AFFILIATED INSTITUTIONS

ANNA UNIVERSITY, CHENNAI

REGULATIONS - 2009

M.E. PERVASIVE COMPUTING TECHNOLOGIES

II TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

SEMESTER II

S.NO.	COURSE CODE	SUBJECT	L	T	P	C
THEORY						
1	PV9321	RFID and Sensor Networks	3	0	0	3
2	PV9322	Advanced Operating Systems	3	0	0	3
3	IT9224	Distributed Systems	3	0	0	3
4	PV9323	Software Technologies for Pervasive Computing	3	0	0	3
5	E2****	Elective II	3	0	0	3
6	E3****	Elective III	3	0	0	3
PRACTICAL						
7	PV9324	Pervasive Computing Laboratory	0	0	3	2
8	PV9325	RFID and Sensors Laboratory	0	0	3	2
		TOTAL	**18**	**0**	**6**	**22**

SEMESTER III

S.NO.	COURSE CODE	SUBJECT	L	T	P	C
THEORY						
1	E4****	Elective IV	3	0	0	3
2	E5****	Elective V	3	0	0	3
3	E6****	Elective VI	3	0	0	3
PRACTICAL						
4	PV9331	Project Work (Phase I)	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

S.NO.	COURSE CODE	SUBJECT	L	T	P	C
PRACTICAL						
1	PV9341	Project Work(Phase II)	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 73

LIST OF ELECTIVES

S.NO.	COURSE CODE	SUBJECT	L	T	P	C
1	PV9001	Wearable Computing	3	0	0	3
2	PV9002	Context aware Computing	3	0	0	3
3	PV9003	Smart Objects & Spaces	3	0	0	3
4	PV9004	Human Computer Interactions	3	0	0	3
5	PV9005	Pervasive Computing Privacy and Security	3	0	0	3
6	PV9006	Computational Intelligence	3	0	0	3
7	PV9007	Business and Industrial Applications of Pervasive Computing Technologies.	3	0	0	3
8	PV9008	High Performance Communication Networks	3	0	0	3
9	PV9009	Ad - Hoc Networks	3	0	0	3
10	PV9010	Mobile Computing	3	0	0	3
11	PV9011	Requirements Engineering for Real Time Systems	3	1	0	4
12	PV9012	Parallel algorithms and programming	3	0	0	3
13	PV9013	Advanced Digital Signal Processing	3	0	0	3
14	PV9014	Hardware Software Co - Design	3	0	0	3
15	PV9015	Advanced Computer Architecture	3	0	0	3
16	PV9016	Advanced Micro Controllers	3	0	0	3

PV9321 RFID AND SENSOR NETWORKS LT P C
3 0 0 3

UNIT I RFID BASICS 9

Introduction – transponder and reader architecture – types of tags and readers – frequencies of operation – selection criteria for RFID systems – information processing in the transponder and reader – fundamental operating principles – antennas for RFIDs.

UNIT II RFID CODES STANDARDS AND APPLICATIONS 9

Frequency ranges and licensing regulations – coding and modulation – data integrity and security in RFID systems – memory and microprocessors for RFID – product codes – standards and regulations – Electronic product code – EPC layout and infrastructure – Supply chain management and other examples of RFID applications – EPC in supply chain.

UNIT III SENSOR NETWORKS 9

Introduction to various sensors like Temperature – Humidity – Pressure – Introduction to Sensor networks – motivation – applications – sensors – architectures – and platforms for Wireless sensor networks – Sensor Node Architecture – Sensor Network Architecture – Sample sensor networks applications – Design challenges – Performance metrics

UNIT IV LOCALIZATION AND TRACKING 9

A tracking scenario – sensing model – Collaborative localization – Bayes state estimation – distributed representation – Tracking multiple objects – Ranging techniques – Range based localization algorithms – location services

UNIT V NETWORKING SENSORS AND NETWORK PLATFORMS 9

MAC for sensor networks – Geographic – Energy – aware routing – Attribute – based routing – Sensor node Hardware (Berkeley Motes) – TinyOS – nesC – Tiny GALS – NS – 2 – TOSSIM – PIECES.

TOTAL: 45 PERIODS

REFERENCES

1. F. Zhao and L. Guibas, “Wireless Sensor Networks”, Morgan Kaufmann, San Francisco, 2004.
2. K.Finkenzeller, “RFID Handbook: Fundamentals and Applications in contact less smart cards and identifications”, John Wiley and sons Ltd, 2003.
3. Sandip Lahiri, “RFID Source Book”, Prentice Hall, 2005.
4. Akshay Tyagi, “RF Devices Handbook Technology Design and Applications”, Anerbach Publications, 2006.
5. Cauligi S. Raghavendra, University of Southern California , Krishna Sivalingam, University of Maryland Baltimore County , Taieb M. Znati, University of Pittsburg , “Wireless Sensor Networks” , Springer, August 2005.
6. Holger Karl, Technical University of Berlin , Andreas Willig, University of Potsdam , “Protocols and Architectures for Wireless Sensor Networks”, Wiley, June 2005.
7. IEEE Magazines and Journals.

PV9322 ADVANCED OPERATING SYSTEMS L T P C
3 0 0 3

UNIT I OS DESIGN 9

Overview – Sequential Processes – Banker's Algorithms – Concurrency – Functional Systems – Mutual Exclusion – Distributed systems – parallel systems – and networks of workstations – high performance computing – resource management – Processes Cooperation – Process Communication – Semaphores – Conditional Critical Regions – Event Queues – Deadlock – Processor Management – Short term and Long term scheduling problems – Scheduling algorithms – Queuing system model – Non pre – emptive Scheduling – Pre – emptive Scheduling.

UNIT II OS STRUCTURE AND MANAGEMENT 9

Implementation of OS services at user level – OS structure and performance – reliability and availability of OS services. Storage Management – I/O Programming and Interrupt Structures – Device Management – Information Management – Virtual Memory – Discussions of virtual memory management implementations and recent work in virtual memory for multiprocessors – large virtual address spaces – and other topics. Virtual machines and their impact on OS structure.

UNIT III SYNCHRONIZATION AND COMMUNICATION 9

Synchronization – Distributed Mutual Exclusion – Philosophers Problem – Deadlocks in Distributed Systems Discussions of synchronization with an emphasis on monitors – Communication using remote procedure call – Networking issues in operating systems.

