wesley, 1994.
4. John M. Carroll, "Human Computer Interaction in the New Millennium", Pearson Education, 2002

CP5293

BIG DATA ANALYTICS

L T P C
3 0 0 3

OBJECTIVES:

- To understand the competitive advantages of big data analytics
- To understand the big data frameworks
- To learn data analysis methods
- To learn stream computing
- To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

UNIT I INTRODUCTION TO BIG DATA

7

Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.

UNIT II HADOOP FRAMEWORK

9

Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN

UNIT III DATA ANALYSIS

13

Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.

UNIT IV MINING DATA STREAMS

7

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V BIG DATA FRAMEWORKS**9**

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries.

TOTAL: 45 PERIODS**OUTCOMES:****At the end of this course, the students will be able to:**

- Understand how to leverage the insights from big data analytics
- Analyze data by utilizing various statistical and data mining approaches
- Perform analytics on real-time streaming data
- Understand the various NoSql alternative database models

REFERENCES:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3. Learning R – A Step-by-step Function Guide to Data Analysis, Richard Cotton, O'Reilly Media, 2013.
4. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition, 2007.
5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
6. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.

OBJECTIVES:

- To understand the basics of Image processing
- To model and visualize the transformation of image
- To understand the evolution of object detection
- To mine the interest of the user

UNIT I IMAGE PROCESSING FUNDAMENTALS 9

Introduction- images-sampling and frequency –Domain processing-basic image processing operations-point operators –group operations –other statistical operators –mathematical morphology

UNIT II FEATURE EXTRACTION 9

Low level Feature Extraction: Edge Detection- phase congruency- localized feature extraction- describing image motion. High Level Extraction: Thresholding and subtraction – Template matching- feature extraction by low level features- Hough transformation.

UNIT III OBJECT DETECTION 9

Object Detection- Boundary descriptors –Region descriptors –moving object detection – tracking moving features- Moving extraction and description-Texture description – classification -segmentation.

UNIT IV 3D BIOMETRIC 9

Classification of 3D biometric imaging methods -3D biometric Technologies- 3D palm print capturing systems-3D information in palm print- Feature Extraction from 3D palm print – matching and fusion –security applications.

UNIT V APPLICATIONS 9

Mobile Biometrics- Biometric Application Design –Biometric Technologies issues- Biometrics in society –privacy and Biometrics –Ethics and Technology usage – human factors

TOTAL : 45 PERIODS

OUTCOMES:**At the end of the course the student should be able to**

- Understand the need of biometric in image processing
- Work on the internals Technologies of biometric
- Mine the behavior of the users in the biometric field
- Predict the possible next outcome of the image processing
- Mine the opinion of the user.

REFERENCES:

1. Amine Nail -Ali and Regis Fournier "Signal and Image Processing for Biometrics" John Wiley and sons,2012.
2. David Zhang,Guangming, "3D Biometrics Systems and Applications" Lu, Springer 2013.
3. Julian Ashbourn, "Biometrics In The New World" , Springer 2014.
4. Mark S.Nixon, Alberto S.Aguado, "Feature Extraction and image processing for computer vision, Third Edition, , Elsevier 2012.
5. Scott E Baugh "Digital Image Processing and analysis" 2nd Edition CRC Press 2010
6. Tinku Acharya and Ajoy K Ray "Image Processing Principles and Applications" John Wiley and sons 2005

OBJECTIVES:

- To create understanding of the fundamental concepts of fault tolerance systems
- To learn basic techniques for achieving fault tolerance in hardware
- To have in-depth understanding in software fault tolerance systems
- To gain knowledge in design & testing of fault tolerance systems
- To develop skills in modelling and evaluating fault tolerant architectures in Real time systems

UNIT I INTRODUCTION 9

Faults, Errors and Failures - Levels of Fault tolerance - Dependability measures - Dependability evaluation - Fault Tolerant techniques - Hardware redundancy - Information redundancy - Software redundancy- Time redundancy -Software reliability.

UNIT II HARDWARE FAULT TOLERANCE 9

Passive hardware redundancy - Triple/N modular redundancy - Voting techniques - Active hardware redundancy - Hybrid techniques - Fault tolerance at processor level - Byzantine failures - Network topologies and their resilience.

