

**PG Syllabus**  
**For**  
**MOBILE COMMUNICATION AND**  
**COMPUTING**

UNDER THE DEPT OF  
COMPUTER SCIENCE & ENGINEERING



**NATIONAL INSTITUTE OF TECHNOLOGY**  
(Established by Ministry of Human Resource Development, Govt. of India)  
Yupia, District Papum Pare, Arunachal Pradesh – 791112



## **FORWARD**

To achieve the target of being a global leader in the field of Technical Education, there is some sort of time bound urgency **to work quickly, massively and strongly**, in respect of National Institute of Technology, Arunachal Pradesh being an “**Institute of National Importance**” (by an Act of Parliament) and being **established only in three years back in 2010**. I have therefore adopted a ‘**B**’ formula as stated below to achieve the primary goal of producing World Class Visionary Engineers and exceptionally brilliant Researchers and Innovators:

### **B-FORMULA**

- **Best for Teaching**
- **Best for Research**
- **Best for Entrepreneurship & Innovation**
- **Best for Services to Society**

In implementing the ‘**B**’ formula in letter and spirit, the framing of syllabi has been taken as an **important legitimate parameter**. Therefore, extraordinary **efforts and dedications** were directed for the last one year to frame syllabi in a framework perhaps not available in the country as of today.

Besides attention on ‘**B**’ formula institute has given considerable importance to the major **faults of current Technical Education while framing the syllabus**. The major stumbling blocks in Technical Education today are:

- (I) The **present system is producing “Academic Engineers” rather than “Practical Engineers”**.
- (II) The present system of education makes the **students to run after jobs rather than making them competent to create jobs**.
- (III) There is lack of **initiative to implement the reality of “Imagination is more important than knowledge”**.

Taking due consideration of the findings made above, to my mind credible syllabi has been framed in the institute in which the major innovations are introduction of:

- (I) **I- course (Industrial Course) one in each semester at least one, which is targeted to be taught by the Industrial expert at least upto 50% of its component.**
- (II) **Man making and service to society oriented compulsory credit courses of NCC/ NSS, values & ethics.**
- (III) **Compulsory audit course on Entrepreneurship for all branches.**
- (IV) **Many add-on courses those are (non-credit courses) to be offered in vacation to enhance the employability of the students.**

(V) Many audit courses like French, German, and Chinese to enhance the communication skill in global scale for the students.

(VI) Research and imagination building courses such as Research Paper Communication.

(VII) Design course as “Creative Design”.

Further, the syllabus has been framed **not to fit in a given structure as we believe structure is for syllabus and syllabus is not for structure.** Therefore, as per requirement of the courses, the structure, the credit and the contact hours have been made available in case to case.

The syllabus is also innovative as it includes:

(I) In addition to the list of text and reference books, a list of journals and magazines for giving students a flexible of open learning.

(II) System of examination in each course as conventional examination, open book examination and online examination.

Each course has been framed with definite objectives and learning outcomes. Syllabus has also identified the courses to be taught either of two models of teaching:

(i) J.C. Bose model of teaching where practice is the first theory.

(ii) S.N. Bose model of teaching where theory is the first practice.

Besides the National Institute of Technology, Arunachal Pradesh has initiated a scheme of **simple and best teaching** in which for example:

(i) Instead of teaching RL, RC and RLC circuit separately, only RLC circuit will be taught and with given conditions on RLC circuits, RL and RC circuits will be derived and left to the students as interest building exercise.

(ii) Instead of teaching separately High Pass filter, Band Pass filter and Low Pass filter etc; one circuit of filter will be taught to derive out other circuits, on conditions by the students.

I am firmly confident that the framed syllabus will result in **incredible achievements, accelerated growth and pretty emphatic win over any other systems and therefore my students will not run after jobs rather jobs will run after my students.**

For the framing of this excellent piece of syllabus, I like to congratulate all members of faculty, Deans and HODs in no other terms but “Sabash!”

*Prof. C.T.Bhunia*  
*Director, NIT,(A.P.)*

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**NATIONAL INSTITUTE OF TECHNOLOGY,  
ARUNACHAL PRADESH**



**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
PROPOSED COURSE STRUCTURE FOR M.TECH IN  
MOBILE COMMUNICATION & COMPUTING  
(2 YEARS COURSE)**

**FIRST SEMESTER**

S. No	Course Code	Course Title	P	T	L	Hours/Week	C
1	CSE 900	Mobile and Wireless Communication	0	0	3	3	3
2	CSE 901	Engineering Mathematics & Graph Theory	0	0	3	3	3
3	CSE 902	Mobile Computing	0	0	3	3	3
4	CSE ***	Programme Elective-1	0	0	3	3	3
5	CSE 904	Research Paper Communication	0	0	3	3	3
6	CSE 905	Wireless Communication Laboratory.	3	0	0	3	2
<b>Total</b>			<b>3</b>	<b>0</b>	<b>15</b>	<b>18</b>	<b>17</b>

**SECOND SEMESTER**

S. No	Course Code	Course Title	P	T	L	Hours/Week	C
1	CSE 906	Quantum Computing	0	0	3	3	3
2	CSE 907	Mobile Adhoc Networks	0	0	3	3	3
3	CSE 908	Wireless Sensor Networks	0	0	3	3	3
4	CSE ***	Programme Elective 2	0	0	3	3	3
5	CSE ***	Programme Elective-3	0	0	3	3	3
6	CSE 911	Research Lab	3	0	0	3	2
<b>Total</b>			<b>3</b>	<b>0</b>	<b>15</b>	<b>18</b>	<b>17</b>

**THIRD SEMESTER**

S. No	Course Code	Course Title	P	T	L	Hours/Week	C
1	CSE 912	Teaching in UG	-	-	-	-	3
2	CSE 913	Seminar	3	0	0	3	3
3	CSE 914	Dissertation	0	0	0		20
<b>Total</b>							26

**FOURTH SEMESTER**

S. No	Course Code	Course Title	P	T	L	Hours/Week	C
1	CSE 915	Dissertation	0	0	0		27
2	CSE 916	Teaching in UG	-	-	-	-	3
<b>Total</b>							30

**Elective Programme Subjects:**

<b>Sl No</b>	<b>Course Name</b>	<b>Course Code</b>
<b>1</b>	Cloud Computing.	<b>CSE 950</b>
<b>2</b>	Mobile Databases.	<b>CSE 951</b>
<b>3</b>	Multimedia Computing.	<b>CSE 952</b>
<b>4</b>	Green Computing.	<b>CSE 953</b>
<b>5</b>	Security in Wireless & Mobile System.	<b>CSE 954</b>
<b>6</b>	Programming Mobile Devices.	<b>CSE 955</b>
<b>7</b>	Embedded Systems.	<b>CSE 956</b>
<b>8</b>	Wireless and Mobile Protocol	<b>CSE 957</b>
<b>9</b>	Broad Band Network.	<b>CSE 958</b>

**Name of the Module: Mobile and Wireless Communication**

**Module Code: CSE 900**

**Semester: 1st**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. To realise the vision of "Optimally Connected Anywhere, Anytime" supported by all system levels from access methods and networks to service platforms and services.
2. Preparatory work has characterized Systems beyond 3G as a horizontal communication model, where different terrestrial access levels and technologies are combined to complement each other in an optimum way for different service requirements and radio environments.

**Learning outcomes:**

Upon Completion of the subjects:

1. General knowledge of Mobile and Wireless Communication technology.
2. Brief knowledge of 3G and 4 G wireless standards.