UNIT IV FILE SYSTEMS 9

File Systems – Mode of Computation – Load Balancing – Event Ordering – Discussions of file system interfaces and disk storage management techniques.

UNIT V PROTECTION AND SECURITY 9

Introductory overview of operating system security issues – Operating system security Vs Network and cryptographic security – commonly known security models – their weaknesses and limitations.

TOTAL: 45 PERIODS

REFERENCES

1. George Coulouris, Jean Dollimore, Tim Kind berg, “Distributed Systems”, Addison Wesley, Pearson education, 2001.
2. Pradeep K. Sinha, “Distributed Operating Systems: Concepts and Design”, Wiley, 1996.
3. Maekawa, Oldehoeft, “OS: Advanced Concepts”, Addison Wesley, 1994.

IT9224 DISTRIBUTED SYSTEMS L T P C
3 0 0 3

UNIT I STRUCTURE AND MODELS 9

Introduction: Definition – Examples of distributed systems – Hardware concepts – Software Concepts.

Networking and Internetworking: Introduction – Types of network – Network principles – Internet protocols – Network case studies: Ethernet – wireless LAN and ATM.

UNIT II SYNCHRONIZATION AND COMMUNICATION 9

Communication: Layered protocols – Remote object invocation – Message Oriented Communication – Stream Oriented Communication – Communication Models: Client server– Peer – to – peer.

Time: Theoretical Aspects: Logical clocks – Vector clocks – Global state – Physical and logical time – Event ordering – Clock synchronization – Message delivery ordering.

Algorithms and application protocols: Replication management – Strong and weak consistency – Asynchronous and synchronous algorithms – Atomic commitment – Process groups – Election Mutual exclusion.

UNIT III NAMING, ACCESS CONTROL AND SECURITY 9

Naming: Design of names – pure or hierarchical – Interpretation of names in context – Binding – Long – term consistency.

Access control: Access Control Lists and capabilities in distributed systems – Role – based access control – Policy expression and enforcement.

Security: Mechanisms – technology and security levels – Intrusion Detection and Tolerance.

UNIT IV STORAGE 9

Storage: Design issues for network – based storage services – Distributed Storage Systems.

Building distributed services: Distributed Multimedia Systems – Overlay and Peer – to – Peer Networks – Web Servers.

UNIT V CHALLENGES AND FUTURE TRENDS 9

Issues and challenges: Fault tolerance: Process resilience – Reliable client – server communication – reliable group communication – recovery.

Future trends: Differences and similarities between Wireless Computing – Pervasive/Ubiquitous Computing – Grid Computing.

TOTAL: 45 PERIODS

REFERENCES

1. Tanenbaum, A.S. & van Steen M, “Distributed systems”, Prentice Hall, 2002.

2. Coulouris, G.F., Dollimore, J.B. & Kind berg T, “Distributed systems, concepts and design”, 4th edition, Addison Wesley, 2005.
3. Burkhart, Henn, Hepper, Rintdorff, Schaeck, “Pervasive Computing”, Addison Wesley, 2002.
4. William Buchanan, “Distributed Systems and Networks”, McGraw - Hill, 2000.

PV9323 SOFTWARE TECHNOLOGIES FOR PERVASIVE COMPUTING L T P C
3 0 0 3

UNIT I ISSUES AND CHALLENGES 9

Challenges of Concurrent and Networked Software: Service Access and Configuration – Other Challenges for Networked Software **–** The Mobile Development Process – Architecture – Design and Technology Selection for Mobile Applications

UNIT II APPLICATION AND USER INTERFACE DEVELOPMENT 9

Introduction to Mobile Development Frameworks and Tools Accessed today – Fully Centralized Frameworks and Tools – N – Tier Client–Server Frameworks and Tools – JAVA – BREW – WINDOWS CE – WAP – Symbian EPOC

UNIT III UML AND USER INTERFACE DEVELOPMENT 9

Introduction to UML – Class diagrams – Object diagrams – Collaboration diagrams – Sequence diagrams – Activity diagrams – State chart diagrams – Component diagrams – Deployment diagrams – Use case diagrams – Device – Independent and Multi – channel User Interface Development Using UML

UNIT IV J2ME OVERVIEW 9

J2ME Overview – J2ME and Wireless Devices – Small Computing technology – Wireless Technology – Radio Data Networks – Microwave Technology – Mobile Radio Networks – J2ME Architecture and Development Environment – Runtime Environment – Midlet Programming – J2ME Wireless Toolkit

UNIT V J2ME USER INTERFACE 9

J2ME User Interface – Commands, Items and Event Processing – Exception Handling – High – Level Display – Screens – Low Level Display – Canvas – User Interactions – graphics – Clipping Regions – Animations.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Reza B'Far, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, Cambridge University Press
2. James Keogh, “J2ME: The Complete Reference”, Tata McGraw Hill, 2003.

REFERENCES

1. Tommi Mikkonen, “Programming mobile devices – An Introduction for practitioners”, Wiley.
2. Douglas Schmidt, Michael Stal, Hans Rohnert and Frank Buschmann, “Pattern – Oriented Software Architecture– Patterns for Concurrent and Networked Objects”, John Wiley
3. James Keogh, “J2ME: The Complete Reference”, Tata McGraw Hill, 2003.

PV9324	PERVASIVE COMPUTING LABORATORY	L T P C 0 0 3 2

LIST OF EXPERIMENTS

1. STUDY EXPERIMENT

To explore overall view about

- Pervasive Computing Architecture
- Communication protocols
- Software infrastructure
- Security mechanisms

2. STUDY OF MIDDLEWARE, APPLICATION LEVEL, NETWORK, SYSTEM SOFTWARE

To design the software for mobile phones

- J2ME basics
- User interface design
- Control structures
- Files and databases
- Communication
- Interoperability between Mobile phones

3. APPLICATION LEVEL

To study new HCI techniques for small mobile devices and embedded devices.

