MIT Art, Design and Technology University, Pune

MIT School of Engineering

DETAIL SYLLABUS

FOR

FIRST to SECOND YEAR

M.TECH. (Computer Science and Engineering) - Embedded Systems & Internet of Things

MTEI

2017-18

FACULTY OF ENGINEERING

(BOARD OF STUDIES IN COMPUTER SCIENCE AND ENGINEERING)

Prof. (Dr.) Rajneeshkaur Sachdeo

Dean Engineering

Office Seal

About program structure

Overall curriculum synopsis (At-a-Glance) LTP mode
Semester wise course work details with credit points
Assessment structure of the program
Detailed program outline with reference books

Follow In

(Minimum Credits to be earned: 76)

Coding for course/ subject: 17MTEI101, Where; **17** = Year of BOS, **MTEI** = Branch Code, **1**= Semester No.,**01 to N** = Sequence No of Subject.

SEMESTER-I

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTEI101	Research Methodology	3	0	0	3	40	60	100
17MTEI102	Advanced Mathematics for Computation	3	1	0	4	40	60	100
17MTEI103	Applied Algorithm	3	1	0	4	40	60	100
17MTEI104	IOT architecture and protocols	3	0	0	3	40	60	100
17MTEI1_ _	Core Elective-I	3	0	0	3	40	60	100
17MTEI111	Laboratory Practice -I	0	0	4	2	40	60**	100
17MTEI121	Technical Seminar-I	0	0	4	2	100	--	100
Total		**15**	**2**	**8**	**21**	**340**	**360**	**700**

SEMESTER-II

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTEI201	Advanced Microprocessor & Microcontroller	3	1	0	4	40	60	100
17MTEI202	Embedded Systems and Designs	3	0	0	3	40	60	100
17MTEI203	Advanced IoT Trends & Platforms	3	1	0	4	40	60	100
17MTEI204	Advanced Computer Networks	3	0	0	3	40	60	100
17MTEI2_ _	Core Elective-II	3	0	0	3	40	60	100
17MTEI211	Laboratory Practice - II	0	0	4	2	40	60**	100
17MTEI221	Mini Project	0	0	4	2	100	--	100
Total		**15**	**2**	**8**	**21**	**340**	**360**	**700**

CA = Continuous Assessment, FE= Final Examination,
****Final Lab exam will be conducted with viva-voce of the respective practical (50 exam +10 viva = 60)**
Coding for course/ subject: 17MTEI101, Where; **17** = Year of BOS, **MTEI** = Branch Code, **1**= Semester No., **01 to N** = Sequence No of Subject.

SEMESTER-III

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTEI301	RTOS	3	1	0	4	40	60	100
17MTEI302	Intelligent Systems	3	0	2	4	40	60	100
17MTEI3_ _	Elective-III	3	1	0	4	40	60	100
17MTEI3_ _	Elective-IV	3	1	0	4	40	60	100
17MTEI321	Technical Seminar-II	0	0	4	2	40	60**	100
17MTEI322	Dissertation Phase-I	0	0	4	2	40	60**	100
Total		**12**	**3**	**10**	**20**	**240**	**360**	**600**

SEMESTER-IV

Course Code	Course Name	Hours/week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	FE	Total
17MTEI421	Dissertation Phase-II	0	0	28	14	100	200	300
Total		**0**	**0**	**28**	**14**	**100**	**200**	**300**

CA = Continuous Assessment, FE= Final Examination,
****Final Lab exam will be conducted with viva-voce of the respective practical (50 exam +10 viva = 60)**
Coding for course/ subject: 17MTEI101, Where; **17** = Year of BOS, **MTEI** = Branch Code, **1**= Semester No., **01 to N** = Sequence No of Subject.

LIST OF ELECTIVES

Elective	Course Name	
Elective-I	17MTEI131	Advanced Operating Systems
	17MTEI132	Digital System Design
	17MTEI133	Linux Administration & Shell Programming
	17MTEI134	VLSI Technology and Design Embedded Computing
Elective-II	17MTEI231	Wireless Sensor Network
	17MTEI232	Network Security and Cryptography
	17MTEI233	Wireless & Mobile Communications
	17MTEI234	IoT and Cloud Computing
Elective-III	17MTEI331	Embedded Systems Software
	17MTEI332	Software design and architecture
	17MTEI333	Parallel and distributed computing
	17MTEI334	Internet Programming
Elective-IV	17MTEI336	Pervasive Computing
	17MTEI337	Neural network and fuzzy logic
	17MTEI338	Digital Image Processing

Definition of Credit:-

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab)/week	1 credit

Code	Definition
L	Lecture
T	Tutorial
P	Practical
CA	Continuous Assessment
FE	Final Evaluation

Course/Subject code:

1	7	M	T	E	I	1	0	1
Year of BoS		Bachelors (BT)/ Maters of Technology(MT)/ Integrated M.Tech (MI)		BoS / Program code with/without specialization		Semester 1 - 9 and X - for tenth Semester	01 – 10 --- Theory subjects 11 – 20 --- Practical's 21 – 30 --- Technical Seminar/mini projects/projects 31 – 40 --- Elective with/ without practical's	

Assessment Structure and Passing %

Assessment	Content	Marks	Passing %	Min Marks for Passing
CA (Theory)	Assignments/ Class work / Quizzes / Tests/ Regularity / Punctuality	10 Marks	40%	40
	Mid-term Exam	30 Marks		
FE (Theory)	End term Exam	60 Marks		
CA (Practical)	Lab Assignments/ Tests/ Regularity / Punctuality / Timely submission	40	40%	40
FE (Practical)	External Examination	60 (**50 exam +10 viva = 60**)		

17MTEI101: RESEARCH METHODOLOGY 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

Unit I: Fundamentals Of Research (09 hrs)

Introduction-Meaning of Research, Objectives & Motivation, Types of Research & Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Problems Encountered by Researchers in India; **Defining a Research Problem**:- Research problem, Bringing clarity and focus to your research problem, significance of formulating research problem, Considerations in selecting a research problem, Steps in formulating a research problem.

Unit II: Research Design & Sampling (09 hrs)

Meaning, Need and Types of research design, Features of Good Design, Important concepts of research design, Different research designs, Basic Principles of research designs & important experimental designs. **Design of Sample Surveys**: - Sample design, Sampling & Non-sampling errors, Sample Surveys vs. Census Surveys, Types of Sampling Designs, Probability & Non-probability Sampling

Unit III: Measurement And Scaling Techniques (09 hrs)

Measurement in Research, Measurement Scales, Sources of Error in Measurement, Sound Measurement Test, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Multidimensional Scale, Scale Construction Techniques,

Unit IV: Data Collection & Analysis: (09 hrs)

Collection of Primary Data, Observation Method, Interview Method, Experiments & Surveys, Collection of Secondary Data, Selecting appropriate method for Data Collection, Case study method, Data Preparation process, Descriptive statistics, and Sampling & Statistical Inference; Chi-Square Tests, Anova Technique-one way & two way, Latin square design, ANOCOVA, Sign Tests, Wilcoxon Signed Rank Sum Test for single population, Mann Whitney U Test, Run Tests, Linear Regression Analysis.

Unit V: Hypothesis Testing And Report Writing: (09 hrs)

Hypothesis, Hypothesis Testing, Test Statistics & Critical Regions, Critical value & Decision Rules, Procedure for Hypothesis Testing, Hypothesis Testing for Testing Mean, Proportion & Variance, Hypothesis Testing for Difference of Two Mean, two proportions & two Variances, P-Value Approach, Power of the Test, Limitations of the Tests of Hypothesis, Report writing: Meaning, Techniques and Precautions in Interpretation, Significance of Report Writing, Different steps in Report Writing, Report Layout, Types of Reports, Oral presentation, Mechanics & Precautions for Writing Research Reports.

References:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224- 1522-9
2. Research Methodology a step-by- step guide for beginners by Ranjit Kumar, SAGE

17MTEI102: ADVANCED MATHEMATICS FOR COMPUTATION **3 1 0 4**

(Under revision)

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

Unit I Linear Algebra (09 hrs)

Vector spaces: definition, linear independence of vectors, basis, inner product and inner product space, orthogonality, Gram-Schmidt procedure, subspaces, Matrices: coordinate-dependent linear transformations, null and range spaces, Linear algebraic equations: existence and uniqueness of solution, elementary row/column operations, Gauss elimination and Gauss Jordon methods, Echelon form, pivoting, LU decomposition and Cholesky method, Gauss-Seidel and Jacobi iterative methods,

Unit II Probability and Fuzzy Set (09 hrs)

A review of concepts of probability and random variables: Classical, relative frequency and axiomatic definitions of probability, addition rule, conditional probability, multiplication rule, Bays' Theorem.