**Subject Matter:**

**Unit I:**

**Cellular Communications**

The Cellular Engineering Fundamentals : Introduction, Cell, Frequency Re-use, Channel Assignment Strategies, Fixed and Dynamic Channel Assignment Strategies, Handoff Process, Factors affecting Handoff Process, Handoff Strategies, Few practical cases of Handoff Scenario, Interference and System Capacity, Co-channel Interference (CCI), Adjacent Channel Interference (ACI), Cell Splitting, Sectoring, Microcell Zone concept, Repeaters, Trunked Radio System.

**Wireless Communications and Diversity**

Fast Fading Wireless Channel Modeling  
Rayleigh/Ricean Fading Channels  
BER Performance in Fading Channels  
Diversity modeling for Wireless Communications  
BER Performance Improvement with diversity  
Types of Diversity – Frequency, Time, Space

**Broadband Wireless Channel Modeling**

WSSUS Channel Modeling, RMS Delay Spread  
Doppler Fading, Jakes Model, Autocorrelation  
Jakes Spectrum  
Impact of Doppler Fading

**Unit II:**

**Multiple Access Technologies:** Narrowband Systems, Wideband Systems, Frequency Division Multiple Access, Time Division Multiple Access, Spread Spectrum Multiple Access, Space Division Multiple Access.

**CDMA**

Introduction to CDMA  
Walsh codes, Variable tree OVSF  
PN Sequences  
Multipath diversity, RAKE Receiver  
CDMA Receiver Synchronization

**Unit III:**

**OFDM**

Introduction to OFDM

Multicarrier Modulation and Cyclic Prefix  
Channel model and SNR performance  
OFDM Issues – PAPR  
Frequency and Timing Offset Issues

#### **MIMO**

Introduction to MIMO, MIMO Channel Capacity  
SVD and Eigenmodes of the MIMO Channel  
MIMO Spatial Multiplexing – BLAST  
MIMO Diversity – Alamouti, OSTBC, MRT  
MIMO - OFDM

#### **Unit IV:**

##### **Roaming in wireless and Mobile Networks:**

National and International Roaming, Interstandard Roaming, Prepaid and Postpaid Subscriber Roaming, Basic Structure of Roaming, Roaming Services.

##### **Roaming in a GSM Network:**

Inter-PLMN Signaling Network, Communication between a VPLMN VLR and HPLMN HLR, Roaming Procedures, Roaming call scenarios, Short Message Services(SMS).

##### **3G and 4G Wireless Standards**

WCDMA, LTE, WiMAX etc

##### **Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

##### **Reading List:**

###### **A. Books**

1. Theodore Rappaport, “Wireless Communications: Principles and Practice”, Prentice Hall.
2. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communications”, Cambridge University Press.
3. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.
4. W. C. Lee, Mobile Communications Engineering, New Delhi: Tata McGraw-Hill, Latest Ed.
5. Lee- Mobile Communication & Networking, TMH
6. Ezio Biglieri, “MIMO Wireless Communications”, Cambridge University Press.
7. J. Schiller, “Mobile Communications”, Pearson Education.
8. Shahid K. Diddiqui, “Roaming in Wireless Networks”, McGraw Hill Professional.
9. William Stallings, “Wireless Communications & Networks 2/E”, Pearson.
10. Leo-Garcia & Widjaja, Communication Networks, TMH
11. Gordon A. Gow and Richard K. Smith “Mobile and Wireless Communication”, Mc Graw Hill

###### **B. Magazines:**

1. “The Wireless Age”, Wireless Press, Inc.
2. “Communication Arts”, 10 Constitution Drive, Menlo Park, CA 94025.
3. IEEE Communication Magazine.
4. IEEE Signal Processing Magazine.
5. Telecommunication Magazine.

###### **C. Journals:**

1. Wireless Communications and Mobile Computing (Wireless Comm Mobile Comput), Publisher John Wiley & Sons, ISSN: 1530-8677

2. International Journal of Wireless Communications and Mobile Computing, ISSN: 2330-1007 (Print), ISSN: 2330-1015 (Online)
3. The International Research Journal of mobile and Wireless communications, ISSN 2249-6513
4. British Telecom Technological Journal, AT&T Technical Journals
5. Bell Systems Technical Journal.

**Name of the Module: Engineering Mathematics & Graph Theory**

**Module Code: CSE 901**

**Semester: 1st**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Imparting theoretical and practical application to the students in the area of Engineering Mathematics and Graph Theory.
2. Injecting future scope and the research directions in the field of Engineering Mathematics and Graph Theory
3. Making students competent to analyse and design of real world problem.

**Subject Matter:**

Upon Completion of the subjects:

1. Students will be adequately trained to model problems of real world.
2. Students will be skilled both theoretical and practical application to other branch of engineering.
3. Students will be substantially prepared to take up prospective research assignments.

**Unit I:**

**Propositional Logic:**

Propositional logic I, Propositional logic II, First order logic: syntax and semantics, First order logic: proof and deduction, soundness and completeness, Axiomatic Systems and the Propositional Calculus, First order logic: Applications, Undecidability: Introduction, Godel's Incompleteness Theorem, Second-Order Logic, Resolution, Many-Sorted Logic.

**Unit II:**

**Graph Theory**

**Graphs:**

Definition and examples of graphs,  
 Incidence and degree, Handshaking lemma, Isomorphism  
 Sub-graphs, Weighted Graphs, Eulerian Graphs, Hamiltonian Graphs Walks, Paths and Circuits  
 Connectedness algorithm, Shortest Path Algorithm, Fleury's Algorithm Chinese Postman problem, Travelling Salesman problem

**Unit III:**

**Planar Graphs:**

Combinational and geometric duals  
 Kuratowski's graphs, Detection of planarity, Thickness and crossings

**Matrix Representation of Graphs:**

Incidence, Adjacency Matrices and their properties

**Unit IV:**

**Coloring:**

Chromatic Number, Chromatic Polynomial, the six and five color theorems, the four color theorem

**Eular's and Hamiltonian Graphs and Properties**

**Trees:**

Definition and properties of tree, Pendent vertices, centre of a tree  
 Rooted and binary tree, spanning trees, minimum spanning tree algorithms



Fundamental circuits, cutsets and cut vertices, fundamental cutsets, connectivity and separativity, max-flow min-cut theorem

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Deo N, "Graph Theory with Applications to Engineering and Computer Science", PHI
2. T.Veerarajan and T.Ramachandran, "Theory & problems in Numerical Methods", TMH.
3. E.Balaguruswamy, "Numerical Methods", TMH
4. Dr.S.K.S.Rathore, "Numerical Analysis", Everest Publishing House.
5. Manish Goyal, N.P. Bali , "A Textbook of Engineering Mathematics 8 Edition", Laxmi Publications
6. H.K. Dass , "Advanced Engineering Mathematics", S Chand.
7. Douglas B. West, "Introduction to Graph Theory 2 Edition", PHI
8. W.D Wallis, "A Beginner's guide to Graph Theory", Boston
9. Ronald Gould, "Graph Theory", Dover Publications.
10. Gary Chartrand, Ping Zhang, "Introduction to Graph Theory", Tata McGraw Hill
11. Arnold, V.I. "Ordinary Differential Equations" Cambridge, MA: MIT Press, 1973, 1978.
12. Carrier, George F. and Pearson, Carl E, "Ordinary Differential Equations", Philadelphia, PA: Society for Industrial and Applied Mathematics, 1991.
13. Coddington, Earl A. and Levinson, Norman, Theory of Ordinary Differential Equations Melbourne, FL: Robert E. Krieger, 1984.
14. Hirsch, Morris W. and Smale, Stephen, "Differential Equations, Dynamical Systems, and Linear Algebra", NY: Academic Press, 1974.
15. Jordan, D. and Smith, P, "Nonlinear Ordinary Differential Equations", NY: Clarendon Press, 1987. Second Edition.
16. Howard Pospesel, William G. Lycan, "Introduction to Logic: Propositional Logic", Prentice Hall, 2000
17. Hans Kleine Büning, Theodor Lettmann, "Propositional Logic: Deduction and Algorithms", Cambridge University Press, 1999
18. Witold A. Pogorzelski, Piotr Wojtylak, "Completeness Theory for Propositional Logics", Springer Science & Business Media, 2008