4. CASE STUDIES. PROJECTS IN PERVASIVE COMPUTING

To explore wearable and handheld computing and their enabling technologies

TOTAL: 45 PERIODS

PV9325 RFID AND SENSORS LABORATORY L T P C
0 0 3 2

EXPERIMENTS ON RFID

1. Study of RFIDs in 125 KHz, 13.56 MHz and 820 to 915 MHz range.
2. Simulation of ASK & FSK Modulation & Demodulation in RFID tags and readers. *
3. Study of EPC codes: Writing and reading of EPC codes
4. Ati – Collision algorithms in RFIDs
5. RFID Immobilization and Demonstration
6. Study and Demonstration of RFID development kit/Applications of RFIDs
7. Usage of RFIDs in a simple application.
8. Acquisition: To write software to process the input data from sensors, RFIDs. (e.g. Data from temperature sensors from RFIDs like the number of people in the room to calculate the optimal A/C level etc…)
9. Processing, integration and computation: To integrate the middleware with input devices. (e.g. Data from RFIDs and sensors, mobile phones integrate with the attendance software.)

* Simulation experiments are carried out using ADS, MATLAB, ORCAD etc.

EXPERIMENTS ON SENSORS

1. Study of various types of Sensors (Temperature, Smoke, humidity etc.,).
2. To design, integrate sensors and RFIDs for a typical applications.
3. Interfacing of Sensors with Microcontrollers/actuator/Data acquisition.
4. Study of Sensor Networking Classroom kits (For e.g. using Motes Classroom kits)
5. Study of Sensor Networking using Basic kits and to construct a wireless network of sensors and actuators.
6. (Suitable simulators / development kits are used to carry out the experiments)

TOTAL: 45 PERIODS

PV9001 **WEARABLE COMPUTING** **L T P C**
3 0 0 3

UNIT I INTRODUCTION AND OVERVIEW 9

Fundamental theories – principles of operation – building blocks – pervasive sensing – textile sensors – smart textiles – fundamentals – fabrication – high – tech textiles textile substrates textile body area network wear ability – motion aware clothing – high density packaging – packaging technologies system packages – electrical design case studies – algorithms – social issues and privacy.

UNIT II ARCHITECTURE AND INTERFACING 9

Hard wares for wearable computing – processors and their architectures – audio interfaces – multimodal interface – wearable interfaces and connections to distributed sensor networks – tactile interfaces – dial design – interaction design – tangible user interfaces – integrated environment – exchange and display of information.

UNIT III SOFTWARE AND SIGNAL PROCESSING 9

Intelligent signal processing – system software & operating systems for wearable computing – machine learning for context sensing – context sensing and proactive behavior image/sensory processing – software organization memory management – programming tools – development environments – software engineering methodologies for wearable computing solutions.

UNIT IV POWER SUPPLY AND DESIGN ASPECTS 9

Energy in mobile systems – ambient energy sources – heat dissipation – powering strategies – energy scavenging – Low power design and power management– and hardware case studies – Exploratory design – task driven design – design for wear ability – simulators

UNIT V DETAILED CASE STUDIES 9

Augmented reality– application themes: – home – office and car – case study on various software solutions for wearable computing – typical operating systems –design approaches – recent advances – emerging trends.

TOTAL: 45 PERIODS

REFERENCES

1. Woodrow Barifield , Thomas Caudell, “Fundamentals of Wearable Computing and Augmented Reality”, Lawrence Erlbaum Associates, 2001.
2. James Everett Katz, “Machines That Become Us”, Transaction Publishers, 2001.
3. Maria, Isabel Sanchez, Segura, “Developing Future Interactive Systems”. Idea Group Inc (IGI), 2004.

PV9002 CONTEXT AWARE COMPUTING L T P C
3 0 0 3

UNIT I INTRODUCTION AND CLASSIFICATIONS 9

Introduction to context – aware computing – Philosophical & Mathematical Positions on Context – Context Aware Computing Approaches – Types of context – Low level and high level context – Active and Passive context.

UNIT II CAPABILITIES 9

Sensing – Adaptation – Resource discovery – Augmentation – Information delivery approaches – AI – Agents and System Reflection.

UNIT III MODELING AND EVALUATION 9

Interaction design for applications and evaluation – Experimental design – Modeling and evaluation: context modeling – task modeling – User modeling – Systems modeling – committed action in context – aware systems – Context management.

UNIT IV LEARNING AND RECOGNITION 9

Learning – machine learning – common sense applications of Context aware computing – Designer learning – reasoning and uncertainty Recognizing and interpreting intention – Context – aware: recognition and interpretation.

UNIT V SOFTWARE SUPPORT AND APPLICATIONS 9

Context toolkits – Middleware support for Context Aware Computing – Case studies and Applications of context – aware computing – Limitations of Context Aware Computing.

TOTAL: 45 PERIODS

REFERENCES

1. Thomas P. Moran, “Context – aware Computing”, Lawrence Erlbaum Assoc Inc, 2002.
2. Gay, Geri and Hem Brooke, Helene, “Activity – centered design: an ecological approach to designing smart tools and usable systems”, Cambridge, MA: MIT Press, 2004.
3. Ahmed Seffah, Homa Javahery, “Multiple User Interfaces: Cross – Platform Applications and Context – Aware Interfaces”, Hardcover – 2004.

PV9003 SMART OBJECTS AND SPACES L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Overview of smart spaces and smart objects – Smart sensors – power line control of devices wireless communications and smart devices – fixed and mobile networking technologies and infrastructure for smart objects.

UNIT II SOFTWARE INFRASTRUCTURE 9

Software infrastructure for smart devices/ambient intelligence – middleware framework – model and software architecture for location management context awareness – software architecture for distributed applications on mobile physical objects.

UNIT III ALGORITHMS AND PROTOCOLS FOR SMART ENVIRONMENTS 9

Ubiquitous computing – action prediction and recognition activities – mobility prediction automated intelligent decision making – privacy and security.

UNIT IV HUMAN – MACHINE 9

Machine learning – intelligent computer – human interface – techno – social users.

UNIT V APPLICATIONS 9

Smart houses and dependent people – smart rooms – smart offices – smart cars – assistive environments for individuals with special needs – On going challenges and future directions.

TOTAL: 45 PERIODS

REFERENCES

1. Diane J cook and Sajal Das, " Smart Environments, Technologies, Protocols and Applications", Wiley Intersci 2005
2. Gilles Privat, Clande kintzig, Gerard Poulain, "Communicating with Smart Objects: Developing Technology for Usable Pervasive computing systems" Kogan page science, September 2003.
3. Emile Aarts and Stefano Marzane, "Views on Ambient Intelligence" New Everyday – illustrated.
4. IEEE and other publications as well as supplements form conference proceedings

PV9004 HUMAN COMPUTER INTERACTIONS L T P C
3 0 0 3

UNIT I INTRODUCTION AND HISTORICAL PERSPECTIVE 9

Historical Developments

Course Introduction – HCI: A Historical and Intellectual Perspective.

