ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2009

M.E. MOBILE AND PERVASIVE COMPUTING

I SEMESTER (FULL TIME) CURRICULUM AND SYLLABI

SEMESTER I

Sl. No.	Code No	Course Title	L	T	P	C
THEORY						
1.	MA9209	Applied Mathematics for Pervasive Computing	3	1	0	4
2.	MP9211	Fundamentals_of_Pervasive Computing	3	0	0	3
3.	MP9212	Embedded Systems and Design	3	0	0	3
4.	MP9213	Wireless and Mobile Networks	3	0	0	3
5.	MP9214	Advanced Digital Signal Processing	3	0	0	3
6.	MP9215	Mobile Computing	3	0	0	3
PRACTICAL						
7.	MP9217	Embedded Lab	0	0	3	2
8.	MP9218	Wireless and Ad Hoc Network Lab	0	0	3	2
		Total	**18**	**1**	**6**	**23**

MA9209 APPLIED MATHEMATICS FOR PERVASIVE COMPUTING L T P C
3 1 0 4

OBJECTIVES

Provides mathematical concepts for Pervasive Computing system analysis which includes, graph theory for network modeling, optimization technique for using System and Net resources, Probability and Queuing theories to address stochastic and dynamic environment in data transfer. Also it Provides solutions for linear equations of large systems.

PREREQUISITES

Essential

Knowledge of Matrices, Differential equations and Numerical methods

Optional

UNIT I LINEAR ALGEBRA 9

Introduction to Vector spaces, basic vector analysis methods, Matrix norms – Jordan canonical form – Generalized eigenvectors – Singular value decomposition – Pseudo inverse – Least square approximations – QR algorithm.

UNIT II GRAPH THEORY 9

Introduction to Paths, Trees, Vector spaces, Matrix Coloring and directed graphs; Some basic algorithms – Shortest path algorithms – Depth-First search on a graph – Isomorphism – Other Graph - Theoretic algorithms – performance of graph theoretic algorithms – Graph-theoretic Computer languages

UNIT III OPTIMIZATION TECHNIQUES 9

Linear programming - Basic concepts – Graphical and Simplex methods –Transportation problem – Assignment problem; Dynamic programming - Elements of the dynamic programming model – optimality principle – Examples of dynamic programming models and their solutions.

UNIT IV PROBABILITY AND RANDOM VARIABLES 9

Probability – 1D Random variables – Binomial, Poisson, Geometric, Uniform, Normal, Exponential distributions – Moment generating functions and their properties – Functions Transformation of Random variables, Finite probability - Probability distributions - Conditional Probability – Independence – Baye's theorem; Expectations. Reliability and Markov chain transition probability matrix.

UNIT V QUEUEING THEORY 9

Single and Multiple servers Markovian Queuing models, finite and Infinite capacity Queues – Finite source model – Queuing applications.

L : 45 T : 15 Total : 60 PERIODS

REFERENCES

1. Taha H .A., Operations Research: An Introduction, Pearson Education Edition, Asia, New Delhi, Seventh Edition 2002.
2. Walpole R.E., Myer R.H., Myer S.L., and Ye, K., Probability and Statistics for Engineers and Scientists, Pearson Education, 7th Edition, Delhi, 2002.
3. Lewis.D.W. "Matrix Theory" , Allied Publishers, Chennai 1995
4. Bronson, "Matrix Operations, Schaums outline Series", McGraw Hill, New York. 1989.
5. Kishor S.Trivedi, Probability & Statistics with reliability, queuing and Computer Science Applications, Prentice Hall India, 2001
6. Narasingh Deo,Graph Theory with applications to Engineering and Computer Science, Prentice Hall India,1997
7. Harary, Graph Theory, Narosa publishing house - 2000

SOURCES

1. Oxford University UK ,
   http://www.admin.ox.ac.uk/postgraduate/caz/comp.shtml

2. University of Essex – UK ,
   http://cswww.essex.ac.uk/prospectivestudents/pg/msccompsci.htm

3. PPAM2005 sixth international conference on parallel processing and applied mathematics.
   http://ppam.pcz.pl/topics.htm

MP9211 FUNDAMENTALS OF PERVASIVE COMPUTING L T P C
3 0 0 3

OBJECTIVES

To provide the student with knowledge and skills about a new trend in computing, creating a ubiquitous environment that combines processors, RFID's & sensors with network technologies and intelligent software to create an congenial environment.