**B. Magazines:**

1. "Mathematic Magazine", Washington DC 20036
2. "Plus Magazine", Millennium Mathematics Project at the University of Cambridge.
3. Current Science (Indian Academy of Science)
4. The Mathematics Student (Indian Mathematical Society)
5. Mathematical Spectrum(The University of Sheffield)
6. Mathematics Magazine (Mathematical Association of America)
7. Ganithavahini (Ramanujan Mathematical Society)

**C. Journals:**

1. Graphs and Combinatorics.
2. Journal of Graph Theory.
3. SIAM Journal on Discrete Mathematics.
4. Theoretical Computer Science
5. Annals of Functional Analysis
6. Numerical Methods for Partial Differential Equations
7. Journal of Dynamics and Differential Equations
8. Differential Equations
9. Journal of Difference Equations and Applications

## 10. Journal of Differential Equations

**Name of the Module: Mobile Computing**

**Module Code: CSE 902**

**Semester:**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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### **Objectives:**

The course is design to meet the objectives of:

1. Define Mobile Computing and look at current trends
2. Distinguish between types of Mobility
3. Examine Theory Research in Mobility
4. Examine Systems Research in Mobility
5. Acquire solid knowledge on mobile networks and mobile computing.

### **Learning outcomes:**

Upon Completion of the subjects:

1. Apply advanced data communicating methods and networking protocols for wireless and mobile environments
2. Utilize and employ application frameworks for developing mobile applications including under disconnected and weakly connected environment
3. Select components and networks for particular application
4. Creatively analyze mobile and wireless networks
5. Critically analyse security issues of mobile and wireless computing systems

### **Subject Matter:**

#### **Unit I:**

##### **Mobility of Bits and Bytes:**

Wireless-The Beginning, Mobile Computing, Dialogue Control, Networks, Middleware and Gateways, Application and Services (Contents), Developing Mobile Computing Applications, Security in Mobile Computing Standards-why is it Necessary?

#### **Unit II:**

##### **Mobile fundamentals and channels:**

Multiple access techniques like Frequency division multiple access (FDMA) ,Time division multiple access (TDMA) ,Code division multiple access (CDMA) ,Space division multiple access (SDMA) .

#### **Unit III:**

##### **Mobile radio channels:**

Path-loss, slow-fading, fast-fading , delay spread and coherence bandwidth, flat fading and frequency selective fading ,The power budget design of mobile radio channels.

#### **Unit IV:**

##### **Global System for Mobile Communications:**

GSM Architecture, GSM Entities ,Call Routing in GSM, PLMN Interfaces, GSM Addresses and Identifiers , Network Aspects in GSM , GSM Frequency Allocation, Authentication and Security, Mobile Computing over SMS, Short Message (SMS) , Value Added Services through, MS, Accessing the SMS Bearer, GPRS and packet Architecture GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS , Application for GPRS, Limitation of GPRS, Billing and Charging in GPRS, WAP , MMS , GPRS Applications, Spread – Spectrum Technology, Is – 95.

### **Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Mazliza Othman, "Principles of Mobile Computing & Communications", SPD publications.
2. Rajkamal, "Mobile Computing, 2/e", Oxford University Press.
3. Raksha Shende, "Mobile Computing for beginners", SPD publications.
4. V.Jeyasri Arokiamary, "Mobile Computing", Technical Publications, 2009
5. Kumkum Garg, "Mobile Computing: Theory and Practice", Pearson Education India, 2010
6. Asoke K. Talukdar, "Mobile Computing, 2E", Tata McGraw-Hill Education, 2010
7. C.S.R. Prabhu, "Mobile Computing, Universities Press, 2002
8. Reza B'Far, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge University Press, 2005
9. J. Schiller, "Mobile Communications", Pearson Education,
10. Shahid K. Diddiqui, "Roaming in Wireless Networks", McGraw Hill Professional, 2006.

**B. Magazines:**

1. Mobile choice, London
2. Mobile World, UK.
3. Mobile Today, UK.

**C. Journals:**

1. International Journal of Wireless and Mobile Computing (ISSN online: 1741-1092 ISSN print: 1741-1084)
2. International Journal of Computer Science Research & Technology (ISSN: 2321-8827)

**Name of the Module: Research Paper Communication**

**Module Code: Semester: CSE 904**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Steps in Research, Motivation, Types, good research techniques.
2. Methods of Data collection, Processing, Analysis techniques of raw datas.
3. Hypothesis, Technical writing techniques etc.

**Learning outcomes:**

Upon Completion of the subjects:

1. Writing techniques of research paper.
2. Collecting raw data, processing data using mathematics computation, transformation, and other else.
3. Hypothesis techniques, Testing techniques of Hypothesis etc.

**Subject Matter:**

**Unit I:**

**Research Methodology**

Definition, Objective, Motivation, Types of Research, Significance, Criteria of Good Research

**Defining the Research Problem**

Definition of Research Problem, Selection of Problem, Necessity of defining the Problems, Techniques involves in defining the problem.

**Research Design**

Meaning of Research Design, Need for research Design, Features of a Good Design, Different Design Approach  
**Sampling Design**

Census And Sample Survey, Implications Of A Sample Design, Steps In Sample Design, Criteria of Selecting A Sampling Procedure, Different Types of Sample Designs, How to Select A Random Sample? Random Sample From An Infinite Universe, Complex Random Sampling Designs.

### **Unit II:**

#### **Measuring and Scaling Techniques**

Measurement in Research, Measurement Scales, Sources of Error In Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Scale Classification Bases.

#### **Methods of Data Collection**

Collection of Primary Data, Observation Method, Interview Method, Collection of Data, Collection of Secondary Data.

#### **Processing and Analysis of Data**

Processing Operations, Some Problems In Processing, Elements/Types Of Analysis, Statistics In Research, Measures Of Central Tendency, Measures Of Dispersion, Measures Of Relationship, Regression Analysis.

### **Unit III:**

#### **Sampling Fundamentals**

Need For Sampling, Important Sampling Distributions, Central Limit Theorem, Sampling Theory, Concept Of Standard Error, Estimation, Estimating The Population Mean (M), Estimating Population Proportion, Sample Size And Its Determination

#### **Testing of Hypothesis**

What Is A Hypothesis? Basic Concepts Concerning Testing Of Hypotheses, Procedure For Hypothesis Testing, Measuring The Power Of A Hypothesis Test, Tests Of Hypotheses

### **Unit IV:**

#### **Analysis of Variance and Co-variance**

Analysis of Variance (Anova), The Basic Principle of Anova, Anova Technique, Setting up Analysis of Variance Table, Coding Method,

#### **Interpretation and Report Writing**

Meaning of Interpretation, Technique of Interpretation, Precautions in Interpretation, Different Steps in Writing Report, Types of Reports, Precautions for Writing Research Reports

#### **Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

#### **Reading List:**

##### **A. Books**

1. C R Kothari, "Research Methodology- Methods and Techniques", New Age International Publications.
2. Ranjit Kumar, "Research Methodology", SAGE Publications.
3. James Arthur, Michael Waring, Robert Coe, Larry V Hedges, "Research Methods & Methodologies in Education", SAGE Publications.
4. Donald Howard Menzel , "Writing a technical paper", McGraw-Hill
5. R. Panneerselvam, "Research Methodology" PHI Publication
6. V.V Khanzone "Research Methodology- Techniques and Tools", APH Publisher
7. Raj Mohan Joshi, "Writing Skills for Technical Purpose", Isha Books

##### **B. Magazines:**

##### **C. Journals:**

1. Journal of Research Methods and Methodological Issues, ISSN 2150-8143.

**Name of the Module: Wireless Communication Laboratory**

**Module Code: Semester: CSE 905**

**Credit Value: 2 [P=3, T=0, L=0]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. To learn different modulation techniques, multiple access techniques for wireless communication and propagation models.
2. To understand modern mobile communication systems.