UNIT III SOFTWARE FAULT TOLERANCE 9

Evolution of Recovery block concept – N Version programming - Stochastic Reward Nets - Approaches to software Fault tolerance - Analysis of software fault tolerance - Exception handling in Hierarchical Modular Programs- Check pointing in Modular programs-Random Check pointing - Issues in fault tolerance implementation.

UNIT IV DESIGN DIVERSITY & TESTING 9

Fault tolerant Control and coordination algorithms design – F-T system abstractions and functions- Pitfalls- Practical application- Modeling and analysing F-T Distributed systems - Software fault insertion testing- Fault manager- Categorization of Software faults, Errors, and failures- SIFT methodology and Test plans

UNIT V FAULT TOLERANCE IN REAL TIME SYSTEMS 9

Time- Space tradeoff - Fault tolerant scheduling algorithms - Fault tolerant ATM switches - Fault tolerant Routing and sparing Techniques - Yield and reliability enhancement for VLSI/WSI array processors. Case studies: Non-stop systems, Stratus systems, Cassini command and data sub system, IBM G5, Itanium

TOTAL : 45 PERIODS**OUTCOMES:**

- At the end of the course the student should be able to
- Understand the need for fault tolerance systems
- Work in the internal technologies of fault tolerance in hardware
- Mine the behaviour of various software faults
- Work in designing & testing various fault tolerance systems
- Model and evaluate fault tolerant architectures in Real time systems

REFERENCES:

1. E.Dubrova, "Fault-Tolerant Design", Springer, 2013, ISBN 978-1-4614-2112-2
2. I. Korenand, M.Krishna, "Fault Tolerant Systems", Morgan Kaufmann, 2007, SanFransisco, CA
3. Kjetil Norvag, "An Introduction to fault tolerant systems", IDI Technical report, July 2000, ISSN 0802-6394
4. Micheal R.Lyu, "Software fault tolerance", John Wiley & Sons Ltd.,

OBJECTIVES:

- To understand the fundamentals of Energy Efficient Computing
- To understand the concept of Energy Efficient Storage Systems
- To introduce the various types of scheduling algorithms in energy efficient computing
- To introduce the concept of Green Networking
- To study Energy Aware Computing Applications

UNIT I INTRODUCTION 9

Subthreshold Computing – Energy Efficient Network-on-Chip Architectures for Multi-Core Systems-Energy-Efficient MIPS CPU Core with Fine-Grained Run-Time Power Gating – Case Study : Geysler

UNIT II ENERGY EFFICIENT STORAGE 9

Power-Efficient Strategies for Storage Systems-Energy-Saving Techniques for Disk Storage Systems -Thermal and Power-Aware Task Scheduling and Data Placement for Storage Centric Data centres - Energy-Saving Techniques for Disk Storage Systems

UNIT III ENERGY EFFICIENT SCHEDULING ALGORITHMS 9

Algorithms and Analysis of Energy-Efficient Scheduling of Parallel Tasks- Dynamic Voltage Scaling- Speed Scaling - Memetic Algorithms for Energy-Aware Computation and Communications Optimization in Computing Clusters- Online job scheduling Algorithms

UNIT IV INTRODUCTION TO GREEN NETWORKING 9

Power-Aware Middleware for Mobile Applications -Energy Efficiency of Voice-over-IP Systems - Intelligent Energy-Aware Networks - Green TCAM-Based Internet Routers

UNIT V ENERGY AWARE COMPUTING APPLICATIONS 9

Energy Awareness in Video Codec Design-Overview of H.264/AVC Video Codec Design-Energy Aware Surveillance Camera -Low Power Design Challenge in Biomedical Implant Electronics

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to

- Design Power efficient architecture Hardware and Software
- Analyze the different types of Energy Efficient Storage systems.
- Design the algorithms for Energy Efficient Systems
- Identify the different types of Green Networking schemes in the energy efficient computing
- Explore the applications of Energy Aware Computing

REFERENCES:

1. Bob steiger wald ,Chris:Luero, Energy Aware computing, Intel Press,2012
2. Chong -Min Kyung, Sungioo yoo, Energy Aware system design Algorithms and Architecture, Springer, 2011.
3. Ishfaq Ah mad, Sanjay Ranka, Handbook of Energy Aware and Green Computing, Chapman and Hall/CRC, 2012.

OBJECTIVES:

- To know the basics of artificial neural networks
- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems.
- To have the idea about genetic algorithm
- To provide adequate knowledge about the applications of Soft Computing.