PREREQUISITES

Essential

Computer Architecture, Operating Systems, Data Communication, Computer Networks and At least one high level Programming language.

Optional

Assembly level programming, Internet programming.

UNIT I ARCHITECTURE 9

Relationship of Wireless Computing, Ubiquitous Computing, Internet Computing. Related ideas: Ambient Computing. Elements of Pervasive architecture. Requirements of computational infrastructure. Failure management. General issues: security, performance, dependability. Web architectures. Local networks. Store and forward. Multi-network architectures (e.g. Wireless LAN to LAN to Internet, hand held synchronized to PC to LAN).

UNIT II DEVICES TECHNOLOGY 9

Device and network technologies. Devices categories. Devices characteristic Heterogeneity and Interoperability. Mobile Agents. device management.Compaq iPAQ. 3G devices. Palm Tungsten. WindowsCE devices. Symbian devices. J2ME-enabled devices.

UNIT III SENSOR NETWORKS AND RFIDS 9

Introduction to Sensor networks. Types of sensor networks. Berkeley Motes. Sensor network organization. Sensor network routing mechanisms. Platforms for Wireless sensor networks, Sensor Node Architecture, Sensor Network Architecture. RFID: 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 IV LOCAL AREA AND WIDE AREA WIRELESS TECHNOLOGIES 9

Local area wireless networks: IEEE 802.11 technologies. Mobile IP. Infrared technologies. Bluetooth networks (OBEX Protocol). Messaging Systems. Personal Area Networks. Network Management. Quality of Service. Wireless protocols. Establishing Wide area wireless networks: Concept and structure of ”cell”. Call establishment and maintenance. Channel management. Frequency Assignment techniques. Difference from a wired network.

UNIT V PROTOCOLS AND APPLICATIONS 9

Protocols: Networking protocols. Packet switched protocols. Routing Protocols for Sensor Networks. Data Centric Protocols. Hierarchical Protocols. Location-based protocols. Multimedia Messaging Service (MMS) Protocols. Wireless Application Protocol (WAP). Applications: Mobile access to patient information in a hospital, sales support, retailing, services support, tracking applications, Designing for small screen devices, Search interfaces, Context-awareness, Determining “locality”.

TOTAL : 45 PERIODS

REFERENCES

1. Burkhardt, Henn, Hepper, Rintdorff, Schaeck. “Pervasive Computing”.Addison Wesley, 2002.
2. F. Adelstein, S.K.S. Gupta, “Fundamentals of Mobile and Pervasive Computing”. The McGraw-Hill, 2005.
3. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schack, “Pervasive Computing: Technology and Architecture of Mobile Internet Applications”, 2002, Addison-Wesley, ISBN: 0201722151.
4. Uwe Hansmann, L. Merk, M. Nicklous, T. Stober, U. Hansmann, “Pervasive Computing (Springer Professional Computing) ”, 2003, Springer Verlag, ISBN:3540002189.

SOURCES

1. University: Illinous Institute of technology:
   Url: http://www.cs.iit.edu/courses/cs553.html
2. University: London Universsal College:
   Url: http://www.luc.ac/courses/bsc_computer-science-is.shtml
3. University: Cardiff University
   Url: http://www.cs.cf.ac.uk/teaching/modules/CM0256.pdf

MP9212 EMBEDDED SYSTEMS AND DESIGN L T P C
3 0 0 3

OBJECTIVES

To enable the student to deal with the various aspects of system hardware and firmware design for embedded applications

PREREQUISITES

Essential

Computer Architecture, Operating Systems, Microprocessors, Digital Logic Design.