**Learning outcomes:**

Upon Completion of the subjects:

1. Implementation and practical experiments by manually.
2. Finds the practical obstacle related to the wireless communication.

**List of practical:-**

**Study of wireless Communications using VisSim or Trainer Kit**

Amplitude Modulation and Demodulation  
Frequency Modulation and Demodulation  
ASK, FSK, PSK, QPSK digital modulators  
Code Division Multiple Access (CDMA)  
Global System for Mobile Communication (GSM)  
Spread Spectrum – DSSS Modulation & Demodulation

**Wireless Path loss Computations - Study of Propagation Path loss Models: Indoor & Outdoor (Using Matlab Programming)**

Free Space Propagation – Path Loss Model  
Link Budget Equation for Satellite Communication  
Carrier to Noise Ratio in Satellite Communication  
Outdoor Propagation – Okumura Model  
Outdoor Propagation – Hata Model

**Teaching/ Learning/ Practice Pattern:**

Teaching: 0%  
Learning: 40%  
Practice: 60%

**Examination Pattern:** Practical Examination, Viva.

**Reading List:**

**A. Books**

1. Huseyin Arslan, “Modeling, Simulation, Testing, and Measurements of Wireless Communication Systems: A Laboratory-based Approach”, Springer London, Limited, 2013.
2. Gunnar Heine, “GSM Networks: Protocols, Terminology, and Implementation”, Artech House, 1999
3. Andrew Richardson, “WCDMA Design Handbook”, Cambridge University Press.

**B. Magazines:**

1. The Wireless Age, Wireless Press, Inc.
2. Communication Arts, 10 Constitution Drive, Menlo Park, CA 94025.
3. IEEE Communication Magazine.
4. IEEE Signal Processing Magazine.

**C. Journals:**

1. Wireless Communications and Mobile Computing (Wireless Comm Mobile Comput), Publisher John Wiley & Sons, ISSN: 1530-8677

2. International Journal of Wireless Communications and Mobile Computing, ISSN: 2330-1007 (Print), ISSN: 2330-1015 (Online)
3. The International Research Journal of mobile and Wireless communications, ISSN 2249-6513.
4. British Telecom Technological Journal, AT&T Technical Journals
5. Bell Systems Technical Journal

**Name of the Module: Quantum Computing**

**Module Code: CSE 906**

**Semester: Second Semester**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Why to be interested in quantum computing
2. The prehistory of quantum computing
3. The specific properties of quantum computing in comparison with randomized computing
4. The basic experiments and principles of quantum physics
5. The basics of Hilbert space theory
6. The elements of classical reversible computing

**Learning outcomes:**

Upon Completion of the subjects:

1. Understand and explain the basic notions of Quantum Computing-including Quantum Bits and registers, Quantum Evolution, Quantum Circuits, Quantum Teleportation and the basic Quantum Algorithms known at the present time.
2. Identify the essential difference between the classical paradigm and the quantum paradigm of computation and appreciate why quantum computers can solve currently intractable problems.

**Subject Matter:**

**Unit I:**

**Fundamental Concepts**

Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.

**Quantum Computation**

Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database

**Unit II:**

**Quantum Computers**

Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

**Unit III:**

**Quantum Information**

Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.

**Unit IV:**

**Quantum Error Correction**

Introduction, Short code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:****A. Books**

1. C. T. Bhunia, "Introduction To Quantum Computing", Publisher New Age International Pvt Ltd Publishers, ISBN 9788122430752
2. Micheal A. Nielsen. & Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002
3. David McMahon, "Quantum Computing Explained", Wiley.
4. Michael A. Nielsen, Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge Series on Information and the Natural Sciences
5. Eleanor G. Rieffel, Wolfgang H. Polak, "Quantum Computing: A Gentle Introduction (Scientific and Engineering Computation)", The MIT Press.
6. Susan Shannon, "Trends in Quantum Computing Research", Nova Publishers, 2006
7. Julian Brown, "Quest for the Quantum Computer", Simon & Schuste.
8. Marco Lanzagorta, Jeffrey Uhlmann, "Quantum Computer Scienc", Morgan & Claypool Publishers, 2009
9. Phillip Kaye, Raymond Laflamme, Michele Mosca, "An Introduction to Quantum Computing", Oxford.
10. Sahni, "Quantum Computing", Tata McGraw-Hill Education, 2007.

**B. Magazines:**

1. Cosmos, Australia.

**C. Journals:**

1. Journal of Quantum Information Science, Scientific Research, ISSN Print: 2162-5751, ISSN Online: 2162-576X
2. The Future of Quantum Information Processing, Science (Special Issue).
3. The IEEE Journal of Quantum Electronics, IEEE
4. Quantum information and Computing, Rinton press, New Jersey, US

**Name of the Module: Mobile Adhoc Networks**

**Module Code: CSE 907**

**Semester: Second**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Study of Mobile Adhoc network, its applications, architecture.
2. Mediam access protocol, networking protocol, routing protocol, cross layer design, integration with 4 G.
3. Learn different simulation tools (Eg. NS2) for proposing new protocol and their effectiveness.

**Learning outcomes:**

Upon Completion of the subjects:

1. Explore Mobile Adhoc network field for research purpose.
2. Learn Simulators for implementation and changes in different routing protocol like AODV, DSR.

**Subject Matter:**

### **Unit I: Introduction**

Introduction to Adhoc networks – definition, characteristics features, Application, Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models.

### **Medium Access Protocols**

MAC protocols: design issues, goals and classification. Contention based protocols –with reservation, scheduling algorithms, protocols using direction antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

### **Unit II:**

#### **Network Protocols**

Routing protocols: Design issues, goals and classification. Proactive vs. reactive routing, unicast routing algorithms, Multicast routing hierarchical routing, quos aware routing.

### **Unit III:**

#### **End-End Delivery And Security**

Transports layer: Issues in desiging- transport layer classification, adhoc transport protocols. Security issues in adhoc network: issues and challenges, network security attacks, secure routing protocols.

### **Unit IV:**

#### **Cross Layer Design And Integration Of Adhoc For 4G**

Cross layer design: need for cross layer design, cross layer optimization, parameter optimizations, techniques, cross layer cautionary perspective. Integration of adhoc with mobile IP networks. Mesh networks, vehicular area networks.