Communication

Types and issues – Control – perception – learning – bandwidth – channel capacity – information quantification – Physiology: human sense modalities.

Hardware

Keyboards – pointing devices – screens – Speech synthesis – speech recognition hardware. PDAs – Smart Phones – Smart Environments – Display devices – Devices for

Virtual Reality and 3 D interaction – Peripheral Displays – Toolkits for Peripheral Displays – Evaluating Peripheral Displays.

Interaction Paradigms:

Models of interaction – Interaction Framework – Ergonomics – Software/interface guidelines – Interaction Styles – Context of Interaction – Interaction Paradigms – Mobile device interaction paradigms.

UNIT II DESIGN PROCESS 9

Task analysis

Difference between task analysis and other techniques – text decomposition – knowledge based analysis – Entity – Relationship – based techniques – Source of information and data collection – Use of task analysis.

Dialog notation and design

Dialog design and Diagrammatic of notation – Dialog semantic analysis and design.

Interaction design

Process of design – Task – centered and user – centered design – Functionality and usability – Design guidelines – The use of models in interface design – Iteration – prototyping – formal methods – Task and user analysis – Specifying usability requirements – Interface style and design guides – Prototyping tools.

Universal design

Universal design principles – Multi – modal interaction for pervasive computing environments.

HCI in the software process

Software life cycle – Iterative and prototyping – Principles of support usability – standards – guide lines – HCI patterns – golden rules and heuristics.

UNIT III IMPLEMENTATION AND EVALUATION 9

Implementation issues

Elements of windowing systems – user interface management systems – Response time – Colors – Short cuts – Symbols – Adaptable interfaces – self configuring systems for mobile devices.

Evaluation techniques

Evaluation through expert analysis and user participation – Evaluation methodologies – Evaluation criteria: functionality – usability – learnability – initiative.

UNIT IV MODELS AND THEORIES 9

Cognitive models – Communication and collaboration models: Models of the system

Standard formalisms – Interaction models – continuous behavior.

Modeling rich interaction

Status – event analysis – Rich context – low intention and sensor – based interaction.

UNIT V APPLICATIONS 9

Socio – organization issues and stakeholder requirements

Organizational issues – capturing requirements.

Ubiquitous Computing

Introduction of Ubiquitous computing – Virtual and augmented reality.

Context – aware User Interfaces

Augmented reality – context – aware systems – context – aware toolkits and architectures.

Hypertext, multimedia and the World Wide Web

Understanding hyper test – Web technology and issues – static and dynamic web content.

TOTAL: 45 PERIODS

REFERENCES

1. Dix, Finlay, Abowd and Beale. “Human – Computer Interaction”, Second edition, Prentice Hall, 1998.
2. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. “Human – Computer Interaction”, Addison Wesley, 1994.

PV9005 PERVASIVE COMPUTING PRIVACY AND SECURITY LT P C
3 0 0 3

UNIT I PRIVACY AND SECURITY IN PERVASIVE COMPUTING 9

Introduction: View of pervasive computing – Consequences for Pervasive networks.

Privacy: User Awareness – context – accessibility – authentication.

Security: Secure services – registration/deregistration– secure discover & Secure delivery – authenticated – authorized – confidential – genuine – anonymous – application security.

Physical security: Identification and authentication– network operation – protection for layers – routing – network management – security.

Security Technologies: Public Key Infrastructure (PKI) – terms of PKI – Simple Public Key Infrastructure (SPKI) – terms of SPKI – Role Based Access Control (RBAC) – terms of RBAC.

Public key Infrastructure: Password based public key infrastructure – Prior context– Diffie – Hellman method – Self organized public key infrastructure – Graph– Trust graph.

UNIT II ISSUES, CHALLENGES AND ATTACKS 9

Issues: Authentication vs. Recognition – Identity management – Security and Availability – Dynamic Trust model and Context – awareness – Privacy Issues.

Assumptions made in security analysis: Social basis – threat assumptions – existence of a trusted computing base

Challenges: Challenges on attacks – computation power – lack of clarity and firewall approach.

Attacks: Software attacks – description – drawbacks – Physical attacks – Invasive probing – non–invasive probing– non–invasive measurements – Environmental attacks.

UNIT III APPLICATIONS AND DESIGN MODELS 9

Security in common architectures: CORBA security services – with secure objects – non – repudiation– audit facilities; the W3C architecture – including WS – Security – SAML – WS – Policy – WS – Federation and future directions

Duckling principles: Duckling security policies and principles.

Models: Customization Model – Logical Context Model – User – Time – Network – User agent – Location – Application – Action Model.

Hypermedia Design: Hyper Design Model: Information Model – Navigation Model – Presentation Model.

UNIT IV SECURITY IN AD – HOC NETWORKS 9

Ad – Hoc Networks: Authentication – Network resources – Transient states. Integrity and Non – repudiation. Tamper – Resistance – Intrusion – Detection – Anonymity. Security protocols – Jamming – and Confidentiality.

Schemes: Proper Authentication Scheme – Hierarchical authentication scheme – Multilevel authentication scheme – Link layer – Routing layer – Application layer. Traditional schemes – Indirect Kerberos – Duplicated servers.

Key Management security: Encryption – ID based cryptography – ID based cryptography schemes – Adhoc keying mechanisms – Attacks on routing in MANETs – Secure Routing Protocols.

UNIT V SECURITY ISSUES IN SENSOR NETWORKS 9

Security issues: Sensor networking Vs ad–hoc networks – security protocols – information dissemination in sensor networks.

Challenges: Secure Routing – Key exchange distribution and management – Group communication and multicast – Denial of service attacks.

Sensor network security: Integrity and privacy – Physical security – Secret key implementation – Tamper – Resistant hardware.

Communication security: Authentication – Cryptography – confidentiality – communication Vs Computation.

Application security: Detection of corrupted sensors – Software breaks Vs Tamper – proof.