UNIT I ARTIFICIAL NEURAL NETWORK 9

Introduction-Basic concepts of Neural Network-Model of an Artificial Neuron-Characteristics of Neural Network-Learning Methods-Backpropagation Network Architecture- ackpropagation Learning-Counter Propagation Network-Hopfield/Recurrent Network-Adaptive Resonance Theory.

UNIT II FUZZY LOGIC 9

Basic concepts of Fuzzy Logic-Fuzzy Sets and Crisp Sets-Fuzzy Set Theory and Operations-Properties of Fuzzy Sets-Fuzzy and Crisp relations, Fuzzy to Crisp Conversion-Membership Functions-Interference in Fuzzy Logic-Fuzzy if-then Rules, Fuzzy implications and Fuzzy Algorithms,Fuzzification & Defuzzification-Fuzzy Controller.

UNIT III NEURO-FUZZY MODELLING 9

ANFIS Architecture-Classification and Regression Trees-Data Clustering algorithms-Rulebase Structure Identification.

UNIT IV GENETIC ALGORITHMS 9

Basic concepts-Working Principle-Inheritance Operators-Cross Over-Inversion & Deletion-Mutation Operator-Generation Cycle.

UNIT V APPLICATIONS OF SOFTCOMPUTING 9

Genetic Algorithm Application- Bagley and Adaptive Game-Playing Program- Greg Viols Fuzzy Cruise Controller-Air Conditioner Controller-Application of Back Propagation Neural Network.

TOTAL : 45 PERIODS**OUTCOMES:**

- Knowledge on concepts of soft computational techniques.
- Able to apply soft computational techniques to solve various problems.
- Motivate to solve research oriented problems.

REFERENCES:

1. George J. Klir and Bo Yuan, 'Fuzzy Sets and Fuzzy Logic Theory and Applications', Printice Hall of India, 2002.
2. J.S.R.Jang,C.T.Sun and E.Mizutani,"Neuro-Fuzzy and Soft Computing",PHI,2004, Pearson Education 2004.
3. Laurene Fausett,"Fundamentals of Neural Networks: Architectures, Algorithms and Applications", Pearson Education India, 2006.
4. S.Rajasekaran and G.A.V.Pai."Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI,2010.
5. Timothy J Ross, "Fuzzy logic with Engineering Applications", John Wiley and Sons, 2009.
6. Zimmermann H.J."Fuzzy Set Theory and Its Application" Springer International Edition,2011.

CP5191

MACHINE LEARNING TECHNIQUES

L T P C
3 0 0 3

OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To understand graphical models of machine learning algorithms

UNIT I INTRODUCTION 9

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

UNIT III TREE AND PROBABILISTIC MODELS 9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS 9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT V GRAPHICAL MODELS 9

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Apply the apt machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
- Design systems that uses the appropriate graph models of machine learning
- Modify existing machine learning algorithms to improve classification efficiency

REFERENCES:

1. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014.
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
4. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
5. Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013.

MP5003

AUTONOMOUS COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Knowledge about Autonomous computing
- To study monitoring and performance Autonomous computing
- Knowledge about Bayesian Network in Autonomous computing
- Knowledge about Autonomous Mediation in cilia

UNIT I INTRODUCTION 9

Software Complexity - The Software Life - Autonomic Computing - Autonomic Systems - Autonomic Computing - Motivations Behind Autonomic Computing - Self- Properties and Expected Qualities - Benefits, Challenges and Degrees of Autonomy - Similar Initiatives, Current Status and Relation to Software Engineering - Sources of Inspiration for Autonomic Computing - Overview of Influences – Biology - Bio-inspiration Beyond Nervous Systems - Artificial Intelligence - Complex Systems.

UNIT II COMPUTING ARCHITECTURES 9

Autonomic Elements - Autonomic Manager Reference Architecture - Architecture with Multiple Autonomic Elements - The Monitoring Function - Introduction to Monitoring - Performance Monitoring - Knowing What to Monitor and Monitoring Overheads – Profiling - Monitoring Overheads - Monitoring for Free - Building Probes- Examples of Monitoring Tools, Frameworks and Platforms - Monitoring the Monitors: Adaptive Monitoring

UNIT III THE ADAPTATION FUNCTION 9

Software Adaptation - Code Adaptation - Upgrading Code - Integrating Code - Code Adaptation Techniques - OS-Level Adaptation - Program-Level Adaptation – Component - Level Adaptation - Software Services – OSGi – Modularity – POJO - The Decision Function - Knowledge in Autonomic Managers - Model-Driven Autonomicity.