### **Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

### **Reading List:**

#### **A. Books**

1. C K Toh, “Ad-hoc mobile wireless network – protocols and systems”, prentice hall.
2. Siva Ram Murthy, “Ad-hoc wireless networks – architecture and protocols”, Addison-Wesley.
3. Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic , “Mobile Ad Hoc Networking”, Wiley-Interscience.
4. Edgar H. Callaway, “Wireless sensor networks: architecture and protocols”, Auerbach publications.
5. Azzedine Boukerche, “Algorithms and Protocols for Wireless, Mobile Ad Hoc Networks”, Wiley.
6. Yi Pan, Yang Xiao, “Ad Hoc and Sensor Networks”, Nova Science Publishers.
7. Hai Liu, Xiaowen Chu, Yiu-Wing Leung, "Ad Hoc and Sensor Wireless Networks: Architectures, Algorithms and Protocols”, Bentham Science.
8. Pedro Cuenca, Carlos Guerrero, Ramon Puigjaner, Bartomeu Serra, “Advances in AdHoc Networking”, Springer
9. Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz, “Mobile Ad Hoc Networks: Current Status and Future Trends”, CRC Pres.
10. Aggelou, “Mobile Ad Hoc Networks”, Tata McGraw-Hill Education

#### **B. Magazines:**

#### **C. Journals:**

1. Ad Hoc Networks, Elsevier, ISSN: 1570-8705.
2. Mobile Adhoc Networks, IFRSA.
3. International Journal of Ad Hoc and Ubiquitous Computing.
4. International Journal of Smart Sensors and Ad Hoc Networks



**Name of the Module: Wireless Sensor Networks**

**Module Code: Semester: CSE 908**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Radio and wireless sensor network for traceability of nomadic herds for disease surveillance.
2. Wireless sensor network system in different fields - Design and development of sensor nodes, wireless sensor network and sensor based automatic devices.
3. To develop decision support system for tracing nomadic herds for disease surveillance.

**Learning outcomes:**

Upon Completion of the subjects:

1. Radio standards and communication protocols on the link and networking layers for wireless personal area networks, and inter-working with wireless local area networks and cellular networks
2. The function and use of sensors if different real world fields.
3. Operating systems and programming languages for wireless sensor nodes, architectures, functions and performance of wireless sensor networks .
4. Analyse of the specific requirements for applications in wireless sensor networks regarding energy supply, memory, processing and transmission capacity

**Subject Matter:**

**Unit I:**

**Overview of Wireless Sensor Networks:**

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

**Architectures:**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

**Unit II:**

**Networking Sensors:**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

**Unit III:**

**Infrastructure Establishment:**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

**Unit IV:**

**Sensor Network Platforms and Tools:**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols", CRC Press, 2003
2. Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks: A Networking Perspective", Wiley
3. Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", John Wiley & Sons, 2010
4. C.S. Raghavendra, Krishna M. Sivalingam, Taieb Znati, "Wireless Sensor Networks", Springer, 2006
5. Thomas Haenselmann, "Wireless Sensor Networks: Design Principles for Scattered Systems", Oldenbourg Verlag, 2011
6. Holger Karl, Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
7. Feng Zhao, Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
8. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, And Applications", John Wiley, 2007.
9. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
10. F. Jurdak, "wireless ad hoc and sense networks", Springer publications.

**B. Magazines:**

**C. Journals:**

1. International Journal of Sensor Networks, ISSN online: 1748-1287 ISSN print: 1748-1279
2. Transactions on Sensor Networks (TOSN), ACM
3. Wireless Sensor Systems, IET

**Name of the Module: Cloud Computing**

**Module Code: CSE 950**

**Semester:**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Fundamental Cloud Computing Terminology and Concepts
2. Basics of Virtualization
3. Specific Characteristics that Define a Cloud
4. Understanding Elasticity, Resiliency, On-Demand and Measured Usage
5. Benefits, Challenges and Risks of Contemporary Cloud Computing Platforms and Cloud Services
6. Cloud Resource Administrator and Cloud Service Owner Roles
7. Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) Cloud Delivery Models
8. Combining Cloud Delivery Models
9. Public Cloud, Private Cloud, Hybrid Cloud and Community Cloud Deployment Models
10. Business Cost Metrics and Formulas for Comparing and Calculating Cloud and On-Premise Solution Costs

**Learning outcomes:**

Upon Completion of the subjects:

1. Describe the hardware and software concepts and architecture
2. Contrast the key technical and commercial issues concerning versus traditional software models.
3. Recognize the importance of virtualisation technology in support Computing.
4. Specify and design Cloud Computing capable data centres.

**Subject Matter:**

**UNIT 1:**

**Introduction:** Cloud Computing; Characteristics and Benefits of Cloud Computing; Cloud Models: Service Models, Deployment Models; Historical Development of Cloud Computing; Cloud computing Platforms and Technologies; Cloud Computing Challenges.

**UNIT 2:**

**Principle of parallel and Distributed Computing:** Parallel Computing: Hardware Architecture for Parallel Processing, Approaches of parallel programming , Levels of Parallelism; Distributed Computing: Components of Distributed system, Architecture for Distributed Computing, Models for Inter Process Communication; Technologies for Distributed Computing.

**UNIT 3:**

**Virtualization:** Characteristics of Virtualized Environments; Taxonomy of Virtualization Techniques; Virtualization and cloud Computing; Pros and Cons of Virtualization.

**UNIT 4:**

**Cloud Services and Platforms:** Compute Services; Storage services; Database Services; Application Services; Content Delivery Services; Analytics Services; Deployment & Management Services; Identity & Access Management Services; Open Source Private Cloud Services.

**UNIT 5:**

**Hadoop & MapReduce:** Apache Hadoop; Hadoop MapReduce Job Execution; Hadoop Schedulers; Hadoop Cluster Setup.

**UNIT 6:**

**Python:** Basics; data types and data structures; Control Flow; Functions; Modules; Packages; File Handling; classes; Python for Cloud: Python for MapReduce; Python Packages of Internet.

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski “Cloud Computing: Principles and Paradigms”, John Wiley & Sons, 2010
2. Gupta, Pranab Kumar Das, Nayak, Manojranjan, Pattnaik, Sabyasachi, “Cloud Computing-Based Projects Using Distributed Architecture”, PHI
3. T. A. Deshpande “Cloud Computing”, Nirali Prakashak.
4. Kumar Saurabh, “Cloud Computing 2nd Edition”, Wiley India 2012
5. Lee Gillam, “Cloud Computing: Principles, Systems and Applications”, Springer, 2010
6. Christian Baun “Cloud Computing: Web-Based Dynamic IT Services”, Springer, 2011
7. Miller Michael, “Cloud Computing”, Pearson Education India, 2011
8. Eric A. Marks, Bob Lozano, “Executive's Guide to Cloud Computing”, John Wiley and Sons, 2010
9. Armando Escalante, “Handbook of Cloud Computing”, Springer, 2010
- 10 John Rhoton, “Cloud Computing Explained”, Recursive Limited, 2009

**B. Magazines:**

1. Cloud Computing Magazine, USA

**C. Journals:**

1. Journal of Cloud Computing, Springer
2. International Journal of Cloud Computing, ISSN online: 2043-9997, ISSN print: 2043-9989
3. Cloud Computing, IEEE Transactions.

**Name of the Module: Mobile Databases**

**Module Code: Semester: CSE 951**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Mobile databases systems
2. Serialization of Transactions, Concurrency control Mechanism
3. Data Processing and mobility, Mobile transaction Model etc.

**Learning outcomes:**

Upon Completion of the subjects:

1. Distributed database and mobile database system.
2. Difference between conventional & mobile database, different tools, techniques, query languages, locking techniques etc.
3. Web databases, web-based information systems etc.

**Subject Matter:****Unit I:**

**Introduction to conventional databases, distributed database mobile data access system:** mobility issues, on-demand services, broadcast services, transaction processing, security moving

**Unit II:**

**Object Databases:** Basic concepts and challenges, accessing methods of moving object databases, current information oriented indexing, historical information oriented information, mixed-type indexing, indexing moving object with special characteristics moving object.