Optional

Software Engineering

UNIT I FUNDAMENTAL DESIGN ASPECTS 9

Embedded design life cycle-Product Specification- Hardware Software Partitioning-Design and Integration-Selection Process-Performance Evaluation Tools-Benchmarking- RTOS Microcontroller-RTOS availability- Tool Chain availability-Hardware Software Duality- Coding Hardware-ASIC- Managing the Risk- Co verification-execution environment-Memory organization, interfacing and management-system start-up- speed and code density.

UNIT II EMBEDDED CONTROLLERS 9

Overview of 8051 - ARM Processor Architecture – instruction sets – Thumb instruction sets-DSP Processors - Harvard architecture,Super Harvard ARChitecture (SHARC) - Characteristics of DSP processors, SIMD, Parallel processing, DMA – Data operators, Saturation arithmetic, sticky bits , MAC operations- Pipelining- Example processors.

UNIT III CONTROL ASPECTS 9

Interrupt Service Routines-Watchdog timers-Flash memory-Basic toolset-Host based debugging-Remote debugging-ROM emulators-Logic Analyzer-Caches-Computer Optimisation-Statistical profiling-In circuit emulators-Buffer control-Real-Time trace-Hardware break points-Overlay memory-Timing Constraints-Usage Issues-Triggers.

UNIT IV COMMUNICATION SOFTWARE DESIGN 9

OSI Reference Model-Embedded Communication System-Software Partitioning-Limitations of strict layering-Tasks and Modules- Modules and Task Decomposition- Layer2 Switch / Routers – Protocol Implementations- Management types-Debugging Protocols.Tables and other Data structures- Partitioning of structures and tables-Implementation-Speeding up Access- Table resizing- Table Access Routines-Buffer and Timer Management- Third Party Protocol Libraries. Device and Router Management- Management of Subsystem Architecture-System Start up and Configuration.

UNIT V PROCESS MODELS AND CO DESIGN 9

Modes of Operation- Finite State Machines-Models-HCFSLs and State charts Language-state machine models-Concurrent Process Models-Interprocess Communication-Synchronisation Implementation-Data Flow Model-Design Technology-Automation Synthesis- Hardware Software co simulation-IP cores-Design Process Model.

TOTAL : 45 PERIODS

REFERENCES

1. Arnold S. Berger “Embedded System Design” CMP Books USA 2002
2. David.E.Simon “An Embedded Software Primer”Pearson Education 2001
3. Frank Vahid and Tony Gwargie “Embedded System Design”John Wiley & Sons 2002
4. Steve Heath “Embedded System Design” Elserian Second Edition 2004

SOURCES

1. Anna University
   www.**anna**univ.edu
2. University of Colorado at Boulder
   www.**colorado**.edu
3. East Tennessee State University
   www.etsu.edu
4. Marquette University
   www.**marquette**.edu

MP9213 WIRELESS AND MOBILE NETWORKS L T P C
3 0 0 3

OBJECTIVES

The course will provide in-depth coverage of advances in wireless and mobile networks. Upon completing this course student will be able to analyze the operation and performance of wireless protocols, capture most recent development in wireless mobile systems

PREREQUISITE

Essential

Knowledge of Analog & Digital Communication Principles, Principles of Computer Communication

Optional

Exposure to Mobile Communication and network simulators

UNIT I PRINCIPLES OF WIRELESS COMMUNICATION 10

Digital modulation Techniques – Linear modulation techniques, Spread spectrum modulation, Performance of modulation.Multiple access techniques – TDMA, FHMA, CDMA, SDMA.Overview of Cellular networks – Cellular concept, Handoff strategies, Path loss, Fading and Doppler Effect.