Discrete and continuous random variables, probability mass and probability density function.

Introduction to fuzzy set, operations of fuzzy set, fuzzy arithmetic and relations, fuzzy relation equation, fuzzy logics.

Unit III Complex Variables (09 hrs)

A review of concept of limit, continuity, differentiability & analytic functions. Cauchy Riemann Equations, Line Integral in the complex plane, Cauchy Integral Theorem & Cauchy Integral Formula & its consequences, Power series & Taylor Series(in brief) ,Zeros & Singularity, Laurent' Series, Residues, Evaluation of Real Integrals

Unit IV Statistics (09 hrs)

Sampling Distributions: Chi-Square, t and F distributions. Estimation: The method of moments and the method of maximum likelihood estimation, confidence intervals for the mean(s) and variance(s) of normal populations. Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test, tests of hypotheses on a single sample, two samples

Unit V Transform Calculus (09 hrs)

Concept of Transforms, Laplace Transform(LT) and its existence, Properties of Laplace Transform, Evaluation of LT and inverse LT, Evaluation of integral equations with kernels of convolution type and its Properties, Complex form of Fourier Integral, Introduction to Fourier Transform, Properties of general (complex) Fourier Transform, Concept and properties of Fourier Sine Transform and Fourier Cosine Transform, Evaluation of Fourier Transform, Solution of ordinary differential equation and one dim.

References:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications
2. B. Dasgupta, "Applied Mathematical Methods", Pearson Education, 2006
3. George J.Klir & Bo Yuan, "Fuzzy sets and fuzzy logic: theory and applications" Printice Hall of India.
4. Kuldeep Singh "Linear Algebra (step by step)", Oxford University Press.
5. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons
6. B.V.Ramana "Higher Engineering Mathematics",Mc Graw Hill

17MTEI103: APPLIED ALGORITHMS 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

REVIEW OF DESIGN STRATEGIES (09 hrs)

Divide and conquer, Greedy strategy, Dynamic programming, Backtracking, Branch and Bound. Max flow problem , Complexity analysis.

COMPLEXITY THEORY (09 hrs)

P, NP and NP-Complete complexity classes; A few NP-Completeness proofs.

APPROXIMATION ALGORITHMS (09 hrs)

Introduction, vertex Cover Problem, set cover, TSP, Analysis of approximation algorithms

GEOMETRIC ALGORITHMS (09 hrs)

Convex full problem – formulation, solving by Graham scan algorithm, Jarvis march algorithm; closest pair of points – problem formulation, solving by divide & conquer method.

LINEAR PROGRAMMING (09 hrs)

Formulation of Problems as Linear Programs. Duality. Simplex, Interior Point, and Ellipsoid Algorithms.

TEXT BOOKS:

1. Cormen, Leiserson, Rivest, “Introduction to Algorithms”, PHI
2. Bressard, “Fundamentals of Algorithms”, PHI
3. Horowitz, Sahni, “Fundamentals of Computer Algorithm”, Galgotia

REFERENCE BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education
2. Jon Kleinberg, Evas Tardos, “Algorithm Design”, Pearson Education
3. Algorithms, Kenneth Berman and Jerome Paul, Cenage Learning ISBN-13 978-81-315-0521-2R

17MTEI104: IOT ARCHITECTURE AND PROTOCOLS 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTERNET OF THINGS: AN OVERVIEW (09 hrs)

The "Internet" of "Things", The Internet of Things Today, The Internet of Things Tomorrow, IoT Vision, The Technology of IoT, IoT Architecture, IoT Strategic Research and Innovative Directions : IoT Applications and Use Case Scenarios, IoT Functional View, Application Areas

INTERNET OF THINGS APPLICATIONS (09 hrs)

IoT Smart-X Applications: Smart Cities, Smart Energy and the Smart Grids, Smart Mobility and Transport, Smart Home, Smart Buildings and Infrastructure, Smart Factory and Smart Manufacturing, Smart Health, Food and Water Tracking and Security, Participatory Sensing, Smart Logistics and Retail, IoT and related Future Technologies: Cloud Computing, IoT and Semantic Technologies.

IOT PROTOCOLS: THE HTTP AND UPnP PROTOCOL (09 hrs)

The HTTP Protocol : HTTP basics, Adding HTTP support to the sensor , Adding HTTP support to the actuator, Adding HTTP support to the controller, The UPnP Protocol : Introducing UPnP, Creating a device description document ,Creating the service description document, Providing a web interface, Creating a UPnP interface , Implementing the Still Image service , Using our camera.

IOT PROTOCOLS : THE CoAP, MQTT and XMPP PROTOCOL (09 hrs)

The CoAP Protocol : Making HTTP binary, Adding CoAP to our sensor, Adding CoAP to our actuator , Using CoAP in our controller, The MQTT Protocol : Publishing and subscribing, Adding MQTT support to the sensor, Adding MQTT support to the actuator , Adding MQTT support to the controller, The XMPP Protocol : XMPP basics, Adding XMPP support to a thing , Providing an additional layer of security, Adding XMPP support to the actuator, Adding XMPP support to the camera, Adding XMPP support to the controller.

SECURITY AND INTEROPERABILITY (09 hrs)

Understanding the risks, Modes of attack : Denial of Service, Guessing the credentials, Getting access to stored credentials, Man in the middle, Sniffing network communication, Port scanning and web crawling, Search features and wildcards, Breaking ciphers Tools for achieving security : Virtual Private Networks,X.509 certificates and encryption, Authentication of identities , Usernames and passwords , Using message brokers and provisioning servers ,Centralization versus decentralization, The need for interoperability.

TEXT BOOKS:

1. Peter Waher— Learning Internet of Things‖ PACKT Publishing.
2. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", Rivers Publishing

17MTEI111: LABORATORY PRACTICE – I **0 0 4 2**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

- Lab should include the assignments based on subject like cyber security and biometrics, advanced network modelling and elective-II subjects.
- Course instructor should frame the assignments (4 per subject)

IOT Architecture and Protocols :

1. Implement packet analyser tool / protocol analyser using Java / Python. (Protocols – IP, TCP, UDP, ICMP, etc).
2. Write a program with standard crypto libraries like OpenSSL, NTL, GMP, and develop efficient and secure implementation of any public key cryptography algorithm in Java.
3. Demonstrate use of Diffie-Hellman for key exchange.
4. Implement AES algorithm using standard Java libraries.
5. Implement blind signature using RSA.

Applied Algorithms:

1. Implement Naive string matching algorithm and test it on the larger dataset of various input file and analyze the time complexity.
2. Implement Rabin Karp string matching algorithm and test it on the larger dataset of various input file and analyze the time complexity.
3. Implement KMP string matching algorithm and test it on the larger dataset of various input file and analyze the time complexity.
4. Implement Naive string matching algorithm using multi-threading and analyze the time complexity for different dataset.

17MTEI121: TECHNICAL SEMINAR-I **0 0 4 2**

CA : 100 Marks FE : 00 Marks No. of Total Lectures = 30 Hours

Seminar based on state-of- the art in the selected electives and approved by the guide, useful for professional growth in the field of expertise. The presentation and the report should cover motivation, mathematical modeling, data-table discussion, research contribution and conclusion. The reports to be prepared using LATEX derivative.

17MTEI201: ADVANCED MICROPROCESSOR & MICROCONTROLLER 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM (09 hrs)

CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

HIGH PERFORMANCE RISC ARCHITECTURE – ARM (09 hrs)

Arcon RISC Machine – Architectural Inheritance – Core & Architectures – Registers – Pipeline – Interrupts – ARM organization – ARM processor family – Co-processors – ARM instruction set- Thumb Instruction set – Instruction cycle timings – The ARM Programmer's model – ARM Development tools – ARM Assembly Language Programming – C programming – Optimizing ARM Assembly Code – Optimized Primitives.

ARM APPLICATION DEVELOPMENT (09 hrs)

Introduction to DSP on ARM –FIR filter – IIR filter – Discrete Fourier transform – Exception handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Embedded Operating systems – Integrated Development Environment- STDIO Libraries – Peripheral Interface – Application of ARM Processor – Caches – Memory protection Units – Memory Management units – Future ARM Technologies.

MOTOROLA 68HC11 MICROCONTROLLERS (09 hrs)

Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

PIC MICROCONTROLLER (09 hrs)

CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter – PWM and introduction to C-Compilers.

TEXT BOOKS:

1. Andrew N.Sloss, Dominic Symes and Chris Wright " ARM System Developer"s Guide : Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004.