**Unit III:**

**Queries:** basic Queries (nearest neighbor query, range query), advanced queries (density query, continuous query) trends and open issue

**Introduction of Concurrency control mechanism**

Ways of Locking Data items, Phantom problems, Multi granularity locking, Heuristic approach in locking scheme, Non-locking based scheme, Optimistic Concurrency control mechanisms, Two phase locking for Distributed database systems.

**Unit IV:**

**Fully Connected Information Space**  
**Personal Communication System (PCS)**  
**Mobile Database Systems (MDS)**  
**Transaction Management**  
**Data Caching**  
**Query Processing**  
**Data Classification**  
**Mobile Database recovery**

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Kumar Vijay, "Mobile database systems". John Willy & sons.
2. Robert Laberge, Srdjan Vujosevic, "Building PDA Databases for Wireless and Mobile Development" Wiley
3. David Tariar, "Mobile Database Query Processing", Wiley, 2013
4. Lars Frank, "Design of Distributed Integrated Heterogeneous Or Mobile Databases", Lambert Academic Publishing, 2010
5. Yongyan Huang, "A Restricted Precedence Concurrency Control Protocol for Mobile Distributed Database Systems", ProQuest, 2006

**B. Magazines:**

**C. Journals:**

1. International Journal of Intelligent Information and Database Systems, ISSN online: 1751-5866, ISSN print: 1751-5858.
2. Journal of Parallel and Distributed Computing.

**Name of the Module: Multimedia Computing**

**Module Code: Semester: CSE 952**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Content creation for the web and multimedia.
2. The content creation covers HTML, Java Script, 2D and 3D image manipulation, audio and video, animation and tools such as Dreamweaver, Photoshop, Flash, Maya. The course contains a major practical element.
3. Understand different compression principles; understand different compression techniques; understand different multimedia compression standards; be able to design and develop multimedia systems according to the requirements of multimedia applications.

**Learning outcomes:**

Upon Completion of the subjects:

1. Able to create substantial and well-engineered web sites, 2D and 3D media, audio and video, animation, involving a variety of media, through the use of a number of key professional tools.
2. Understand the characteristic of human's visual system
3. Understand the characteristics of human's audio system; be able to take into considerations in multimedia techniques design and implementation.

**Subject Matter:**

**Unit I:**

**Introduction** - Line - Curve and Ellipse Drawing Algorithms – Attributes – Two-Dimensional Geometric Transformations – Two-Dimensional Clipping and Viewing.

**Three-Dimensional Concepts**

Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations –

Three-Dimensional Viewing – Color models – Animation.

**Unit II:**

**Multimedia Systems Design**

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

**Unit III:**

**Multimedia File Handling**

Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.

**Unit IV:**

**Hypermedia**

Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component – Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems.

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Borivoje Furht, “Handbook of Multimedia Computing”, CRC Press, 1999.
2. Randall Packer, Ken Jordan, “Multimedia: From Wagner to Virtual Reality”, Norton, 2001
3. Prabat K Andleigh, Kiran Thakrar, “Multimedia Systems and Design”, PHI, 2003. (Unit 3 to 5)
4. Ralf Steinmetz, Klara Nahrstedt, “Multimedia: Computing Communications and Applications 1st Edition (Paperback)”, Pearson.
5. Mark S. Drew, Ze-Nian Li, “Fundamentals of Multimedia 1st Edition”, PHI Learning (2009)
6. Donald Hearn and M.Pauline Baker, “Computer Graphics C Version”, Pearson Education, 2003.
7. Judith Jeffcoate, “Multimedia in practice technology and Applications”, PHI, 1998.
8. Foley, Vandam, Feiner, Huges, “Computer Graphics: Principles & Practice”, Pearson Education, second edition 2003.
9. Daniel Cunliffe, Geoff Elliott, “Multimedia Computing”, Lexden Publishing Limited, 2005

**B. Magazines:**

**C. Journals:**

1. ACM Transactions on Multimedia Computing, Communications and Applications, ACM
2. International Journal of Multimedia Information Retrieval, ISSN: 2192-6611 (print version), SSN: 2192-662X (electronic version)
3. International Journal of Multimedia and Ubiquitous Engineering, SERSC.
4. International Journal of Multimedia Intelligence and Security, ISSN online: 2042-3470, ISSN print: 2042-3462

**Name of the Module: GREEN COMPUTING (Elective Subject)**

**Module Code: CSE 953**

**Semester:**

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**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Effects of IT and Networking devices in environments point of views.
2. Green Computing approach for propose more energy efficient devices and construct a framework for green architecture in different areas eg. Data enters, wired & wireless networking, Wireless sensor networks, Smart Grid etc.
3. Measuring and Analysis techniques of existing & proposed systems and find out the greenness.

**Learning outcomes:**

Upon Completion of the subjects:

1. Explore and understand different research areas of green computing to minimize energy consumption, reducing Green House Gases.
2. Different tools and simulators for measuring power usages efficiencies,
3. Changing existing networking protocols, result analysis, comparison of both existing and new proposed approach etc.

**Subject Matter:**

**Unit I:**

Origins, Regulations and industry initiatives- Government, Industry.

Approaches to green computing- Product longevity, Algorithmic efficiency, Resource allocation.

**Virtualization:** Green Maturity model for Virtualization, Virtualization level : Level0, Level 1, Level 2, Level 3.

**Unit II:**

Terminal servers, Power management, Operating system support, Power supply, Storage, Video card, Display. Web, Temporal and Spatial Data Mining Materials recycling, Telecommuting.

Thin Clients: Introduction of thin clients, Characteristics of thin clients, Thin Clients variants.

**Unit III:**

Middleware Support for green computing, Tools for monitoring, HPC computing, Green Mobile, embedded computing and networking, Management Frameworks Standards and metrics for computing green

**Environmentally Sustainable Infrastructure Design:** Sustainable Technology, Sustainable Intelligence, Decomposing Infrastructure Environment.

**Profiling Energy Usages for Efficient Consumption:** Profiling Energy Usages for the Application, Profiling Energy Usages for the operating System and Extra Energy usages profile.

**Unit IV:**

**Green Networking:** Where to save energy in Wired Networking, Taxonomy of Green Networking research: Adaptive Link rate, Interface Proxying, Energy ware Infrastructure, Energy ware Application.

**Efficient-Efficient Data Canters:** Reason for over power consumption in data centers, Data Center Management Architecture in greener perspective.