UNIT II WIRELESS PROTOCOLS 11

Issues and challenges of Wireless networks – Location management, Resource management, Routing, Power management, Security.Wireless Media Access Techniques – ALOHA , CSMA , Wireless LAN , MAN , IEEE 802.11 (a,b,e,f,g,h,i),,Bluetooth. Wireless routing protocols – Mobile IP, IPv4, IPv6, Wireless TCP. Protocols for 3G & 4G cellular networks – IMT – 2000, UMTS, CDMA2000, Mobility management and handover Technologies, All-IP based cellular network

UNIT III TYPES OF WIRELESS NETWORKS 9

Mobile networks – Ad-hoc networks, Ad-hoc routing, Sensor networks, Peer-Peer networks. Mobile routing protocols – DSR, AODV, Reactive routing, Location aided routing. Mobility models – Entity based, Group mobility, Random Way-Point mobility model.

UNIT IV ISSUES AND CHALLENGES 9

Issues and challenges of mobile networks – Security Issues – Authentication in mobile applications, Privacy Issues, Power management, Energy awareness computing. Mobile IP and Ad-hoc networks, VoIP applications.

UNIT V SIMULATION 6

Study of various network simulators (GloMoSim,NS-2,Opnet),Designing and evaluating the performance of various Transport and Routing protocols of Mobile and Wireless networks using network simulator(any one)

TOTAL : 45 PERIODS

REFERENCES

1. Theodore S. Rappaport, Wireless Communications, Principles and Practice, Prentice Hall, 1996.
2. W. Stallings, Wireless Communications & Networks, Prentice Hall, 2001. J. Schiller, ”Mobile Communications", Addison Wesley, 2000.
3. W. C. Y. Lee, Mobile Communications Engineering: Theory and Applications, 2nd edition, McGraw Hill, 1997.
4. K. Pahlavan and P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall, 2002.
5. U. D. Black, Mobile and Wireless Networks, Prentice Hall, 1996.
6. Charles E.Perkins, Ad-Hoc Networking, Addison-Wesley, December 2000
7. IEEE Journals and Proceedings

SOURCES

1. Wireless & Mobile Networking
   http://www.cvn.columbia.edu/courses/Fall2000/ELENE6950.html
   University of Columbia,USA
2. Mobile and Wireless Networks
   http://www.ecse.rpi.edu/homepages/abouzeid/6962-04/syllabus04.pdf
   Rensslaer Polytechnique Institute,Newyork,USA
3. Mobile and Wireless Networks
   http://cosmos.kaist.ac.kr/network/mwn.doc
   Korea Advanced Institute of Technology, Korea
4. Mobile Wireless Computing
   www.monarch.cs.rice.edu/comp524/syllabus.pdf
   Rice University, New York, USA
5. Wireless Networking: Architectures, protocols and standards
   http://personal.stevens.edu/~yyao/syllabus-586.html
   Stevens University of Technology, Newjercy, USA
6. Wireless Networks
   http://www.eas.asu.edu/~hasancam/courses/Fall-2002/cse591/syllabus-cse591-2002f.html Arizona State University.

MP9214	ADVANCED DIGITAL SIGNAL PROCESSING	L T P C
		3 0 0 3

OBJECTIVE

Presents a comprehensive introduction to important emerging DSP technologies with a focus on wavelets/sub band and applications in multimedia manipulation and computer graphics. Provides students with backgrounds for pursuing independent research in DSP, audio/video compression, processing, and related application

PREREQUISITE

Essential

Knowledge of signals, systems and Random behavior of signals & Systems

Optional

Exposure to Filters and Various Transforms

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 – Multicarrier 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 Pub.: 1996.

SOURCES

1. Digital Signal Processing II, University of Illinois at Urbana Champaign.
   http://courses.ece.uiuc.edu/ece551/

2. Advanced Digital Signal Processing
   http://bme.iust.ac.ir/courses/adsp.html
   Iran University of Science and Technology

3. Advanced Digital Signal Processing, University of Surrey, UK
   http://www.ee.surrey.ac.uk/CE/technical/advdsp.html

3. Advanced Digital Signal Processing
   http://www.cvn.columbia.edu/courses/Fall1999/ELENE6860.html
   Columbia University

4. Advanced Digital Signal Processing
   http://www-lns.tf.uni-kiel.de/staff/jkl/adsv_syl.htm
   University of Kiel

MP9215 MOBILE COMPUTING L T P C
3 0 0 3

OBJECTIVES

This course is to learn about the concepts and principles of mobile, and the ubiquity of wireless communication technologies and the proliferation of portable computing devices. The key purpose of the programme is to develop skills of finding solutions and developing software for mobile computing applications.