REFERENCE BOOKS:

1. Steve Furber , "ARM System –On –Chip architecture", Addision Wesley, 2000.
2. Daniel Tabak , "Advanced Microprocessors", Mc Graw Hill. Inc., 1995
3. James L. Antonakos , " The Pentium Microprocessor", Pearson Education, 1997.
4. Gene .H.Miller, "Micro Computer Engineering", Pearson Education , 2003.
5. John .B.Peatman , "Design with PIC Microcontroller", Prentice Hall, 1997.

17MTEI202: EMBEDDED SYSTEMS & DESIGNS 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO EMBEDDED SYSTEMS (09 hrs)

Embedded Systems Overview, Design Challenge- Optimizing Design Metrics. Processor Technology: General Purpose Processors-Software, Single purpose processors-Hardware, Application Specific Processor

EMBEDDED SYSTEM DESIGN DESIGN AND DEVELOPMENT (09 hrs)

System Design and Development, Life Cycle Models – The Waterfall Model, The V-Cycle model, The Spiral Model, Rapid Prototyping-Incrementor, Problem Solving, The Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, Systems Specification Vs System Requirements, Partitioning and Decomposing a System, Functional Design, Architectural Design, Functional Model Vs Architectural Model, Prototyping

HARDWARE PLATFORMS (09 hrs)

Types of Hardware Platforms- Single Board Computers, PC-Add-on cards, Custom Built Hardware Platforms, 89C51 Micro-controller development Board, AVR Micro-controller Development Board

DESIGN TECHNOLOGY (09 hrs)

Automation : Synthesis – Going Up: The Parallel Evolution of Compilation and Synthesis, Synthesis Levels, Logic Synthesis, Register-Transfer Synthesis, Behavioral Synthesis, System Synthesis and Hardware or Software Co-design, Temporal and Spatial Thinking, Verification : Hardware/ Software Co-simulation – Formal Verification and Simulation, Simulation Speed, Hardware-Software Co-simulation, Emulators , Intellectual Property Cores – Hard, Soft and Firm cores, New challenges posed by cores to processor providers, New challenges posed by cores to processor users, Design Process Models

EMBEDDED SYSTEMS PROJECT MANAGEMENT (09 hrs)

Project Proposal Preparation, Project Planning, Providing the Development Infrastructure, Co-Design and Co-Verification, Risk Management and Quality Management. FUTURE TRENDS – Pervasive or Ubiquitous Computing, Java for Embedded Systems, Embedding Intelligence, Emerging Applications.

TEXT BOOKS:

1. Dr. K. V. K. K. Prasad ―Embedded / real time System: Concepts, Design, & Programming – Black Book, Dreamtech Press Publication.
2. Frank Vahid, Tony Givargis – Embedded System Design. – Wiley Publication Third Edition, ISBN 978-81-265-0837-2
3. James K. Peckol – Embedded Systems – Wiley Publication ISBN 978-81-265-2456-3

REFERENCE BOOKS:

1. Rajkamal, ―Embedded System Architecture Programming Design‖ Tata Graw Hill Publication Second Edition, 2008.
2. Lyla B. Das, "Embedded Systems: An Integrated Approach" Pearson, ISBN: 978-81-317-8766-3

17MTEI203: ADVANCED IoT TRENDS & PLATFORMS 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

DEMYSTIFYING THE IoT PARADIGM (09 hrs)

Why the IoT Is Strategically Sound, The Brewing and Blossoming Trends in IT Space, Envisioning the Internet of Things Era, Illustrating the Device-to-Device/ Machine-to-Machine Integration Concept, Explaining the Aspect of Device-to-Cloud (D2C) Integration, The Emergence of the IoT Platform as a Service (PaaS), Digging into the Cloud-to-Cloud (C2C) Integration Paradigm, Describing the Sensor-to-Cloud Integration Concept, Azure IoT Hub Device Management, The Prominent IoT Realization Technologies, The IoT: The Key Application Domains, The Emerging IoT Flavours.

REALIZATION OF IOT ECOSYSTEM USING WIRELESS TECHNOLOGIES (09 hrs)

Architecture for IoT Using Mobile Devices, Mobile Technologies for Supporting IoT Ecosystem, Mobile Use Cases for IoT, Low Power Wide Area Networking Technologies, **Infrastructure and Service Discovery Protocols for the IoT Ecosystem -** Layered Architecture for IoT, Protocol Architecture of IoT, Infrastructure Protocols- Routing Protocol, IEEE 802.15.4, IPv6 over Low-Power Wireless Personal Area Networks, Bluetooth Low Energy, Device or Service Discovery for IoT, Protocols for IoT Service Discovery, Prominent IoT Service Discovery Products Available in the Market.

THE INTEGRATION TECHNOLOGIES AND TOOLS FOR IOT ENVIRONMENTS (09 hrs)

IoT Communication Protocol Requirements, The IoT Portion for Smarter Enterprises and Environments, Sensor and Actuator Networks, The IoT Device Integration Concepts, Standards, and Implementations, The Device Integration Protocols and Middleware, The Protocol Landscape for IoT. **The Enablement Platforms for IoT Applications and Analytics-** Describing the IoT Journey, The IoT Building Blocks, A Few Enthralling IoT Use Cases, IoT Application Enablement Platforms, Characterizing IoT or Machine-to-Machine Application Platforms, IoT AEPs—The Architectural Building-Blocks,

Case Study - Amazon Web Service IoT Platform

THE NEXT-GENERATION CLOUDS FOR IOT APPLICATIONS AND ANALYTICS (09 hrs)

Introduction, Reflecting the Cloud Journey, About the Cloud Technology, The Cloud Service Ecosystem, The Key Motivations for Cloud-Enabled Environments, IoT and Cloud-Inspired Smarter Environments, The Era of Hybrid Clouds, Envisioning Federated Clouds, Special-Purpose Clouds, The Emergence of Edge/Fog Clouds, The Architectural Components of the Smarter Traffic System, Tending toward Software-Defined Clouds, The Building Blocks of Software-Defined Clouds, Software-Defined Storage (SDS), The Onset of Cognitive Clouds.

Case Study - Envisioning Smart Health Care Systems in a Connected World

EMERGING FIELD OF IOT DATA ANALYTICS (09 hrs)

Introduction, The Principal Steps toward Knowledge Discovery and Dissemination, The Rewarding Repercussions of the Data Explosion, Describing Big Data Analytics, The Strategic Importance of Big Data Analytics, Big Data Analytics: The Prominent Use Cases, Real-Time and Streaming Analytics, Expounding the IoT Data Analytics Domain, The Key Drivers for IoT Data Analytics, The Emergence of Edge Clouds for Real-Time Insights, Deep Diving and Digging into Edge Analytics, The Renowned Edge Analytics Use Cases, The Architectural Components of the Smarter Traffic System, The Key Capabilities of Next-Generation IoT Data Analytics Platforms, The Prime Modules of IoT Data Analytics Platforms, The Renowned Use Cases for IoT Data Analytics, The Distinct Capabilities of IoT Data Analytics Platforms.

Case Study- Envisioning Futuristic Smart Airports Using IoT Integration

REFERENCE BOOKS:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. Adrian McEwen, Hakim Cassimally, " Designing the Internet of Things", Wiley Publication
3. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

17MTEI204: ADVANCED COMPUTER NETWORKS 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

COMPUTER NETWORKS AND THE INTERNET (09 hrs)

Overview- What is the Internet, 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM - Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure.

THE LINK LAYER AND LOCAL AREA NETWORKS (09 hrs)

Link Layer: Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least- Cost-Path algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at Network Layer

LOGICAL ADDRESSING AND END-TO- END PROTOCOLS (09 hrs)

IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 toIPv6 Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control

WIRELESS NETWORKS AND MOBILE IP (09 hrs)

Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs)

OPTICAL NETWORKS AND WDM SYSTEMS (09 hrs)

Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All-Optical Switch. Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS)

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose,Keith W.Ross, Third Edition, Pearson Education, 2007
2. Computer and Communication Networks, Nader F. Mir, Pearson Education, 2007

REFERENCE BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan, Fourth Edition, Tata McGraw Hill, 2007
2. Guide to Networking Essentials, Greg Tomsho,Ed Tittel, David Johnson,Fifth Edition, Thomson.
3. An Engineering Approach to Computer Networking, S.Keshav, Pearson Education.
4. Campus Network Design Fundamentals, Diane Teare, Catherine Paquet, Pearson Education (CISCO Press)
5. Computer Networks, Andrew S. Tanenbaum, Fourth Edition, Prentice Hall.
6. The Internet and Its Protocols, A.Farrel,Elsevier.