TOTAL: 45 PERIODS

REFERENCES

1. Akkins, Derk, “Internet security professional reference”, 2nd edition, Techmedia publications, 1997.
2. Scott, Charlie,”Virtual privacy networks”, O’Reilly publication, 2000.

3. Swaminathan. Tara and Elden, Charles, "Wireless security and privacy", Pearson education Asia publication, 2003.
4. William Stallings, "Cryptography and networks security", 3rd edition, Pearson education publication, 2005.

PV9006 COMPUTATIONAL INTELLIGENCE L T P C
3 0 0 3

UNIT I INTRODUCTION – ARTIFICIAL INTELLIGENCE 8

Artificial Intelligence: History and Applications – Production Systems – Structures and Strategies for state space search – Data driven and goal driven search – Depth First and Breadth First Search – DFS with Iterative Deepening – Heuristic Search – Best First Search – A* Algorithm – AO* Algorithm – Constraint Satisfaction – Using heuristics in games – Minimax Search – Alpha Beta Procedure planning.

UNIT II ARTIFICIAL INTELLIGENCE – REPRESENTATION SCHEMES 9

Knowledge representation – Propositional calculus – Predicate Calculus – Theorem proving by Resolution – Answer Extraction – AI Representational Schemes – Semantic Nets – Conceptual Dependency – Scripts – Frames – Introduction to Agent based problem solving.

UNIT III NEURAL NETWORKS 11

Neural networks (NNs) for machine learning – models of neuron – perceptrons and perceptron learning rule – limitations of perceptrons – Multilayer perceptrons (MLPs) – back propagation learning algorithm – MLPs as classifiers – local minima and ovefitting – applications of MLPs – Radial basis functions (RBFs) – interpolation and approximation with RBFs – RBFs *vs.* MLPS – related classical optimization.

UNIT IV GENETIC ALGORITHM AND EVOLUTIONARY PROGRAMMING 9

Genetic algorithms: Introduction – genetic Operators – chromosomes – mutations and cross – over – Fitness functions – Evolutionary programming – learning classification systems Multi – agent systems – PCA and SOM with evolutionary computations – Modeling uncertainty – distributions– intervals– fuzzy sets– rough sets– Fuzzy Vs Crisp– membership pas– Fuzzy systems.

UNIT V EXPERT SYSTEM AND LANGUAGE PROCESSING 9

Overview of Expert System Technology – Rule based Expert Systems– Introduction to Natural Language Processing – Languages and Programming Techniques for AI – Introduction to PROLOG and LISP– Search strategies and Logic Programming in LISP– Production System examples in PROLOG.

TOTAL: 45 PERIODS

REFERENCES

1. George.F.Luger, "Artificial Intelligence –Structures and Strategies for Complex Problem Solving", 4th edition, Pearson Education, 2002.
2. E. Rich, K.Knight, "Artificial Intelligence", 2nd edition, Tata McGraw Hill
3. Winston. P. H, "LISP", Addison Wesley
4. Ivan Bratko, "Prolog Programming for Artificial Intelligence", 3rd edition, Addison Wesley, 2000
5. A.P. Engelbrecht, "Computational Intelligence", John Wiley &Sons, 2002.
6. M. Berthold, D. Hand, "Intelligent Data Analysis", Springer Verlag.

PV9007 BUSINESS AND INDUSTRIAL APPLICATIONS OF PERVASIVE COMPUTING TECHNOLOGIES **L T P C 3 0 0 3**

UNIT I INTRODUCTION **9**

Introduction to the supply chain – Business processes in supply chains – Types of supply chains – Supply chain performance measures – Supply chain drivers – strategic – Tactical – Operational decisions in supply chains – Planning demand and supply in a supply chain – Demand forecasting – aggregate planning.

UNIT II INVENTORY, TRANSPORTATION NETWORKS AND SUPPLY CHAIN OPTIMIZATION **9**

Supply chain inventory Management – Cycle – Safety Inventories – Multi –echelon supply chains – Transportation networks – Facility decisions – network design – Supply chain automation – Supply chain integration – Performance modeling of supply chains – Mathematical programming for supply chain planning – design – and optimization.

UNIT III INFORMATION TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT **9**

Information technology in a supply chain – Internet enabled supply chains: e – market places – e–commerce – e–procurement– e–logistics – transportation & warehousing – transportation exchanges and tracking system– e–fulfillment – Web services – and ERP and supply chains – GIS in SCM Tracking system using GPS and Mobile networks: Supply Chain Decision Support Systems

UNIT IV RFID IN SUPPLY CHAIN MANAGEMENT **9**

Introduction – RFID – Sensors – and sensor networks in supply chain management and warehousing management with examples in Retail Industry – manufacturing – hospital management – hospitality industry – Transportation – library management and other applications.

UNIT V CASE STUDIES **9**

Supply chain management implementations in manufacturing sector – Medicine and Healthcare – Hospitality industry.

TOTAL: 45 PERIODS

REFERENCES

1. Sunil Chopra, Peter Melinda, "Supply Chain Management – Strategy, Planning and operation", PHI.
2. R.B.Handfield, E.L.Nicholos, "Introduction to Supply Chain Management", PHI.
3. Jeremy F Shapiro, "Modeling the supply chain", Duxbury Thomson Learning.
4. David Simchi Levi, Philip Kaminsky, Edith Simchi Levi, "Design and Managing the supply chain – concepts ,strategies and case studies", McGraw Hill.
5. Hartmar Stadtler, Christoper Kilger, "Supply chain Management and advanced planning concepts, models, software and case studies", Springer
6. Sridhar Tayur, Ram Ganeshan, Michael Magazine, "Quantitative models for supply chain Management", Kluwer Academic Publishers.
7. N.Viswanathan, "Analysis of Manufacturing Enterprises", Kluwer Academic Publishers.
8. David F.Ross, "E – Supply Chain Management", St. Lucie Press
9. David J..Bloomberg, Stephan Lemay, Joe.B.hanna, "Logistics", PHI.
10. K. Finkenzeller, "RFID Handbook – 2nd Edition" John Wiley 2003

PV9008 HIGH PERFORMANCE COMMUNICATION NETWORKS **L T P C**
3 0 0 3

UNIT I OVERVIEW OF HIGH PERFORMANCE COMMUNICATION NETWORKS **8**

MPLS Wide – Area Networks – Label Stack and Label Distribution – Traffic Engineering – Architectures of High – Speed LANs – Design of Switching Systems and Routers – Transmission systems and multiplexers – Estimation of Link Blocking – Switching Networks – Crossbar switches – multistage switches – Shard – memory switches – Non – blocking switches – Concentration and Expansion switches – Increasing speed of switches – Optical Networks and WDM Techniques – IP Over Optical Core Switches – Cross – Connect Wavelength networks.