PREREQUISITES

Essential

Computer Networks, Operating Systems, Java Programming

Optional:

Databases, C++ Programming

UNIT I INTRODUCTION TO MOBILE COMPUTING 9

Motivations, concepts, and challenges of mobile computing, Types of mobile networks, Mobile network architectures, Cellular telephony, Mobile Ad-hoc networks, Routing and mobile IP, relationship with distributed computing, Internet computing, ubiquitous / pervasive computing.

UNIT II ARCHITECTURE 9

Wireless communication concepts, modulation and multiplexing techniques (spread spectrum, multi-access methods), medium access control, classification of wireless networks: WPAN, WLAN, WMAN, WWAN; IRDA, Bluetooth, Wi-Fi, WiMAX, Mesh networks, evolution of cellar communication systems (1G, 2G, 3G, 4G).Extended client-server model; peer-to-peer model; mobile agent model; wireless Internet; smart client; messaging; mobile data management;. bus and memory architectures, I/O architectures , System On Chip (SOC) designs . ARM and Thumb instruction set architectures.

UNIT III SOFTWARE 9

Principles of disconnected operation: caching, hoarding, etc. Software adaptation and OS support. Resource sharing. OS for embedded devices: PalmOS, WindowsCE, embedded Linux, WAP/WML, J2ME, Windows Mobile and .Net Framework, BREW. Mobile agents, Resource and service discovery, Mobile Java, Mobile Grid and collaborative processing with Jini.

UNIT IV SENSOR AND ACTUATOR 9

Sensor and actuator networks: Platforms and capabilities, Programming sensor networks, Sensor database: in-network query processing and storage management. Routing and MAC-layer algorithms. Localization and synchronization techniques. Introduction to development with TinyOS.

UNIT V ISSUES & APPLICATIONS 9

Concepts and applications: mobile positioning techniques, GIS, LBS architecture and protocols. Mobility management**:** Handoff and location management concepts: mobility management in PLMN, mobility management in mobile Internet, mobility management in mobile agent. Mobile Ad hoc Networks (MANETs) and applications: Concepts and applications, routing protocols, clustering, mobile P2P systems. Mobile computing middleware**:** Functionalities of mobile computing middleware, tuple-space middleware, context-aware middleware, reflective middleware, publication/subscription middleware, service discovery; disconnected operations.

TOTAL : 45 PERIODS

REFERENCES

1. Reza B'Far, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, 2005.
2. J. Schiller, Mobile Communications, 2nd edition, Pearson Education, 2003.
3. Evaggelia Pitoura and George Samaras, Data Management for Mobile Computing, Kluwer Academic Publishers, 1998.
4. R. Riggs, A. Taivalsaari, M. VandenBrink, Programming Wireless Devices with Java2 Platform, Micro Edition, Addison-Wesley, 2001.
5. H.M. Deitel, P.J. Deitel, T.R. Nieto, and K. Steinbuhler, Wireless Internet & Mobile Business – How to Program, Prentice Hall, 2002.
6. Programming Wireless Devices with Java2 Platform, Micro Edition, R. Riggs, A. Taivalsaari, M. VandenBrink, ISBN: 0-201-74627-1, Addison-Wesley, 2001.
7. Wireless Internet, Applications and Architecture, Mark Beaulieu, ISBN: 0-201-73354-4, Addison-Wesley, 2002.

SOURCES

1. University: Manchester University
   URL: http://www.cs.manchester.ac.uk/Study_subweb/Postgrad/ACS-CS/webpages/syllabus/acs/CS624.php
2. University: Lanchester University
   URL: http://www.comp.lancs.ac.uk/postgraduates/mod_mobcomp.html
3. University: Texas tech university
   URL: http://www.cs.ttu.edu/~sobol/courses/mc/syllabus/index.html
4. University: Birkbeck University
   URL: http://www.bbk.ac.uk/ebusiness/programmes/modules/t10mobileandubiq.shtml

MP9217 EMBEDDED LABORATORY L T P C
0 0 3 2

OBJECTIVE

Objective of the Embedded Lab is to analyze and design various Microcontroller applications and RTOS Characteristics.