17MTEI211: LABORATORY PRACTICE– II **0 0 4 2**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

- Lab should include the assignments based on subjects like Advanced Microprocessor & Microcontroller, Embedded Systems and Designs, Advanced IoT trends and platforms, and Elective-II subjects.
- Course instructor should frame the assignments (4 per subject)

17MTEI221: MINI PROJECT 0 0 4 2

CA : 100 Marks FE : 00 Marks No. of Total Lectures = 30 Hours

OBJECTIVES:

- To develop research skills of students
- To develop an understanding of application of research in real life
- To expose students with project-product development cycle using industrial experience, use of state-of-art technologies.
- To encourage and expose students for participation in National/ International paper presentation activities.
- Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities
- To make practice of developing a good web application using the techniques and scripting students have learnt during the semester, a small project will be done by the student as an assignment.

Students shall select a social issue / managerial issue of local relevance for investigation. They should **use IoT or Cloud Computing** concepts research.

GUIDELINES:

1. Students should select a problem which addresses some basic home, office or other real life applications.
2. Students should understand testing of various components.
3. Students should see that final product submitted by them is in working condition
4. Students should submit the report along with the project.
5. Group of maximum three students can be permitted to work on a single mini project.

17MTEI301: RTOS **3 1 0 4**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO REAL TIME OPERATING SYSTEM-RTOS (09 hrs)

Embedded Systems, Embedded Hardware units and devices, Embedded software, I/O types and examples, Serial communication devices, wireless devices, timer and counting devices, watchdog timer, RTC, networked embedded systems, Serial Bus communication protocols, Real time tasks, real time systems, real time scheduling algorithms, rate monotonic algorithm, the earliest deadline first algorithm, qualities of Good RTOS.

RTOS – I: PROCESSES, TASKS & THREADS & THEIR SYNCHRONIZATION USING INTERPROCESS COMMUNICATION (09 hrs)

Multiple processes in an application, multiple threads in an application, tasks, task and thread states, task and data, clear-cut distinction between function, ISR, IST and Task by their characteristics, interprocess communication and synchronization, signals, concepts of semaphores, disabling and enabling functions, shred data problem, queues and mailboxes, pipe and socket functions, remote procedure call functions.

RTOS-II: BASIC FUNCTIONS OF OS AND RTOS COMMUNICATION (09 hrs)

Operating system services, Process management, timer functions, event functions, memory management, device, file and I/O subsystem management, interrupt routines in RTOS environment and handling of interrupt source calls, introduction to real time system, basic design using RTOS, RTOS task scheduling models, OS Security issues, OS standards: POSIX, RTOS interrupt latency and response time of the task as performance metrics.

RTOS PROGRAMMING: MICROC/OS-II AND VXWORKS (09 hrs)

RTOS, MicroC /OS-II, introduction to UNIX based RTOS, RTOS VxWorks, POSIX compliant operating system, Real time linux operating system, Windows CE, OSEK

CASE STUDIES OF PROGRAM MODELING AND PROGRAMMING WITH RTOS (09 hrs)

Automatic chocolate vending machine using MUCOS RTOS, Case study of Digital Camera, RTOS for Control systems, Case study of an embedded system for Smart card, access control systems(Smart cards, RFIDs, Fingerscan).

TEXT BOOKS:

1. Rajkamal, ―Embedded System Architecture Programming Design‖ Tata Graw Hill Publication Second Edition, 2008.

17MTEI302: INTELLIGENT SYSTEMS 3 0 2 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION (09 hrs)

Introduction, History, Problem solving with AI, AI models, , What is an intelligent Agents, Rational agent, PEAS, Environments types, types of Agents, Learning agent

PROBLEM SOLVING (09 hrs)

Problem-Solving Agents, Formulating problems, Measuring problem-solving performance, Uninformed Search Strategies, Comparing uninformed search strategies, Avoiding Repeated States, Informed (Heuristic) Search Strategies, Greedy best-first search , Memory-bounded heuristic search, Local Search Algorithms and Optimization Problems, Hill-climbing search , Simulated annealing search , Local beam search , Genetic algorithms

CONSTRAINT SATISFACTION PROBLEMS & GAME THEORY (09 hrs)

Constraint Satisfaction Problems, Backtracking Search for CSPs, Variable and value ordering, Propagating information through constraints, Intelligent backtracking: looking backward, Games , Optimal Decisions in Games , Optimal strategies, The minimax algorithm, Alpha-Beta Pruning, Evaluation functions , Cutting off search

ARTIFICIAL NEURAL NETWORKS (09 hrs)

Artificial neural networks , Introduction, or how the brain works , The neuron as a simple computing element , The perceptron, Multilayer neural networks, Accelerated learning in multilayer neural networks, The Hopfield network, Bidirectional associative memory.

KNOWLEDGE ENGINEERING & MACHINE LEARNING (09 hrs)

Introduction to Machine Learning, Supervised, unsupervised methods, Knowledge engineering and data mining, Introduction to machine learning approaches - k-means, Naïve Bayes, Self-Organizing Maps

TEXT BOOKS

1. Artificial Intelligence A Guide to Intelligent Systems Second Edition, Michael Negnevitsky, Pearson Education
2. Stuart Russell and Peter Norvig (1995), “Articial Intelligence: A Modern Approach”, Third edition, Pearson, 2003.

REFERENCE BOOKS

1. Elaine Rich and Kevin Knight “Artificial Intelligence”, Tata McGraw Hill, 1991
2. Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley, 1992
3. Machine Learning,Tom Mitchell,McGraw Hill, 1997,ISBN: 978-0-070-42807-2
4. Jiawei han, Micheline Kamber, "Data Mining: Concepts and systems", Morgan Kaufmann Publishers

17MTEI321: TECHNICAL SEMINAR-II **0 0 4 2**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

Seminar based on state-of-the art in the selected electives/current trends/innovations/research. The presentation and the report should cover motivation, mathematical modelling, data-table discussion and conclusion. The reports should be prepared using LATEX derivative.

To maintain the quality of the seminar work it is mandatory on the seminar guides to maintain a progressive record of the seminar contact hour of 1 hour per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table (as additional teaching load); such record of progressive work shall be referred by the examiners during evaluation.

17MTEI322: DISSERTATION PHASE-I **0 0 4 2**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 30 Hours

Motivation, Problem statement, survey of journal papers related to the problem statement, problem modelling and design using set theory, NP-Hard analysis, SRS, UML, Classes, Signals, Test scenarios and other necessary, problem specific UML, software engineering documents. Student should publish one International Journal Paper (having ISSN Number and preferably with Citation Index II/Scopus/SCI/WoS); or paper can be published in reputed International Journal recommended by the guide of the Dissertation and in addition to above the term work shall include the paper published, reviewers comments and certificate of presenting the paper in the conferences . To maintain the quality of the dissertation work it is mandatory on the dissertation guides to maintain a progressive record of the dissertation contact of 1 hour per week which shall include the dissertation discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student.

17MTEI421: DISSERTATION PHASE-II **0 0 28 14**

CA : 100 Marks FE : 200 Marks No. of Total Lectures = 210 Hours

Selection of Technology, Installations, UML implementations, testing, Results, and performance discussions using data tables per parameter considered for the improvement with existing known algorithms and comparative graphs to support the conclusions drawn. Student should publish one International Journal Paper (having ISSN Number and preferably with Citation Index II/Scopus/SCI/WoS); or paper can be published in reputed International Journal recommended by the guide of the Dissertation and in addition to above the term work shall include the paper published, reviewers comments and certificate of presenting the paper in the conference.

The project report to be prepared with the approval of Guide using appropriate documentation tool (LATEX) with the following points:

- Motivation,
- Problem statement,
- Literature Survey,
- Analysis & Modelling,
- SRS,
- UML Diagrams,
- Test scenarios
- Experimental Results and
- The other necessary, problem specific software engineering documents.

Student should refer standard journal papers such as IEEE, ACM, Springer Elsevier, etc,

Students must have:

- **Paper Publication of the research work in standard journals with the approval of Guide.**
- **Paper Presentation in standard International Conferences with the approval of Guide.**

7MTEI131: ADVANCED OPERATING SYSTEMS 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO DISTRIBUTED SYSTEMS (09 hrs)

Goals, Types of Distributed systems, Architectural styles, System architectures, Architectures versus middleware, Processes, Threads in Distributed Systems, Role of Virtualization in Distributed Systems, Clients, Server design issues, Code migration, Communication ,Types of Communication, Remote procedure call, Parameter Passing, Asynchronous RPC, Message-oriented communication, Stream-oriented communication, Multicast communication, Naming.