**Green Cellular Networking:** Survey, Measuring Greenness matrices, Energy Saving in Base Stations, Research Issues, Challenges, Future Generation Wireless Systems, Wireless Sensor Network for Green Networking

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

#### **A. Books**

1. Bud E. Smith, "Green Computing: Tools and Techniques for Saving Energy, Money, and Resources", Auerbach Publications.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line", MC-Grow Hill
3. Jason Harris, "Green Computing and Green IT Best Practices on Regulations and Industry Initiatives, Virtualization, Power Management, Materials Recycling and Telecommuting", Emereo Publishing
4. John Lamb, "The Greening of IT-How Companies Can Make a Difference for the Environment", Pearson Education
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press
6. F. Richard Yu, Xi Zhang, Victor C.M. Leung, "Green Communications and Networking", CRC Press.
7. Daniel Minoli, "Designing Green Networks and Network Operations: Saving Run-the-Engine Costs", CRC Press.
8. Gary Moore, "The Dark Side of Green: The Unintended Consequences of the Climate Change Movement", CRC Press, April 2011.
9. Bhuvan Unhelkar. "Handbook of Research on Green ICT: Technology, Business and Social Perspectives", IGI-Global, 2010.
10. Bhuvan Unhelkar, "Green IT Strategies and Applications: Using Environmental Intelligence", CRC Press, March 2011
11. Wu-chun Feng, "Green Computing: Large-Scale Energy Efficiency", CRC Press. January 2011

#### **B. Magazines:**

1. The Wireless Age, Wireless Press, Inc.
2. TechNet Magazine, Microsoft.
3. Smart Computing.

#### **C. Journals:**

1. International Journal of Green Computing
2. Sustainable Computing: Informatics and Systems.
3. Computing Now! Special issue of Green IT
4. Jan/Feb 2011 issue of IEEE IT Professional: Special issue on Green IT

**Name of the Module: Security in Wireless & Mobile System (Elective Subject)**

**Module Code: CSE 954**

**Semester:**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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#### **Objectives:**

The course is design to meet the objectives of:

1. The goal of this course is to familiarize students with the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks. As well as, understanding of the various ways in which wireless networks can be attacked and tradeoffs in protecting network

#### **Learning outcomes:**

Upon Completion of the subjects:

1. Students will have a broad knowledge of the state-of-the-art.
2. Open problems in wireless and mobile security, thus enhancing their potential to do research or pursue a career in this rapidly developing area.

#### **Subject Matter:**

##### **Unit I:**

**IP Layer Security, Link Layer Security, Network Security Options.**

**Security Issues in a Mobile IPV6 Network,**

**Mobile Code Issues:** Security Measures for Mobile Agents, Security Issues for Downloaded Code in Mobile phones



**Unit II:**

**Secure Mobile Commerce:** MCommerce and its Security Challenges, Security of the radio interface  
Security issues in Single Hop Wireless Networks: Cellular Network Security, Access Control and Roaming Issues,  
Mobile IP Security

**Unit III:**

**Security Issues in Multi-hop Wireless Networks:** Mobile Adhoc Network Security, Trust Management and  
Routing Issues, Wireless Sensor Network Security, Key Management, Sybil Attacks and Location Privacy,  
Vehicular Networks Application and Security, Wireless Metropolitan Area Networks (e.g.802.11b)

**Unit IV:**

Cryptographic Security, Speech Cryptology, WAP (Wireless Access Security) and its Security Architecture,  
Wireless Transport Layer Security, Optimizing Wireless Security with FPGAs and ASICs

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:****A. Books**

1. Man Young Rhee, "Mobile Communication Systems and Security", John Wiley & Sons, 2009
2. Hakima Chaouchi, Maryline Laurent-Maknavicius, "Wireless and Mobile Networks Security", John Wiley & Sons, 2010
3. S. Kami Makki, "Mobile and Wireless Network Security and Privacy", Springer, 2007
4. Merritt Maxim, David Pollino, "Wireless Security", McGraw Hill Professional, 2002
5. Aaron E. Earle, "Wireless Security Handbook", CRC Press, 2010
6. Nichols, Lekkas, "Wireless Security Models, Threats, and Solutions", McGraw-Hill
7. Aaron E. Earle, "Wireless Security Handbook", Auerbach
8. Steven Furnell, "Mobile Security", IT Governance Ltd, 2009

**B. Magazines:****C. Journals:**

1. International Journal of Wireless Networks and Broadband Technologies (IJWNBT), IGI.
2. International Journal of Security and Networks, ISSN online: 1747-8413, ISSN print: 1747-8405
3. International Journal of Wireless Information Networks (IJWIN), ISSN: 1068-9605 (print version),  
ISSN: 1572-8129 (electronic version)

**Name of the Module: Programming Mobile Devices (Elective Subject)**

**Module Code: CSE 955**

**Semester:**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

1. Resource management in mobile devices.
2. Study mobile devices operating systems, their API Eg. Symbion, Androids.
3. Programming languages and framework uses for mobile devices.

**Learning outcomes:**

Upon Completion of the subjects:

1. Study resource management in small limited resource devices.
2. Study of Android Operating System and its application infrastructure
3. Study of Symbian operating system and application infrastructure.

**Subject Matter:**

**Unit I:**

**Motivation and Programming Strategies**

**Memory Management** - Design Patterns for Limited Memory, Memory Management in Mobile Java, Memory Management in example OS

**Applications** - Workflow for Application Development, Techniques for Composing Applications, Application Models in Mobile Java, Case study: Symbian OS Application Infrastructure

**Unit II:**

**Dynamic Linking** - Implementation Techniques, Implementing Plugins, Managing Memory Consumption Related to Dynamically Linked Libraries, Rules of Thumb for Using Dynamically Loaded Libraries, Mobile Java and Dynamic Linking

**Unit III:**

**Concurrency** - Infrastructure for Concurrent Programming, MIDP Java and Concurrency, Case study: Symbian OS and Concurrency.

**Unit IV:**

**Resource Management** - Resource-Related Concerns in Mobile Devices, MIDP Java. **Networking** - MIDP Java and Web Services, Bluetooth Facilities with an example OS Security - Secure Coding and Design, Infrastructure for Enabling Secured Execution, Security Features in MIDP Java,

**Case study:** Symbian OS Security Features

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

**A. Books**

1. Tommi Mikkonen “Programming Mobile Devices: An Introduction for Practitioners”, Wiley
2. Paolo Bellavista, Antonio Corradi, “The Handbook of Mobile Middleware”, CRC Press, 2006
3. Craig Heath, “Symbian OS Platform Security: Software Development Using the Symbian OS Security Architecture”, Wiley.
4. Joshua Marinacci , “Building Mobile Applications with Java”, O’Reilly Media, Inc., 2012
5. Ben Morris , “The Symbian OS Architecture Sourcebook: Design and Evolution of a Mobile Phone OS”, John Wiley & Sons, 2007
6. Grant Allen, “Beginning Android 4”, Apress, 2011

**B. Magazines:**

1. Android Magazine , Imagine Publishing Ltd, Dorset

**C. Journals:**

2. Journal of Programmable Devices, Circuits, and Systems, ICGST
3. CiiT International Journal of Programmable Device Circuits and Systems, Print: ISSN 0974 – 973X, Online: ISSN 0974 – 9624

**Name of the Module: Embedded Systems (Elective Subject)**

**Module Code: CSE 956**

**Semester:**

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**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Define the class and its goals
2. Provide a general overview of Embedded Systems
3. Learn to design and development of an embedded system, including hardware and embedded software development.
4. Give examples of Embedded Systems
5. Show current statistics of Embedded Systems

**Learning outcomes:**

Upon Completion of the subjects:

1. Know about Embedded systems and the interface issues related to it.
2. Know about different techniques on embedded systems
3. Know about the real time models, languages and operating systems
4. To analyze real time examples, obstacles and solutions.