PREREQUISITES

Essential

Knowledge in Micro controllers and DSP.

Optional

Knowledge of Operating Systems.

Lab Exercise

I Basic programming of micro controllers

Study of the architecture and instruction set of popular micro controllers
(8 bit, 16 bit, 32 bit processors)

1. Assembler and Embedded Programming
2. Simulation and timing; hardware preliminaries

II. Interfacing experiments using microcontrollers

1. Using interrupts
2. Using and interfacing clocks
3. Interfacing peripheral devices / IO**.**
4. Interfacing memory
5. Motor speed control.

III. RTOS Experiments

1. Introduction to Real-Time /Embedded Operating Systems.
2. Process Management & Inter Process Communication
3. Memory management
4. I/O subsystem
5. Real Time Scheduling

IV. DSP Experiments (Either in TMS or in ADSP processor)

1. Implementation of multirate sampling systems
2. Periodogram estimation
3. Adaptive filter implementation
4. Implementation of QMF

IV. **Mini Project**

TOTAL : 45 PERIODS

MP9218	**WIRELESS AND AD HOC NETWORK LAB**	**L T P C**
		0 0 3 2

OBJECTIVE

Objective of the Lab is to analyze and design the operation and performance of wireless protocols, capture most recent development in wireless mobile systems in both infrastructured and infrastuctureless scenario.

PREREQUISITES

Essential

Knowledge in Networking, mobile communication, Computer hardware and software.

Optional

Knowledge of Ad hoc networks and mobile computing.

Lab Exercise

1. Performance analysis of Unicast routing protocol for ad hoc network.
   - i) Table-driven protocols (e.g., link state or DSDV)
   - ii) On demand protocols with caching (e.g., DSR, AODV, TORA)
   - iii) Hybrid protocols (e.g., ZRP, contact-based architectures)
   - iv) Hierarchical protocols (e.g., cluster based and landmark-based)
   - v) Geographic routing (e.g., greedy routing, GPSR)

2. Performance analysis of Multicast routing for ad hoc network.
   i) Using tree-based or mesh-based approaches (ODMRP, CAMP, FGMP)
   ii) Extensions of unicast ad hoc routing (MAODV, MCEDAR)

3. Performance analysis of broadcast routing
   i) Using naïve flooding, heuristics (e.g., probabilistic, counter based),
   ii) Minimum dominating sets (e.g., MPR multi-point relays, CEDAR)
4. Resource discovery and rendezvous routing using contact-assisted protocols (e.g., MARQ, CARD, PARSE), and distributed consistent hashing (e.g., Rendezvous regions, GHT)

5. Comparison between various Wireless MAC protocols
   (CSMA/CA (802.11),MACA,MACAW,PAMAS,SMAC)

6. Analysis of using TCP over various queuing disciplines (FIFO, RED, and WFQ).

7. Measurement of physical and MAC layer characteristics of wireless Links: using signal strength, data rate, retransmission and delay measurements.
Program for bit stuffing and CRC computation

8. Comparison of various mobility models using GloMoSim/NS2
(Random way point, group mobility, highway model, Manhattan model,hybrid models)
(Spatial correlation, temporal correlation, relative speed, link durations)
9. Measurement of network parameters for WLAN (SNR, overall throughput and Delay)
10. Short range Bluetooth communications (formation of Piconet and scatternet) (Topology maintenance and Multihop transmissions, Mobility issues) (File transfer rate)
11. Web-based applications in Wireless Environment (Write a program to download a web page)
12. Delay & Jitter measurement for Multimedia Communication.
13. Analysis of various protocols using protocol analyzer

TOTAL : 45 PERIODS