SYNCHRONIZATION (09 hrs)

Clock synchronization, Physical Clocks, Global Positioning System, Clock Synchronization Algorithms, Logical clocks, Lamport Logical Clocks, Vector Clocks, Mutual exclusion, Centralized algorithm, Decentralized algorithm, Distributed algorithm, Token ring algorithm, Global positioning of nodes, Election algorithms, Traditional election algorithms, Elections in wireless environments, Elections in large-scale systems

CONSISTENCY AND REPLICATION (09 hrs)

Introduction, Reasons for Replication, Replication as Scaling Technique, Data-centric consistency models: Continuous Consistency, Consistent Ordering of Operations; Client-centric consistency models, Eventual Consistency, Monotonic Reads, Monotonic Writes, Read Your Writes, Writes Follow Reads, Replica management, Replica-server placement, Content replication and placement, Content Distribution, Consistency protocols, Continuous Consistency, Primary-Based Protocols, Replicated-Write Protocols, Cache-coherence protocols, Implementing client-centric consistency

FAULT TOLERANCE AND SECURITY (09 hrs)

Introduction to fault tolerance, Process resilience, Reliable client-server communication, Reliable group communication, Distributed commit, Recovery, Introduction to security, Secure channels, Access control, Security management

DISTRIBUTED FILE SYSTEMS (09 hrs)

Architecture, Processes, Communication, Naming, Synchronization, Consistency and replication, fault tolerance, Security

TEXT BOOKS:

1. Distributed System Principles and Paradigms – Andrew S. Tanenbaum, PHI
2. Distributed O.S Concepts and Design - P.K.Sinha, PHI

REFERENCE BOOKS:

1. Advanced concepts in Operating Systems - Mukesh Singhal & N.G.Shivaratri, TMH

17MTEI132: DIGITAL SYSTEM DESIGN 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

MINIMIZATION AND TRANSFORMATION OF SEQUENTIAL MACHINES (09 hrs)

The Finite State Model – Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines. Fundamental mode model – Flow table – State reduction – Minimal closed covers – Races, Cycles and Hazards.

DIGITAL DESIGN (09 hrs)

Digital Design Using ROMs, PALs and PLAs, BCD Adder, 32 – bit adder, State graphs for control circuits, Scoreboard and Controller, A shift and add multiplier, Array multiplier, Keypad Scanner, Binary divider.

SM CHARTS (09 hrs)

State machine charts, Derivation of SM Charts, Realization of SM Chart, Implementation of Binary Multiplier, dice game controller.

FAULT MODELLING & TEST PATTERN GENERATION (09 hrs)

Logic Fault model – Fault detection & Redundancy- Fault equivalence and fault location –Fault dominance – Single stuck at fault model – Multiple stuck at fault models –Bridging fault model. Fault diagnosis of combinational circuits by conventional methods – Path sensitization techniques, Boolean Difference method – Kohavi algorithm – Test algorithms – D algorithm, PODEM, Random testing, Transition count testing, Signature analysis and test bridging faults.

FAULT DIAGNOSIS IN SEQUENTIAL CIRCUITS (09 hrs)

Circuit Test Approach, Transition Check Approach – State identification and fault detection experiment, Machine identification, Design of fault detection experiment.

TEXT BOOKS:

1. Fundamentals of Logic Design – Charles H. Roth, 5th Ed., Cengage Learning.
2. Digital Systems Testing and Testable Design – Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc.
3. Logic Design Theory – N. N. Biswas, PHI

REFERENCE BOOKS:

1. Switching and Finite Automata Theory – Z. Kohavi, 2nd Ed., 2001, TMH
2. Digital Design – Morris Mano, M.D.Ciletti, 4th Edition, PHI.
3. Digital Circuits and Logic Design – Samuel C. Lee, PHI

17MTEI133: LINUX ADMINISTRATION & SHELL PROGRAMMING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

LINUX BASICS (09 hrs)

Introduction to Linux, History & Features of Linux, Linux structure, various flavors of Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions or file, directory and users, searching a file & directory, zipping and unzipping concepts

INTERNAL REPRESENTATION OF FILES (09 hrs)

Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disabling of users accounts, creating and mounting file system.

LINUX NETWORKING (09 hrs)

Introduction to Networking in Linux, Network basics & tools, File transfer protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

SYSTEM PERFORMANCE (09 hrs)

Checking and monitoring system performance - file security & Permissions, becoming super user using su. Getting system information with uname, host name, disk partitions & sizes, users, kernel. Installing and removing packages. Backup, restore and Compress utilities - tar, cpio, dump, sync and restore utilities.

INTRODUCTION TO SHELL SCRIPTS (09 hrs)

Introduction to Shell programming, review of basic UNIX, pipelines of commands, about shell scripts, variables, Shell Bourne shell, C shell, Linux commands, permissions, editors, filters,sed,grep family, shell variables, scripts, met characters and environment, if and case statements, for a while and until loops.

TEXT BOOKS:

1. Red Hat Enterprise Linux 4: System Administration Guide Copyright 2005 Red Hat, Inc.
2. Linux and UNIX Shell Programming By D. S. W. Tansley, Pearson Education Ltd.
3. Operating System - Linux, NUT Press, PHI Publisher, 2006 Edition.

REFERENCE BOOKS:

1. Red Hat Linux Bible, Cristopher Negus, Wiley Dreamtech India
2. Beginning Linux Programming by Neil Mathew & Richard Stones, Wiley Dreamtech India
3. Linux Administration Handbook, EviNemeth,Garth Snyder, Trent KHein -Pearson Education.

17MTEI134: VLSI TECHNOLOGY AND DESIGN EMBEDDED COMPUTING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

OVERVIEW OF VLSI DESIGN METHODOLOGY (09 hrs)

VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, and computer aided design Technology; **Introduction to Microelectronics Electronics -** MOS, CMOS, BiCMOS Technology. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids – Vds relationships, Threshold Voltage VT, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

LAYOUT DESIGN AND TOOLS (09 hrs)

Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. Combinational MOS Logic Circuits: Introduction, MOS logic circuits with Depletion Nmos Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs), Introduction of Sequential MOS Logic Circuits, Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop, Introduction to Dynamic Logic Circuits, Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits

FLOOR PLANNING (09 hrs)

Floor planning methods, Global Interconnect, Floor Plan Design, Off-chip connections. Design for testability: Introduction, Fault types and models, Controllability and observability, AdHoc Testable design techniques, Scan –based techniques, built-in Self-Test (BIST) techniques, current monitoring IDDQ test, Introduction to Programmable Logic Devices: FPGA and CPLD

EMBEDDED COMPUTING (09 hrs)

Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design Design Example: Model Train Controller. Instruction Sets, CPUs: Preliminaries, ARM Processor, Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, Case Study of Data Compressor

BUS-BASED COMPUTER SYSTEMS (09 hrs)

CPU Bus, Memory Devices, I/O devices, Component Interfacing, Designing with Microprocessor, Development and Debugging, System-Level Performance Analysis Design Example: Alarm Clock. Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Basic Compilation Techniques, Program optimization, Program-Level performance analysis, REAL-TIME OPERATING SYSTEMS- OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. Introduction to embedded software development process and tools.

REFERENCE BOOKS:

1. S. M. Sze, "VLSI Technology", McGraw-Hill, Second Edition.
2. CMOS Digital Integrated circuits – Analysis and Design by Sung – Mo Kang, Yusuf Leblebici, TATA McGraw-Hill Pub. Company Ltd., Third Edition.
3. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin,CRC Press, 2011. 4.K.V.K.K. Prasad, "Embedded Real Time systems: Concepts, Design & Programming", Dream Tech Press, 2005.
4. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufman Publishers.
5. Sriram V. Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2004.

17MTEI231: WIRELESS SENSOR NETWORK 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

CHARACTERISTICS OF WSN (09 hrs)

Characteristic requirements for WSN -Challenges for WSNs–WSN vs Adhoc Networks-Sensor node architecture–Commercially available sensor nodes–I mote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations

MEDIUM ACCESS CONTROL PROTOCOLS (09 hrs)

Fundamentals of MAC protocols -Low duty cycle protocols and wakeup concepts -Contention – based protocols-Schedule- based protocols-SMAC- BMAC-Traffic- adaptive medium access protocol (TRAMA)- The IEEE 802.15.4 MAC protocol.