**Subject Matter:**

**Unit I:**

**Introduction to Embedded Systems**

**Architecture of Embedded Systems** - Hardware Architecture, Software Architecture, Communication Software, Development/Testing Tools

**Programming for Embedded Systems**

**Unit II:**

**The Process of Embedded System Development** - Design Tradeoffs, Hardware Software co-design, Implementation, Integration and Testing

**Hardware Platforms**

**Communication Interfaces**

**Unit III:**

**Embedded/Real-time Operating Systems Concepts** - Representative Embedded Systems, **Programming in RT-Linux**

**Embedded Database Application Mobile**

**Java Applications**

**Unit IV:**

**Embedded Software Development on 8051 Micro-controller Platform**

**DSP-based Embedded Systems** - Implementation of Embedded Systems with VHDL, FPGA and CPLD

**Embedded Systems Applications using Strong ARM Platform**

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%  
Learning: 40%  
Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:****A. Books**

1. Raj Kamal , “Embedded systems”, Tata McGraw-Hill Education, 2008.
2. A.P.Godse, A.O.Mulani, “Embedded Systems”, Technical Publications, 2009.
3. Dr. K.V.K.K. Prasad, “Embedded/Real-time Systems: Concepts, Design and Programming”, Dreamtech press.
4. Vahid, “Embedded System Design: A Unified Hardware/Software Introduction”, John Wiley & Sons, 2006
5. Dreamtech Software team, “Programming for Embedded Systems”, Willey –dreamtech
6. Santanu Chattopadhyay, “Embedded System Design”, PHI Learning Pvt. Ltd., 2013
7. Shibu K V, “Introduction to Embedded Systems 1st Edition”, Tata McGraw - Hill Education (2009)
8. Jack G. Ganssle, Stuart R. Ball, “Embedded Systems”, Newnes, 2008
9. Krzysztof Iniewski, “Embedded Systems: Hardware, Design and Implementation”, John Wiley & Sons, 2012
10. H. Bailey, “Embedded System Design”, Dreamtech Press, 2005

**B. Magazines:**

1. Embedded Systems Design magazine archive, South Tower San Francisco, CA 94107
2. Embedded Innovator Newsletter and magazines, Intel, Santa Clara, CA.
3. Embedded Computing Design, Saint Clair Shores, MI 48082
4. Military Embedded Systems, Saint Clair Shores, MI 48082

**C. Journals:**

1. International Journal of Embedded Systems, Inder Science Publishers, ISSN online: 1741-1076, ISSN print: 1741-1068
2. International Journal of Reconfigurable and Embedded Systems (IJRES), ISSN: 2089-4864, IAES
3. Journal of Embedded Computing, ISSN 1740-4460, IOS Press
4. Journal of Embedded Systems, Science and Education Publishing.

**Name of the Module: Wireless and Mobile Protocols (Elective subject)**

**Module Code: CSE 957**

**Semester:**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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**Objectives:**

The course is design to meet the objectives of:

1. Architecture and protocols of typical communications networks.
2. Flow control, congestion control, error control, etc.
3. Typical routing algorithms, delay modelling, multiple-access principles, basic queueing theory etc.
4. Different Wireless, Mobile IP protocol.

**Learning outcomes:**

Upon Completion of the subjects:

1. Learn research areas of wireless and mobile protocols and its perspective.
2. Learn Network Simulator (NS2).
3. Learn WAP architecture.
4. Learn Middleware application program Interfaces.

**Subject Matter:****Unit I:**

Introduction, applications, definition of terms, history

**Overview of Mobile Internet Protocol: MIP Mobile Internet**

**Protocol version 6:MIPv6**

## **Unit II:**

### **TCP for Mobile Environments, Case study with example TCP protocols**

- Describe the operation of the TCP/IP protocol suite in a mobile environment, including the operation of Mobile IP and a mobile ad hoc routing protocol;
- Modify an existing implementation of a protocol to alter functionality or performance;

### **Role of mobile computing middleware.**

- Use middleware application program interfaces (APIs) to realize mobile applications;

## **Unit III:**

### **Wireless Application Protocols: WAP – Architecture and Protocol Suite Bluetooth – Architecture, Network, Protocols**

### **Overview of Wireless LAN Protocols: WiFi**

## **Unit IV:**

Support for mobility, WWW, WAP, i-mode, J2ME

WiMAX – 802.16

### **Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

### **Reading List:**

#### **A. Books**

1. Azzedine Boukerche, “Algorithms and Protocols for Wireless, Mobile Ad Hoc Networks (Wiley Series on Parallel and Distributed Computing)”, Wiley
2. Sandeep Singhal, Thomas Bridgman, “The Wireless Application Protocol: Writing Applications for the Mobile Internet”, Addison Wesley Longman.
3. Steve Mann, Scott Sbihli, “The Wireless Application Protocol (WAP): A Wiley Tech Brief”, John Wiley & Sons, 2002
4. Singhal, “WAP - Wireless Application Protocol”, Pearson Education India
5. Perkins, Perkins Charles E., “Mobile IP”, Pearson Education India
6. Mark Norris, “Mobile IP technology for M-business”, Artech House, 2001

#### **B. Magazines:**

#### **C. Journals:**

1. International Journal of Wireless and Mobile Computing, ISSN online: 1741-1092, ISSN print: 1741-1084, Inder Science Publishers.
2. International Journal of Wireless & Mobile Networks (IJWMN), ISSN: 0975-3834

**Name of the Module: Broadband Network (Elective subject)**

**Module Code: CSE 958**

**Semester:**

**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

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### **Objectives:**

The course is design to meet the objectives of:

1. Study of the technologies enabling broadband services and networking.
2. High-speed network access technologies, core-network architectures.
3. Broadband services, ATM, Optical Communication network.

**Learning outcomes:**

Upon Completion of the subjects:

1. The course concludes with a discussion of the opportunities and threats posed to service providers and the communications industry by the emerging disruptive technologies of broadband networking.
2. Conduct research in the area of network traffic and networking protocols.

**Subject Matter:****Unit I:**

**Overview of internet** –concepts, challenges and history.

**Next Generation Internet**- challenges and problems.

Multicasting in Internet.

Real time communication over Internet.

**Unit II:**

**Packet scheduling Algorithms**- requirements and choices.

Admission control in internet.

Differentiated Services in internet.

Internet Telephony and voice over IP (VoIP)- RTP and RTCP.

Broadband ISDN and ATM Networks- ATM protocols.

**Unit III:**

**IP switching and MPLS**- Overview of IP over ATM and its evolution to IP switching.

Policy based Networking. Policy servers.

Web in Qos domain. Architecture for Web Qos.

**Unit IV:**

**Web Access** – Intelligent web browsing and web caching.

Internet & web Traffic measurement and characterization. Prediction for network management.

**Optical communication networks**- DWDM based transport network. Issues in IP over DWDM optical IP routers and switching.

**Teaching/ Learning/ Practice Pattern:**

Teaching: 60%

Learning: 40%

Practice: 0%

**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:****A. Books**

1. Chris Hellberg, Dylan Greene, Truman Boyes, “Broadband Network Architectures: Designing and Deploying Triple-Play Services-Play Services”, Pearson Education, 2007
2. James Trulove, “Broadband Networking”, Auerbach
3. Mike Sexton, Andy Reid, “Broadband networking:ATM, SDH, and SONET”, Artech House, 1997.
4. Marlyn Kemper Littman, “Building Broadband Networks”, CRC Press, 2002
5. Abdallah Shami, Martin Maier, Chadi Assi, “Broadband Access Networks: Technologies and Deployments”, Springer, 2010
6. Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM”, Pearson Education India.
7. Johnson I. Agbinya, Oya Sevimli, Sam Reisenfeld, “Advances in Broadband Communication and Networks vol2”, River Publishers, 2008
8. Achille Pattavina , “Switching theory: architecture and performance in broadband ATM networks”, J. Wiley
9. Soung C. Liew, Tony T. Lee, “Principles of Broadband Switching and Networking”, John Wiley & Sons, 2010

**B. Magazines:**

1. Broadband Communities Magazine online, Rosenberg.

**C. Journals:**

1. Journal of High Speed Network, ISSN: 09266801, IOS Press
2. Broadband journal, Journal of the SCTE.
3. Broadband Network, Journal of Networking Technology, Print ISSN: 0974-898X, Online ISSN: 0974-8998

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