UNIT IV EVALUATION ISSUES 9

Introduction - Reasoning Techniques - Classifiers and Statistical Learning Methods - Bayesian Networks Example - Evaluating Autonomic Systems - Evaluation Elements - Some Evaluation Metrics for Emergent Systems - Autonomic Mediation in Cilia - Software Integration – Cilia - Autonomic Cilia.

UNIT V CILIA AND CHALLENGES 9

Overview - Cilia Touch points - Cilia Meta-level and Base Level - Towards Autonomic Life-Cycle Management of Cilia Chains - Challenges and Motivation - Future of Autonomic Computing and Conclusions - Alternative Autonomic Stories - Autonomic Computing in the Near Future

TOTAL : 45 PERIODS

OUTCOMES:

- Basic knowledge in the field of Autonomous computing
- Knowledge in code Adaptation & software services in Autonomous computing
- Understanding Cillia

REFERENCES:

1. Mireille Hildebrandt, Antoinette Rouvroy , “Law, Human Agency and Autonomic Computing: The Philosophy of Law Meets the Philosophy of Technology, Routledge , 2011.
2. Philippe Lalanda, Julie A. McCann, Ada Diaconescu , “Autonomic Computing: Principles, Design and Implementation” , Springer, 2013
3. Richard Murch "Autonomic computing", Person Education 2004.

MP5004

HAPTIC TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

. To provide an overview of Haptic technology and enable the student to create applications in a collaborative environment.

UNIT I INTRODUCTION 9

Human Senses-Haptic Exploration-Concepts and Terminology-Roadmap to Multimedia Haptics - Haptic Multimedia Audio and Visual System-Haptic Evolution-Haptics for Medical Application-Tele Robotics and Tele operation-Media-Mobile Haptics-Virtual reality-Learning and Education-Haptic Security

UNIT II HUMAN HAPTIC PERCEPTION AND MACHINE HAPTICS 9

Touch and Cognition-Human Haptic System-Concept of Illusion-Human Perceptual parameters for Interface Development-Haptic Interfaces-HAVE Sensors- HAVE Actuators-Performance Specifications-State-of-Art Haptic interfaces

UNIT III COMPUTER HAPTICS 9

Haptic Rendering Subsystem-Polygon based Representation and Scene Graph-Collision Detection Techniques and Bounding Volumes-Penetration Depth and Collision Response-Haptic Rendering of Surface Properties-Haptic Rendering of other Representation methods-Haptic Rendering of more than 3-DOF-Control Methods for Haptic systems-Benchmarking Haptic Rendering systems- Haptic Software Frameworks

UNIT IV MULTIMEDIA HAPTICS 9

Haptic as a new media-HAVE Content Creation- Content Representation-Hap tic Media Transmission-Architecture for C-HAVE-Communication Framework for C-HAVE systems-Quality of Experience in Multimedia Haptics-Haptics WaterMarking.

UNIT V TOUCHING THE FUTURE: CHALLENGES AND TRENDS 9
 The Golden Age of Haptics-Human Haptics-Machine Haptics-Computer Haptics-Multimedia Haptics Haptic Technology In Surgical Simulation and Medical Training- Haptic Devices- Haptic Rendering- Applications of Haptic technology.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course given in the curriculum, students should be able to

- Demonstrate knowledge in human perception, Machine and Multimedia Haptics.
- Create integrated and collaborative haptic systems
- Analyze and characterize Human , Multimedia and machine haptics

REFERENCES:

1. Abdulmotaleb El Saddik, Mauricio Orozco, Mohamad Eid, Jongeun Cha “Haptics Technologies: Bringing Touch to Multimedia” (Springer Series on Touch and Haptic Systems)
2. <http://haptic.mech.nwu.edu>
3. <http://www.webopedia.com/TERM/H/haptic.html>
4. <http://www.stanford.edu/dept/news/report/news/2003/april2/haptics-42.html>
5. <http://www.utoronto.ca/atrc/rd/vrml/haptics.html>
6. <http://www.caip.rutgers.edu/~bouzit/lrp/glove.html>

MP5005	CLOUD COMPUTING AND SERVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of cloud and utility computing
- To understand the various issues in cloud computing
- To understand the various services in cloud computing
- To appreciate the emergence of cloud as the next generation computing paradigm
- To be able to set up a private cloud