ROUTING AND DATA GATHERING PROTOCOLS (09 hrs)

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping, Data centric Routing, SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing, Rumor Routing COUGAR, ACQUIRE, Hierarchical Routing, LEACH, PEGASIS-Location Based Routing– GF, GAF,GEAR, GPSR – Real Time routing Protocols–TEEN, APTEEN, SPEED, RAP-Data aggregation, data aggregation operations, Aggregate Queries in Sensor Networks, Aggregation Techniques –TAG, Tiny DB

EMBEDDED OPERATING SYSTEMS (09 hrs)

Operating Systems for Wireless Sensor Networks, Introduction-Operating System Design Issues-Examples of Operating Systems, TinyOS, Mate, MagnetOS, MANTIS, OSPM, EYES OS, SenOS–EMERALDS, PicOS, Introduction to Tiny OS–NesC–Interfaces and Modules-Configurations and Wiring-Generic Components, Programming in Tiny OS using NesC, Emulator TOSSIM

APPLICATIONS OF WSN (09 hrs)

WSN Applications, Home Control, Building Automation, Industrial Automation, Medical Applications, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Case Study: IEEE 802.15.4 LR, WPANs Standard, Target detection and tracking, Contour/edge detection, Field sampling

TEXT BOOKS:

1. Ingemar J Cox et al, “Digital Watermarking and Steganography”, Morgan Kaufmann Publishers, New York, 2008.
2. Juergen Seits, “Digital Watermarking for Digital Media”, IDEA Group Publisher, New York, 2005.

REFERENCE BOOKS:

1. K. Akkaya and M. Younis, “A survey of routing protocols in wireless sensor networks”, Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325349
2. Anna Ha´c, “Wireless Sensor Network Designs”, John Wiley & Sons Ltd17SE311: Computer System Design Lab

17MTEI232: NETWORK SECURITY & CRYPTOGRAPHY 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

OVERVIEW AND NUMBER THEORY (09 hrs)

Overview- Threats, risks, consequences, Sources of threats, Attacks classification, Network Security Model, Classical Encryption Techniques, Number Theory- Prime numbers, Factoring, Modular arithmetic, Fermat's & Euler's theorems, GCD, Euclid's algorithm, Testing for primality, Chinese Remainder theorem, Discrete logarithm problem.

CRYPTOGRAPHY (09 hrs)

Concepts and Techniques, symmetric and asymmetric key cryptography, steganography, Symmetric key Ciphers- DES structure, DES Analysis, Security of DES, Block cipher modes of operation, Triple DES,RC5, AES structure, Analysis of AES , Key distribution Asymmetric key Ciphers- Principles of public key cryptosystems, RSA algorithm, Analysis of RSA, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

MESSAGE AUTHENTICATION AND DIGITAL SIGNATURES (09 hrs)

Authentication requirements and functions, MAC, Secure Hash Algorithm, HMAC, Digital signatures, X.509, Kerberos, Authentication protocols.

NETWORK AND WEB SECURITY (09 hrs)

IPsec, Internet Key Exchange, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET), Pretty Good Privacy (PGP), S/MIME.

SECURITY PRACTICES (09 hrs)

Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall, Trusted Systems, Security audit, Penetration testing and ethical hacking.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security", 6 th Edition, Pearson Education.
2. Atul Kahate," Cryptography and Network Security", 2 nd Edition, Mc Graw Hill

REFERENCE BOOKS:

1. Behrouz Forouzan, "Cryptography and Network Security", Special Indian Edition, Tata Mc Graw Hill
2. Margaret Cozzens, Steven J Miller, The mathematics of encryption, American Mathematical Society
3. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", CENGAGE Learning, 4th Edition.
4. Yang Xiao, Frank H Li, Hui Chen, "Handbook of Security of Networks", World Scientific, 2011.

17MTEI233: WIRELESS & MOBILE COMMUNICATIONS 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION (09 hrs)

Transmission Fundamentals: Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, Transmission Media, Multiplexing; Communication Networks: LANs, MANs, and Wans, Switching Techniques, Circuit Switching, Packet Switching; Protocols and the TCPlIPSuite: The Need for a Protocol Architecture, TheTCP/IP Protocol Architecture, the OSI Model, Internetworking.

CELLULAR WIRELESS NETWORKS (09 hrs)

Principles of Cellular Networks,FirstGeneration Analog Second-Generation TDMA Second-Generation CDMA,Third-Generation Systems; Antennas and Propagation-Antennas, Propagation Modes, Line-of Sight Transmission, Fading in the Mobile Environment; Modulation Techniques-Signal Encoding Criteria, Digital Data- Analog Signals, Analog Data-Analog Signals, Analog Data-Digital Signals; Spread Spectrum-The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum,Code Division Multiple Access; Coding and Error Control-Error Detection, Block Error Correction Codes , Convolutional Codes, Automatic Repeat Request

WIRELESS SYSTEMS AND MOBILE COMMUNIATIONS (09 hrs)

Multiple access in Wireless System – Multiple access scheme, frequency division multiple access, Time division multiple access, code division multiple access, space division multiple access, packet radio access, multiple access with collision avoidance. Global system for mobile communication – Global system for mobile communication, GSM architecture, GSM entities, call routing in GSM,PLMN interface, GSM addresses and identifiers, network aspects in GSM,GSM frequency allocation, authentication and security General packet radio service(GPRS) - GPRS and packet data network, GPRS network architecture, GPRS network operation, data services in GPRS, Applications of GPRS, Billing and charging in GPRS Wireless System Operations and standards - Cordless Systems, Wireless Local Loop, WiMAX and IEEE 802.16 Broadband Wireless Access Standards Mobile IP and Wireless Application. Protocol

WIRELESS TECHNOLOGIES (09 hrs)

Wi-Fi and the IEEE 802.11 Wireless LAN Standard – IEEE 802 architecture, IEEE 802.11 architecture and services, IEEE 802.11 Medium access control, IEEE 802.11 physical layer, Wi-Fi protected access. Bluetooth: Radio specification, baseband specification, link manager specification, logical link control and adaption protocol.

DEVELOPING MOBILE APPLICATIOSN USING ANDROID (09 hrs)

Android APIs, Android Architecture, Application Framework, The Application components, The manifest file, downloading and installing Android, Exploring the Development Environment, Developing and Executing the first Android application, Working with Activities, The Linear Layout, The Relative Layout, The Scroll View Layout, The Table Layout, The Frame Layout, Using the Text View, Edit Text View, Button View, Radio Button, Checkbox, Image Button, Rating Bar, The options Menu, The Context Menu.

REFERENCE BOOKS:

1. Wireless Communications & Networks, Second Edition, William Stallings by Pearson
2. Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH
3. Android Application Development Black Book, Pradeep Kothari, dreamtech press.

4. Wireless and mobile networks, Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S.Kakkasageri by WILEY Wireless networks, P. Nicopolitidis,M.S. Obaidat,G.I.Papadimitriou,A.S.Pomportsis by WILEY
5. Mobile Computing,Raj Kamal by Oxford
6. Mobile Computing Theory and Practice-Kumkum Garg-Pearson
7. Lauren Darcey and Shane Conder, Android Wireless Application Development,Pearson Education, 2nd ed. (2011).

17MTEI234: IoT & CLOUD COMPUTING 3 0 0 3

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

PRINCIPLES OF PARALLEL AND DISTRIBUTED COMPUTING (09 hrs)

Introduction to cloud computing, Cloud computing Architecture, cloud concepts and technologies, cloud services and platforms, Cloud models, cloud as a service, cloud solutions, cloud offerings, introduction to Hadoop and MapReduce.

CLOUD PLATFORMS FOR INDUSTRY (09 hrs)

Healthcare and education, Cloud Platforms in the Industry, cloud applications. Virtualization, cloud virtualization technology, deep dive: cloud virtualization, migrating in to cloud computing, Virtual Machines Provisioning and Virtual Machine Migration Services, On the Management of Virtual Machines for cloud Infrastructure, Comet cloud, T-Systems

CLOUD COMPUTING APPLICATIONS (09 hrs)

Industry, Health, Education, Scientific Applications, Business and Consumer Applications, Understanding Scientific Applications for Cloud Environments, Impact of Cloud computing on the role of corporate IT. Enterprise cloud computing Paradigm, Federated cloud computing Architecture, SLA Management in Cloud Computing, Developing the cloud: cloud application, Design.

IOT PHYSICAL DEVICES AND ENDPOINTS (09 hrs)

Introduction to Raspberry PI-Interfaces (serial, SPI, I2C),Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

IOT PHYSICAL SERVERS AND CLOUD OFFERINGS (09 hrs)

Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework, designing a RESTful web API

TEXT BOOKS

1. Cloud Computing: Raj Kumar Buyya, James Broberg, andrzej Goscinski, 2013 Wiley
2. Mastering Cloud Computing: Raj Kumar buyya, Christian Vecchiola, selvi-2013.
3. Cloud Computing: Arshdeep Bahga, Vijay Madisetti, 2014, University Press.
4. Cloud computing: Dr Kumar Saurab Wiley India 2011.