UNIT II ROUTER AND DELAY ANALYSIS AND CONGESTION CONTROL **8**

Study of Router Interfaces – Input and Output Port Processors – Integrated Service Method – Differentiated Service Method – Delay Analysis and Congestion Control – Delay Models at the Node Level – Delay Models at the Network Level – Flow Control at the Link Level – Resource Allocations – General Methods of Congestion Control – TCP Congestion Control – Congestion Avoidance Methods.

UNIT III VOICE OVER IP AND ISDN **11**

Basic IP Telephone System – Digital Voice Sampling and Distortion – Compression Techniques for High – Speed Networks – Limit of Compression – Signaling – Protocol for Void – Telephone Numbering – H.323 Protocol – Session Initiation Protocol – Real

Time Transport Protocols – ISDN – ISDN overview – ISDN Interfaces and functions ISDN physical layer – ISDN services – Signaling system number.

UNIT IV WIRELESS HIGH – SPEED NETWORKS 9

Review of Wireless Fundamentals – Design of Wireless Systems at Link Level – Modulation Techniques – Channel Coding – Wireless Network Topology – 802.11 Standards – Wireless LANs – High – Speed Architectures – MAC Layers –RFID

UNIT V ADVANCED WIRELESS NETWORKS, ISSUES AND CHALLENGES 9

Challenges to the key technological advances and approaches – Advanced wireless High speed data network solution and future directions – Residential high speed wireless data personal area networks – Overview of high rate wireless data personal area networks and their targeted applications.

TOTAL: 45 PERIODS

REFERENCES

1. William Stallings, “ISDN and Broadband – ISDN with frame relay and ATM”, PHI
2. William Stallings, “High speed networks”, PHI.
3. D E Comer, “Computer Networks and Internet”, PHI
4. D E Comer; “Internetworking with TCP/IP Vol 1”, PHI.
5. J Siedler Ellis, “Principles of Computer Communication Network Design”, Horwood.

PV9009 AD HOC NETWORKS LT P C
3 0 0 3

UNIT I INTRODUCTION TO AD – HOC NETWORKS 9

Definition – applications and motivations – principles of graph theory – ad–hoc media access protocols – integration of wired and wireless networks– ad–hoc and geographic routing – mobile IP and MIPv6

UNIT II MOBILITY IN AD – HOC 9

Various mobility models: Random way point – group mobility – highway model – Manhattan model – hybrid models; Mobility metrics for the models – spatial correlation – temporal correlation – relative speed – link durations and path durations.

UNIT III ROUTING IN AD – HOC 12

Unicast routing using table – driven protocols (link state or DSDV) – on demand Protocols with caching (DSR– AODV – TORA – QoS routing) – hybrid protocols (ZRP – contact – based architectures) – hierarchical protocols (cluster based and landmark – based) and geographic routing (e.g., greedy routing–GPSR) Multicast routing using tree

– based or mesh – based approaches (ODMRP – CAMP – FGMP) and extensions of unicast ad hoc routing (e.g., MAODV – MCEDAR) – Broadcast routing using flooding, heuristics (probabilistic, counter based) –Minimum dominating sets (MPR multi – point relays– CEDAR) – Resource discovery and rendezvous routing using contact–assisted protocols (MARQ – CARD – PARSE) – and distributed consistent hashing (Rendezvous regions– GHT)

UNIT IV ISSUES & CHALLENGES 9

Capacity of Ad–hoc Networks – Multimedia transmission in ad–hoc wireless networks – Resource management – Bandwidth – Buffer – Power management –The Effects of Beaconing on the Battery Life of Ad – Hoc Mobile Computers –Security issues in ad–hoc networks.

UNIT V IMPLEMENTATION 6

Implementation of Ad–hoc networks – introduction to simulation tools –Comparison of typical routing protocols in terms of power strength – throughput and delays

TOTAL: 45 PERIODS

REFERENCES

1. K. Toh, “Ad Hoc Mobile Wireless Networks: Protocols and Systems”, 1st edition, Prentice Hall PTR, 2001.
2. Charles Perkins, Ed., “Ad Hoc Networking”, 1st edition, Addison Wesley Professional, 2000.
3. Ivan Stojmenovic, “Handbook of Wireless Networks and Mobile Computing”, Wiley – Interscience
4. IEEE Journals and proceedings

PV9010 MOBILE COMPUTING LT P C
3 0 0 3

UNIT I INTRODUCTION 6

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Evolution of cellular communication systems: 1G, 2G, 3G and 4G.

UNIT II CELLULAR DATA NETWORKS 12

First Generation Analogue Systems (TACS – AMPS) – Second Generation Digital Systems (GSM – ADC – PDC or JDC) – Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

UNIT III MOBILE NETWORK LAYER 9

Mobile IP: Goals – Assumptions and Requirement – Entities – IP packet delivery – Agent advertisement and discovery – Registration – Tunneling and Encapsulation – Optimization – Reverse Tunneling – IPV6 – DHCP.

UNIT IV MOBILE TRANSPORT LAYER 9

Traditional TCP – Indirect TCP – Snooping TCP – Mobile TCP – Fast retransmit/Fat Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP.

UNIT V PLATFORMS AND RECENT TRENDS 9

Network simulators: NS2 – GLOMOSIM – SENSIM – OPNET – Programming Platforms – J2ME – SYMBIAN OS – Recent advances in Wireless Networks.

TOTAL: 45 PERIODS

REFERENCES

1. J.Schiller, "Mobile Communication", Addison Wesley, 2000.
2. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks", Pearson Education, 2004.
3. Theodore S.Rappaport, "Wireless Communications", Prentice Hall
4. William Stallings, "Wireless Communication and Networks", Pearson Education, 2003.
5. Lother Merk, Martin. S. Nicklaus and Thomas Stober, "Principles of Mobile Computing", 2nd Edition, Springer, 2003.
6. William C.Y.Lee, "Mobile Communication Design Fundamentals", John Wiley, 1993.
7. Ashoke K Talukder, Roopa Yavagal, "Mobile Computing", Tata McGraw Hill, 2005.