UNIT I INTRODUCTION 9

Evolution of cloud computing – Need for cloud computing – Benefits – Limitations – Migration into Cloud - Basics of virtualization - Desktop virtualization - Server virtualization - Case study: VMware - Basics of web services - Key concepts - Federation in cloud - Four levels of federation - Privacy in cloud

UNIT II INFRASTRUCTURE AS A SERVICES 9

Three-layer cloud computing architecture - On-demand provisioning - Elasticity in cloud Cloud Computing Services – Infrastructure-as-a-Service – Apache Cloud Stack –Cloud providers - Cloud deployment models - Security in cloud - Software-as-a-Service security - Case study: Aneka - Service level agreements.

UNIT III SOFTWARE AS A SERVICE 9

Software-as-a-Service – Background – Computing today – Benefits of SaaS – Drawbacks of SaaS – Service Oriented Architecture (SOA) – Case Studies: Amazon Web Services (AWS) – Google App Engine

UNIT IV PLATFORM AS A SERVICE**9**

Platform-as-a-Service – PAAS defined – Requirements of an ideal PaaS Platform – Custom PaaS – Reference Architecture for Applications in custom PaaS – COTS implementation of PaaS - IBM Bluemix

UNIT V CLOUD STORAGE AND DEPLOYMENT TOOLS**9**

Overview of cloud storage - Cloud storage providers - Case studies: Walrus - Amazon S3 - Cloud file system – Map Reduce - Case study: Hadoop - Study of open source cloud platforms - Nimbus - Open Nebula - Eucalyptus

TOTAL : 45 PERIODS**OUTCOMES:****At the end of the course the student should be able to**

- Understand the need of various services in cloud computing environment
- Works on various open source tools in cloud computing
- Understand the need and usage of public, private and hybrid cloud
- Understand the concept of cloud storage
- Understand the need of next generation computing resources.

REFERENCES:

1. Danielle Ruest and Nelson Ruest, 'Virtualization: A Beginner's Guide', McGraw Hill, 2009.
Tom White, "Hadoop: The Definitive Guide", O'REILLY Media, 2009.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. John W.Rittinghous, James F.Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2010
4. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing - A Business Perspective on Technology and Applications", Springer, 2009.
5. Leonard Richardson, Sam Ruby, "RESTful Web Services Web services for the real world", O'REILLY, 2007.
6. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing -Principles and Paradigms", John Wiley and Sons, 2011.
7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGrawHill, 2009.
8. Tom White, "Hadoop: The Definitive Guide", O'REILLY Media, 2009.
9. www.open.eucalyptus.com/
10. <http://opennebula.org>
11. www.nimbusproject.org
http://www.nimbusproject.org/files/riteau_CCA11.pdf
12. <https://readthedocs.org/projects/cloudstack/downloads/pdf/latest/>
13. <https://www.cs.colorado.edu/~kena/classes/5828/s12/.../dibieogheneovohanghaojie.pdf...>
14. www.syntelinc.com/sites/default/files/platform_as_a_service_paas_demystified.pdf
15. www.ibm.com/bluemix

OBJECTIVES:

- To get exposed to the fundamentals of bioinformatics
- To learn bio-informatics algorithm and phylogenetic concept
- To understand open problems and issues in replication and molecular clocks
- To learn assemble genomes and corresponding theorem
- To study and exposed to the domain of human genomics

UNIT I INTRODUCTION AND FUNDAMENTALS 9

Fundamentals of genes , genomics , molecular evolution – genomic technologies – beginning of bioinformatics - genetic data –sequence data formats – secondary database – examples – data retrieval systems – genome browsers.

UNIT II BIOINFORMATICS ALGORITHM AND ANALYSIS 9

Sequence alignment and similarity searching in genomic databases : BLAST and FASTA – additional bioinformatics analysis involving nucleic acid sequences-additional bioinformatics analysis involving protein sequences – Phylogenetic Analysis.

UNIT III DNA REPLICATION AND MOLECULAR CLOCKS 9

Beginning of DNA replication – open problems – multiple replication and finding replication – computing probabilities of patterns in a string-the frequency array-converting patterns-solving problems- finding frequents words-Big-O notation –case study-The Tower of Hanoi problem

UNIT IV ASSEMBLE GENOMES AND SEQUENCES 9

Methods of assemble genomes – string reconstruction – De Bruijn graph – Euler's theorem – assembling genomes –DNA sequencing technologies – sequence antibiotics – Brute Force Algorithm – Branch and Bound algorithm – open problems – comparing biological sequences- Case Study –Manhattan tourist Problem.