REFERENCES

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, OReilly (SPD), 2014, ISBN: 978935023975917SE401:

17MTEI331: EMBEDDED SYSTEMS SOFTWARE 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO EMBEDDED SYSTEMS (09 hrs)

What Is an Embedded System, History and Future, Real-Time Systems, Common System Components, Requirements That Affect Design Choices, Embedded Design Examples, Embedded Software Development: Hardware knowledge, efficient code, Peripheral interfaces, and robust code, Minimal resources, Reusable software, Development tools, Exploring Embedded Languages

EMBEDDED SYSTEMS-THE SOFTWARE POINT OF VIEW (09 hrs)

Software Basics, Software and Its manifestations: Combining hardware and software, High level language, Preprocessor, Cross Compiler, Assembler, Linker and Loader, Storing, An Embedded C Program, C Building Blocks, C Program Structure, Bitwise Operators, Pointer Variables and Memory Addresses, The function, Pointer to Functions, Structures

EMBEDDED LINUX FUNDAMENTALS (09 hrs)

Bootloaders, Device Driver Basics: Character Device, PCI Device Drivers, File Systems, Device Tree, MTD Subsystem, And Embedded Development Environment.

EMBEDDED WORKING ENVIRONMENT (09 hrs)

Development Tools, ssh, Kernel Debugging Techniques, Debugging Embedded Linux Applications, Stepper Motor Controller interfacing using Begal Black Bone Embedded System, Embedded Graphics and Multimedia Tools and Applications.

ANATOMY OF ANDROID (09 hrs)

Porting Linux, Linux and Real Time, Embedded Android: Bootloader, Kernel, Init, Zygote, System Server, Activity Manager, Launcher (Home), Embedded Android Applications: Calculator, Twitter Search App, Slide Show App,

TEXT BOOKS

1. Programming Embedded Systems, Second Edition with C and GNU Development Tools, O-Reilly
2. Lyla B. Das, “Embedded Systems: An Integrated Approach” Pearson, ISBN:978-81-317-8766-3

REFERENCE BOOKS

1. Dr. K. V. K. K. Prasad ―Embedded / real time System: Concepts, Design, & Programming – Black Book‖ Dreamtech Press Publication.
2. Rajkamal, ―Embedded System Architecture Programming Design‖ Tata Graw Hill Publication Second Edition, 2008.
3. Frank Vahid, Tony Givargis – Embedded System Design. – Wiley Publication Third Edition, ISBN 978-81-265-0837-2
4. James K. Peckol – Embedded Systems – Wiley Publication ISBN 978-81-265-2456-3

17MTEI332: SOFTWARE DESIGN AND ARCHITECTURE 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION (09 hrs)

Design Definition, Input, output, and constraints of the design process, Types of design, Relationship to software quality and evolution, Software design process- nature of design process, design qualities, Design as a 'wicked' problem.

DESIGNING WITH OBJECTS (09 hrs)

The 'object concept'. Design practices for the object-oriented paradigm, Object-Oriented frameworks, Object-based design, Creational, Structural, behavioral design patterns, Component based design, Formal approach to design.

INTRODUCTION TO SOFTWARE ARCHITECTURE (09 hrs)

Software Architecture, Quality Attributes, Architecture and Requirements, Designing an Architecture, Documenting software Architecture, Architecture and Software Product line.

SOFTWARE ARCHITECTURE DESIGN VIEWS (09 hrs)

Overview of Software Architectures , IS2000: The Advanced Imaging Solution, Global Analysis, Architecture View -Conceptual View and Module View, Styles of the Module View-type, Execution Architecture View, Code Architecture View ,View-type and Styles, Coffee Maker Exercise.

CONTEXTS OF SOFTWARE ARCHITECTURE (09 hrs)

Architecture in a - Technical Context, Project Life-Cycle Context, Business Context, Professional Context, Architecture Influenced, Quality Attribute Considerations

TEXT BOOKS

1. David Budgen, "Software Design", 2nd edition, Pearson Education (LPE)

REFERENCE BOOKS

1. Software Design: From Programming to Architecture Eric J. Braude ISBN: 978-0-471-20459-6
2. Software Architecture in Practice, 3rd Edition By Len Bass, Paul Clements, Rick KazmanPublished Sep 25, 2012 by Addison-Wesley Professional
3. Applied Software Architecture ,Christine Hofmeister, Robert Nord, Deli Soni, Addison-Wesley Professional; 1st edition (November 4, 1999) ,ISBN-10: 0201325713 , ISBN-13: 978-0201325713
4. Enterprise Patterns and MDA: Building Better Software with Archetype Patterns and UMLJim Arlow, Ila Neustadt ,Addison-Wesley Professional, 2004, ISBN-10: 032111230X ISBN-13: 9780321112309
5. Kai Qian, Xiang Fu, Lixin Tao, "Software Architecture and Design Illuminated", Jones & Bartlett Learning, 2009, ISBN 076375420X, 9780763754204

17MTEI333: PARALLEL & DISTRIBUTED COMPUTING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO PARALLEL COMPUTING (09 hrs)

Parallel Computing Architectures, Paradigms, Issues, & Technologies architectures, topologies, organizations, Parallel Programming performance, programming paradigms and applications

PARALLEL PROGRAMMING USING SHAED MEMORY (09 hrs)

Basics of shared memory programming, memory coherence, race conditions and deadlock detection, synchronization, multithreaded programming, OpenMP, pthreads, Java thread

PARALLEL PROGRAMMING USING MESSAGE PASSING AND ADVANCE TOPICS (09 hrs)

Basics of message passing techniques, synchronous/asynchronous messaging, partitioning and load-balancing, MPI, Advanced Topics: accelerators, CUDA, OpenCL, PGAS

INTRODUCTION TO DISTRIBUTED PROGRAMMING (09 hrs)

Architectures, programming models, Distributed Programming Issues/Algorithms: fundamental issues and concepts - synchronization, mutual exclusion, termination detection, clocks, event ordering, locking.

DISTRIBUTED COMPUTING TOOLS & RECENT TRENDS (09 hrs)

CORBA, JavaRMI, Web Services, shared spaces, Map-Reduce, Hadoop, Grid Computing, P2P Computing, and Autonomic Computing. Case studies

TEXT BOOKS:

1. Hariri and Parashar (Ed.), Tools and Environments for Parallel & Distributed Computing, John Wiley, 2004.
2. David Kirk, Wen-Mei W. Hwu, Wen-mei Hwu, Programming massively parallel processors: a handson approach, Morgan Kaufmann, 2010.
3. Kay Hwang, Jack Dongarra and Geoffrey C. Fox (Ed.), Distributed and Cloud Computing, Morgan Kaufmann, 2011.
4. Peter Pacheco, an Introduction to Parallel Programming, Morgan Kaufmann, 2011.

17MTEI334: INTERNET PROGRAMMING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTERNET BASICS (09 hrs)

Internet Addressing, Browsers, Servers, Protocols, Web Application Architectures, Scripting Languages, Databases, Search Engines, Web Services, Collective Intelligence, Mobile Web, Features of Web 3.0, Overview of Networking, TCP, UDP, InetAddress and Ports, Working with URLs, Internet Protocols simulation, HTTP, SMTP, POP, FTP, Remote Method Invocation.

CLIENT-SIDE PROGRAMMING (09 hrs)

Scripting for content structuring, form design, client side validation, dynamic page generation, adding interactivity, styles, using HTML, CSS, Java Script, Bootstrap, XML, Document Type Definition, XML Schema, Document Object Model, AJAX and XML, Evolution of AJAX JQuery

INTERNET PROGRAMMING LANGUAGES (09 hrs)

Java - Fundamental Programming Structures, Strings, Objects, Classes and Methods, Inheritance, Packages and Interfaces, Exception handling, Collections, Multithreading, Java I/O Streams, File Handling.
PHP - Obtaining, Installing & Configuring PHP, Introduction to PHP, Reading Data in Web Pages, PHP Browser-Handling Power, Object-Oriented Programming, Sessions, Cookies, and FTP, Exceptional handling, AJAX and PHP.

SERVER-SIDE PROGRAMMING (09 hrs)

Types of servers, Configuring and Using Web servers, Setting up Databases, Database Connectivity using Java/PHP, Handling form data, validation, querying databases, information retrieval, response generation. Introduction to server-side scripting – NodeJs, NodeJS fundamentals, NodeJS modules, sample application using CRUD operations.

WEB APPLICATION DEVELOPMENT (09 hrs)

Creating Interactive Websites, Search engines, cookies, Blogs, Social web applications, Developing WIKI pages, Programming for the Mobile web.