PV9011 REQUIREMENTS ENGINEERING FOR REAL TIME SYSTEMS LT P C
3 1 0 4

UNIT I REAL TIME CONCEPTS AND HARDWARE CONSIDERATIONS 9

System concept – Real time definitions – Events and Determinations – CPU utilization – real time system design issues – Basic architecture – hardware interfacing – central processing UNIT memory – input output – enhancing performance – other special devices

UNIT II SOFTWARE CONSIDERATIONS 9

Real time Kernel – Polled loop systems – phase/ state – driven systems – co routines – interrupt driven systems – full featured real time operating systems – inter task communication and synchronization – memory management

UNIT III SYSTEM PERFORMANCE AND OPTIMIZATION 9

Response time calculation – interrupt latency – time – loading and its measurements – reducing response times and time – loading – analysis of memory requirements – reducing memory loading – queuing models

UNIT IV RELIABILITY TESTING AND FAULT TOLERANCE 9

Faults – fault types – fault detection – fault and error containment – fault tolerance – redundancy – data diversity – failures – bugs and effects – reliability – testing

UNIT V HARDWARE/SOFTWARE INTEGRATION AND REAL TIME APPLICATION 9

Goals of real time system integration – tools for integration – methodology – the software Heisenberg uncertainly principles – real time applications – real time databases – real time image processing

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Phillip A. Laplante, “Real – time Systems Design and Analysis : An Engineer's Handbook:”, Prentice – Hall of India.
2. C.M.Krishna, Kangg.Shin, “Real – Time Systems”, McGraw Hill

REFERENCES

1. Kotonya G. and Sommerville I, “Requirements Engineering Processes and Techniques”, John Wiley and Sons, 1998.
2. Skidmore S. and Eva M, “Introducing Systems Development”, Palgrave Macmillan, 2004.
3. Yeates D. and Wakefield T, “Systems Analysis and Design”, FT Prentice Hall, 2003
4. Alexander I. and Stevens R, “Writing Better Requirements”, Addison Wesley, 2002.
5. Alexander I. and Maiden N, “Scenarios, Stories and Use Cases”, John Wiley and Sons, 2004.
6. Paul D., Yeates D. et al, “Business Analysis”, British Computer Society, 2006.
7. Andrew Stellman and Jennifer Greene, “Applied Software Project Management”, Cambridge, MA: O'Reilly Media, 2005.
8. Hassan Gomaa, “Software Development of Real time systems”, Edgar H. Sibley, 1996.
9. Derek J.Hatley, Imtiaz A. Pirbhai, “Strategies for Real – time Systems Specification”, Dorset House Publishing

PV9012 PARALLEL ALGORITHMS AND PROGRAMMING LT P C
3 0 0 3

UNIT I PARALLEL ARCHITECTURES 9

Introduction to parallelism – control parallelism – data parallelism – multi – core processors – parallel processor organization – processor arrays – Flynn's taxonomy – clusters – grids

UNIT II PARALLEL ALGORITHMS 9

PRAM model – Matrix multiplication – FFT – Sorting – parallel search – graph algorithms – combinatorial search algorithms

UNIT III PARALLEL PROGRAMMING 9

Parallel programming languages – parallel programming models – MPI, standard, implementation – point – to – point communications – user defined data types and packing – collective communications – communicators – profiling

UNIT IV CELL BE ARCHITECTURE 9

Cell broadband Engine – PPE architecture – PPU ISA – VMX extensions – SPE – SPU ISA – MFC – mailboxes–signals – EIB – memory control – I/O control – Cell arrays

UNIT V CELL PROGRAMMING 9

Cell programming models – C/C++ intrinsic for PPU VMX – C/C++ intrinsic for SPU – cell SDK – data mapping to SPU – scheduling SPU – SPU – PPU communications – Performance analysis – case studies

TOTAL: 45 PERIODS

REFERENCES

1. Michael J. Quinn, "Parallel Computing theory and practice", 2nd edition, McGraw Hill International Edition, 1994.
2. Michael J. Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
3. William Gropp, Ewing Lusk, and Anthony Skjellum, "Using MPI", 2nd edition, MIT Press, 1999.
4. Ian Foster, "Designing and Building Parallel Programs", Addison – Wesley, 1995.
5. Peter Pacheko, "Parallel Programming with MPI", Morgan Kaufmann Publications, 1997.
6. Kai Hwang and Zhi Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, 2003.
7. David E. Culler and Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/Software Approach", Morgan Kaufman Publishers, 1999.

PV9013 ADVANCED DIGITAL SIGNAL PROCESSING LT P C
3 0 0 3

UNIT I BASIC SYSTEMS AND TRANSFORMS 10

Basic multirate operations – efficient structures for decimation and interpolation – a simple alias – free QMF system – two dimensional filter banks – Review of various transforms – DTFT – DFT – ZT – FIR and IIR filter design (any one method)

UNIT II SPECTRAL ESTIMATION 9

Spectral analysis and Estimation – Classical spectral estimation – parametric models of random processes – Autoregressive processes and spectral properties –Higher order power spectral estimation – Bispectrum – Trispectrum – n^{th} order spectrum

UNIT III WAVELET TRANSFORM 9

Wavelet theory – wavelet theory based signal and image processing – Extensions to wavelet packets applications in image compression – EZW code – Spatial oriented tree – Finer time – scale resolution and fast integral transforms – Signal analysis applications

UNIT IV ADAPTIVE FILTERS 9

Adaptive filters – FIR adaptive filters – Newton's steepest decent method –adaptive filter based on Steepest descent method – Widow Hopf LMS adaptive algorithm – adaptive channel equalization – Adaptive echo canceller–RLS–Sliding window RLS

UNIT V APPLICATIONS 8

Applications – Multi – carrier Communications – Computer graphics – image query – Location aware computing

TOTAL: 45 PERIODS

REFERENCES

1. J.G. Proakis, C.M. Rader, F. Ling and C.L. Nikias, "Advanced Digital Signal Processing", Macmillan, 1992.
2. S. Haykin, "Adaptive Filter Theory", Prentice – Hall, 2002.
3. P.P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice – Hall, 1993.
4. J. Stollnitz, Tony D. Derose, and David Salesin, "Wavelets and Computer Graphics: Theory and Applications", Morgan Kaufmann, 1996.