UNIT V HUMAN GENOME 9

Human and mouse genomes-random breakage model of chromosome evolution – sorting by reversals – greedy heuristic approach – break points- rearrangements in tumor and break point genomes-break point graphs- synteny block construction -open problems and technologies

TOTAL : 45 PERIODS**OUTCOMES:****Upon Completion of the course, the students will be able to**

- Deploy the genomics technologies in Bioinformatics
- Able to distinct efficient algorithm and issues
- Deploy the replication and molecular clocks in bioinformatics
- Work on assemble genomes and sequences
- Use the Microarray technologies for genome expression

REFERENCES:

1. Ion Mandoiu and Alexander Zelikovsky , “Computational Methods for Next Generation Sequencing Data Analysis “ Wiley series 2016.
2. Istvan Miklos,Renyi institutue, “Introduction to algorithms in bioinformatics”,Springer 2016
3. Philip Compeau and Pavel pevzner , “Bioinformatics Algorithms:An Active Learning Approach” Second edition volume I , Cousera, 2015.
4. Supratim Choudhuri, “Bioinformatics For Beginners” ,Elsevier,2014.

MP5006

SOCIAL NETWORKS

L T P C
3 0 0 3

OBJECTIVES:

- To study about Basic Social Networks concepts
- To study Knowledge about Network segmentation and Effectiveness
- Knowledge about Clustering in social network social circles Applications
- Study about Ethical Dilemmas and Advance Research.

UNIT I INTRODUCTION

9

Introduction - Networks as Information Maps-Leaders and Followers - Networks as Conduits . The Point of View - Basic Network Concepts - Propinquity - Homophily - Homophily and Collectivities - Dyads and Mutuality- Social Networks-Distributions - Dyads and Triads - Density Structural Holes-Weak Ties - Centrality - Distance - Size of the Interpersonal Environment The "Small World" - Multiplexity-Roles and Positions - Named Positions and Relationships - Informal Positions and Relationships - Informal Relations and Hierarchies.

UNIT II NETWORK SEGMENTATION AND EFFECTIVENESS

9

Introduction - Named and Unnamed Network Segments - Primary Groups, Cliques, and Clusters - Segmenting Networks from the Point of View of the Observer - Segmenting Groups on the Basis of Cohesion - Resistance to Disruption - Structural Similarity and Structural Equivalence Core/Periphery Structures - Psychological Foundations of Social Networks - Support - Safety and Affiliation-Effectiveness and Structural Holes-Safety and Social Networks - Effectiveness and Social Networks - Driving for Status or Rank - Cultural Differences in Safety, Effectance, and Rank - Motivations and Practical Networks - Motivations of Corporate Actors - Cognitive Limits on Individual Networks.

UNIT III APPLICATIONS

9

Diversity, and Social Cohesion - The Small World, Circles, and Communities Introduction - Formal Small World Models Clustering in Social Networks-Social Circles Applications of Small World Theory to Smaller Worlds - Networks and Diffusion - An Introduction - The Basic Model - Exogenous Factors in the Adoption of Innovation - Influence and Decision - Making –Epidemiology - Social Networks and HIV-AIDS - Transporting Disease.

UNIT IV BUILDING BLOCKS

9

Small Groups,Leadership and Social Networks:The Basic Building Blocks-Introduction-Primary Groups and Informal Systems:Propositions - Pure Informal Systems-How to Find Informal Systems - Asymmetric Ties and the Influence of the External System - Formalizing the System - Organizations and Networks - Contradictions of Authority - Emergent Networks in Organizations.The Factor - Floor - Information-Driven Organizations - Bridging the Gaps.