TEXT BOOKS:

1. Herbert Schildt, “Java - The Complete Reference”, McGraw-Hill Osborne Media
2. Paul Deitel, “Internet & World Wide Web: How to Program”, Prentice Hall, 4th Edition, 2007.
3. Barasat Ali Syed, “Beginning Node.js”, Apress

REFERENCE BOOKS:

1. Cay S. Horstmann and Gary Cornell, “Core Java, Vol. 2: Advanced Features”, 8th Edition, Prentice Hall, 2008.
2. Robert W. Sebesta, “Programming the World Wide Web”, Addison-Wesley, Sixth Edition, 2010.
3. Elliotte Rusty Harold, “Java Network Programming”, Third Edition, O’Reilly, 2004.

17MTEI335: PERVASIVE COMPUTING **3 1 0 4**

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

TOOLS AND TECHNIQUES FOR DYNAMIC RECONFIGURATION AND INTEROPERABILITY OF PERVASIVE SYSTEMS **(09 hrs)**

Pervasive Computing and Its Significance Research Trends in Pervasive Computing and Networking, Mobile Agent Technology: Introduction, Mobile Agent Security, Mobile Agent Platforms, Sensor Networks : Introduction, Sensor Network Applications, Dynamic Reconfiguration of Sensor Networks, Collaboration and Interoperability Among Sensor Networks, Applications : A Pervasive System for Volcano Monitoring, A Pervasive Computing Platform for Individualized Higher Education

PERVASIVE LEARNING TOOLS AND TECHNOLOGIES **(09 hrs)**

Introduction, Pervasive Learning: A Promising Innovative Paradigm, Historical Development of Computing and IT in Education, Past Experience and Issues, Practice and Challenge at Waseda E-School, Emerging Technologies and Systems for Pervasive Learning: Emerging Computing Paradigms for Education, Pervasive Learning Support Systems and Technologies, Integration of Real-World Practice and Experience with Pervasive Learning: Ubiquitous Learning, UPS (Ubiquitous Personal Study), Nature of Pervasive Learning and Provision of Well-Being in Education: Ubiquitous and Pervasive, The Possible Trend of Pervasive Technology in Education

SERVICE MANAGEMENT IN PERVASIVE COMPUTING ENVIRONMENTS **(09 hrs)**

Introduction, Service Management in Pervasive Computing Environments: Introduction, Pervasive Computing Environments, Service Management Framework, General Components of a Service Management System, System Support Components, Service Management Challenges, Techniques for Service Management in PvCE: Introduction, Classification of Service Discovery Protocols, Service Discovery in Infrastructure-Based Networks, Service Discovery in Infrastructure-Less Networks, Multiprotocol Service Discovery, Service Discovery Approaches, Service Composition: Service Composition Functions, Survey of Methods in Service Composition Process, Service Composition Approaches

WEARABLE COMPUTING AND SENSOR SYSTEMS FOR HEALTHCARE **(09 hrs)**

Introduction, The Health Body Area Network, Medical and Technological Requirements of Health Sensors, Wearable Sensors for Vital Signals Monitoring, Wearable Sensors for Activity Recognition, Sensors and Signals for Emotion Recognition, Intra-BAN Communications in Pervasive Healthcare Systems: Standards and Protocols: IEEE 802.15.4 and ZigBee, Bluetooth, Bluetooth Low Energy, Integrated and Additional Solutions for Health BAN Communications

STANDARDS AND IMPLEMENTATION OF PERVASIVE COMPUTING APPLICATIONS **(09 hrs)**

Introduction: Pervasiveness and Mobility in Computing and Communications, Context Awareness, Heterogeneity, Wireless Technologies and Standards: A Simple Classification of Wireless Networks, Concluding Remarks, Middleware: Future Trends: Beyond the Middleware, Case Studies: Pervasive Computing in Extreme Areas; The Hiker's Personal Digital Assistant, Pervasive Computing in Personal Health Systems; The My HealthService Approach

TEXT BOOKS:

1. Mohammad S. Obaidat, Mieso Denko And Isaac Woungang, "Pervasive Computing And Networking", Wiley Publication.

17MTEI336: NEURAL NETWORK AND FUZZY LOGIC 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

INTRODUCTION TO NEURAL NETWORKS AND FUZZY SYSTEMS (09 hrs)

Characteristics of Neural Networks, Models of Neuron – Biological Neuron and Artificial Neuron, Learning Rules, Recent advances in Neural Networks and Fuzzy Systems.

LEARNING (09 hrs)

The Perceptron and its learning law, Adaptive networks, Supervised Learning Neural Networks, Single layer and multi-layer perceptrons, Back propagation learning, Radial basis function networks, Modular neural networks, Neuro-dynamic programming and reinforcement learning

FUZZY LOGIC AND FUZZY SYSTEMS (09 hrs)

Classic and fuzzy logic, approximate reasoning, Natural language, linguistic hedges, fuzzy rule based systems, graphical technique of inference.

FUZZY SETS (09 hrs)

Fuzzy sets; fuzzy rules and fuzzy reasoning; temporal fuzzy logic; fuzzy systems; fuzzy associative memories; fuzzy rule generation using neural net approaches; fuzzy inference systems; fuzzy neural networks; adaptive neuro-fuzzy inference systems (ANFIS); neuro-fuzzy control.

APPLICATIONS (09 hrs)

Applications of Neural Networks and Fuzzy Systems, Pattern classification, Associative memories, Combinatorial optimization, Applications in decision making,

TEXT BOOKS

1. B. Kosko , (1994), 'Neural Networks and Fuzzy Systems: A dynamical systems approach to machine intelligence,' Prentice Hall India.
2. G.J. Klir and B. Yuan, (1997), 'Fuzzy Sets and Fuzzy Logic,' Prentice Hall India.

REFERENCES

1. Haykin, ―Neural Network a comprehensive Foundation‖, PHI
2. B. Yegnanarayana, ―Artificial Neural Networks‖, PHI
3. James A Freeman, David M Skapura, ―Neural Networks-Algorithms, Applications and Programming Techniques,‖ Person Education
4. S.V. Kartalopoulas , 'Understanding Neural networks and Fuzzy Logic,' IEEE Press and Prentice Hall India.

17MTEI337: DIGITAL IMAGE PROCESSING 3 1 0 4

CA : 40 Marks FE : 60 Marks No. of Total Lectures = 45 Hours

FUNDAMENTAL STEPS OF IMAGE PROCESSING (09 hrs)

Fundamental steps of image processing, components of an image processing of system, the image model and image acquisition, sampling and quantization, station ship between pixels, distance functions, scanner.

STATISTICAL AND SPATIAL OPERATIONS (09 hrs)

Statistical and spatial operations, Grey level transformations, histogram equalization, smoothing & sharpening-spatial filters, frequency domain filters, homomorphic filtering, image filtering & restoration:-Inverse and weiner filtering. FIR weiner filter, Filtering using image transforms, smoothing splines and interpolation.

MORPHOLOGICAL & SEGMENTATION IN IMAGE (09 hrs)

Morphological and other area operations, basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms, extension to grey scale images. Segmentation and Edge detection region operations, basic edge detection, second order detection, crack edge detection, gradient operators, compass and laplace operators, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds.

IMAGE COMPRESSION (09 hrs)

Image compression: Types and requirements, statistical compression, spatial compression, contour coding, quantizing compression, image data compression-predictive technique, pixel coding, transfer coding theory, lossy and lossless predictive type coding. Basics of color image processing, pseudocolor image processing, color transformation, color smoothing and sharpening, color segmentation, color image compression, compression standards.

IMAGE TRANSFORMS (09 hrs)

Image Transforms - Fourier, DFT, DCT, DST, Haar, Hotelling, Karhunen -Loeve, Walsh, Hadamard, Slant. Representation and Description - Chain codes, Polygonal approximation, Signatures Boundary Segments, Skeltons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, PCA.

TEXT BOOKS

1. Digital Image Processing – by Rafael.C.Gonzalez & Richard E.Woods, 3rd edition, Pearson Education, 2008.
2. Digital Image Processing, M.Anji Reddy, Y.Hari Shankar, BS Publications.
3. Fundamentals of Digital Image Processing – by A.K. Jain, PHI.

REFERENCE BOOKS

1. Digital Image Processing – William K, Part I - John Wiley edition.
2. Digital Image Processing using MATLAB – by Rafael.C.Gonzalez, Richard E.Woods, & Steven L.Eddins, Pearson Education, 2006
3. Digital Image Processing, Kenneth R. Castleman, Pearson Education, 2007