PV9014 HARDWARE SOFTWARE CO – DESIGN LT P C
3 0 0 3

UNIT I ESSENTIAL ISSUES IN CO – DESIGN 9

Models – Architectures – Languages – A Generic Co – Design Methodology

UNIT II PROTOTYPING AND EMULATION 9

Prototyping and Emulation Techniques – Prototyping and Emulation Environments – Future Developments in Emulation and Prototyping

UNIT III TARGET ARCHITECTURES 9

Architecture Specification Techniques – System Communication Infrastructure – Target Architecture and Application System Classes – Architecture for Control Dominated Systems – Architecture for Data Dominated Systems – Mixed Systems and Less Specialized Systems – Selected Co Design Problems

UNIT IV COMPILATION TECHNIQUES AND TOOLS FOR EMBEDDED PROCESSOR ARCHITECTURE 9

Continued Integration Leads to Embedded Processor – Embedded Software Development Needs – Compilation Technologies – Practical Consideration in a Compiler Development Environment

UNIT V DESIGN SPECIFICATION AND VERIFICATION 9

Concurrency – Coordination Concurrent Computations – Interfacing Components – Verification

TOTAL: 45 PERIODS

REFERENCES

1. Jorgen Staunstrup, Wayne Wolf., "Hardware/Software Co – Design: Principles and Practice", Kluwer Academic Publishers.
2. Givanni De Micheli, Rolf Ernst., Wayne Wolf, "Readings in Hardware/Software Co – Design", Morgan Kaufmann Publishers.
3. Balarin Felice, "Hardware – software Co – design of Embedded Systems – The Polis Approach", Kluwer Academic Publishers.

PV9015 ADVANCED COMPUTER ARCHITECTURE LT P C
3 0 0 3

UNIT I FUNDAMENTALS OF COMPUTER DESIGN 9

Introduction – Classes of Computers – Defining Computer Architecture – Trends in Technology – Trends in Power in Integrated Circuits – Trends in Cost – Dependability – Measuring – Reporting and Summarizing Performance – Quantitative Principles of Computer Design

UNIT II INSTRUCTION LEVEL PARALLELISM AND ITS EXPLOITATION 9

Instruction – Level Parallelism: Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Prediction – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Examples and the Algorithm – Hardware – Based Speculation – Exploiting ILP Using Multiple Issue and Static Scheduling – Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation – Advanced Techniques for Instruction Delivery and Speculation

UNIT III LIMITS ON INSTRUCTION LEVEL PARALLELISM 9

Introduction – Studies of the Limitations of ILP – Limitations on ILP for Realizable Processors – Crosscutting Issues: Hardware versus Software Speculation – Multithreading: Using ILP Support to Exploit Thread – Level Parallelism

UNIT IV MULTIPROCESSOR AND THREAD LEVEL PARALLELISM 9

Introduction – Symmetric Shared – Memory Architectures – Performance of Symmetric Shared – Memory Multiprocessors – Distributed Shared Memory and Directory – Based Coherence – Synchronization: The Basics – Models of Memory Consistency: An Introduction – Crosscutting Issues

UNIT V MEMORY HIERARCHY DESIGN 9

Introduction – Eleven Advanced Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Crosscutting Issues: The Design of Memory Hierarchies

TOTAL: 45 PERIODS

REFERENCES

1. D.A Patterson and J.L. Hennessy, "Computer Architecture – A Quantitative Approach", 2nd edition, Morgan Kaufmann Publishers, 1996.
2. Vincent P. Heuring, Harry F. Jordan, "Computer Systems Design and Architecture", Addison Wesley, 1999.

PV9016 ADVANCED MICRO CONTROLLERS LT P C
3 0 0 3

UNIT I ARM ARCHITECTURE 9

ARM Embedded Systems – The RISC Design Philosophy – The ARM Design Philosophy – Embedded System Hardware – Embedded System Software – ARM Processor Fundamentals – Registers – Current Program Status Register – Pipeline – Exceptions – Interrupts and the Vector Table – Core Extensions – Architecture Revisions – ARM Processor Families

UNIT II ARM INSTRUCTION SET 9

Introduction to the ARM Instruction Set – Data Processing Instructions – Branch Instructions – Load – Store Instructions – Software Interrupt Instruction – Program Status Register Instructions – Loading Constants – ARMv5E Extensions – Conditional Execution – Introduction to the Thumb Instruction Set – Thumb Register Usage – ARM – Thumb Interworking – Other Branch Instructions – Data Processing Instructions – Single – Register Load – Store Instructions – Multiple – Register Load – Store Instructions – Stack Instructions – Software Interrupt Instruction

UNIT III ARM PROGRAMMING USING C 9

Efficient C Programming – Overview of C Compilers and Optimization – Basic C Data Types – C Looping Structures – Register Allocation – Function Calls – Pointer

Aliasing – Structure Arrangement – Bit – fields – Unaligned Data and Endianness – Division – Floating Point – Inline Functions and Inline Assembly – Portability Issues

UNIT IV ARM PROGRAMMING USING ASSEMBLY CODE 9

Writing and Optimizing ARM Assembly Code – Writing Assembly Code – Profiling and Cycle Counting – Instruction Scheduling – Register Allocation – Conditional Execution – Looping Constructs – Bit Manipulation – Efficient Switches – Handling Unaligned Data

UNIT V MOTOROLA 68HC11 AND PIC MICRO CONTROLLER MOTOROLA 68HC11 MICROCONTROLLER 9

Instructions and addressing modes – operating modes – Hardware reset – Interrupt system – Parallel I/O ports – Flags – Real time clock – Programmable timer – pulse accumulator – serial communication interface – A/D converter – hardware expansion – Assembly language Programming

PIC MICRO CONTROLLER

CPU architecture – Instruction set – Interrupts – Timers – I/O port expansion –I^2C bus for peripheral chip access – A/D converter – UART

TOTAL: 45 PERIODS

REFERENCES

1. Andrew Sloss, Dominic Symes, and Chris Wright, “ARM SYSTEM DEVELOPER'S GUIDE”, Elsevier.
2. Valvano, “Embedded Microcomputer Systems", Thomson Asia.
3. John .B.Peatman, “Design with PIC Microcontroller, Prentice hall, 1997.