UNIT V ETHICAL DILEMMAS**9**

Large-Scale Models - Tipping Points and Thresholds - Networks as Social Capital - Social Support Individual Networked Resources: Position and Resource Generators - Networks as a Research Paradigm - Anonymity, Confidentiality, Privacy, and Consent - Who Benefits - Cases-Survey Research - Organization Research - Terrorists and Criminals Networks and Terrorism: The CASOS Projects - Coda: Ten Master Ideas of Social Networks Introduction - The Ten Master Ideas

TOTAL : 45 PERIODS**OUTCOMES:**

- Knowledge about Social Networks effectiveness
- Learn about social networks in smart word
- Knowledge about Ethical Dilemmas & Social Networks

REFERENCES:

1. Altshuler, Y., Elovici, Y., Cremers, A.B., Aharony, N., Pentland, " Security and Privacy in Social Networks " , Springer, 2013
2. Charles Kadushin, "Understanding Social Networks", Oxford University press, 2012.
3. P Borgatti; Martin G Everett; Jeffrey C Johnson, "Analyzing social networks", SAGE Publications, 2013.

COGNITIVE COMPUTING**MP5007**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about design of cognitive systems
- To be familiar with techniques to support cognitive systems
- Able to analyze the effectiveness of a cognitive system
- Understand the deployment of cognitive applications
- Understand the development process of cognitive systems

UNIT I INTRODUCTION TO COGNITIVE COMPUTING**9**

The Foundation of Cognitive Computing-Cognitive Computing as a New Generation-The Uses of Cognitive Systems-What Makes a System Cognitive?-Artificial Intelligence as the Foundation of Cognitive Computing-Understanding Cognition-Understanding Complex Relationships Between Systems-The Elements of a Cognitive System-Design Principles for Cognitive Systems-Components of a Cognitive System-Building the Corpus-Bringing Data into the Cognitive System-Machine Learning-Hypotheses Generation and Scoring-Presentation and Visualization Services.

UNIT II NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS**9**

Natural Language Processing in Support of a Cognitive System-The Role of NLP in a Cognitive System-Semantic Web-Appling Natural Language Technologies to Business Problems. Representing Knowledge in Taxonomies and Ontologies-Representing Knowledge-Defining Taxonomies and Ontologies-Explaining How to Represent Knowledge-Models for Knowledge Representation-Implementation Considerations.

UNIT III ADVANCED ANALYTICS IN COGNITIVE COMPUTING 9

Applying Advanced Analytics to Cognitive Computing-Advanced Analytics Is on a Path to Cognitive Computing-Key Capabilities in Advanced Analytics-Using Advanced Analytics to Create Value-Impact of Open Source Tools on Advanced Analytics- Case studies.

UNIT IV COGNITIVE SYSTEMS APPROACHES 9

The Role of Cloud and Distributed Computing in Cognitive Computing-Leveraging Distributed Computing for Shared Resources-Why Cloud Services Are Fundamental to Cognitive Computing Systems-The Business Implications of Cognitive Computing: Preparing for Change-Advantages of New Disruptive Models-The Difference with a Cognitive Systems Approach-Meshing Data Together Differently-Using Business Knowledge to Plan for the Future-Building Business Specific Solutions-Making Cognitive Computing a Reality.

UNIT V BUILDING A COGNITIVE APPLICATION 9

The Process of Building a Cognitive Application-The Emerging Cognitive Platform-Defining the Objective-Defining the Domain-Understanding the Intended Users and Defining their Attributes-Defining Questions and Exploring Insights-Creating and Refining the Corpora-Training and Testing- CASE STUDY: Building a Cognitive Healthcare Application-Foundations of Cognitive Computing for Healthcare-Constituents in the Healthcare Ecosystem-Cognitive Applications across the Healthcare Ecosystem- Emerging Cognitive Computing Areas- Future Applications for Cognitive Computing.

TOTAL : 45 PERIODS

OUTCOMES:

- Clear understanding of the elements and principles in designing a cognitive system
- Appreciate the role of Natural language processing and knowledge representation in Cognitive systems
- Analyze a cognitive computing system through case studies
- Able to select an appropriate approach to build a cognitive system
- Provide a system flow to deploy a cognitive application

REFERENCES:

1. Developing Cognitive Applications
<https://www.ibm.com/developerworks/learn/cognitive/>
2. Machine Learning and Cognitive Systems: The Next Evolution of Enterprise intelligence,<https://www.wired.com/.../machine-learning-cognitive-system>.
3. Marcia Kaufman Adrian Bowles, Judith Hurwitz, “Cognitive Computing and Big Data Analytics”, First Edition, Wiley.
4. Steven Bird, Ewan Klein, Edward Loper, “ Natural Language Processing with Python – Analyzing text with natural language toolkit”, O’Reilly Media , 2009.
5. Tom M. Mitchell, “Machine Learning” , McGraw Hill.