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 Pan 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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# Proposed Course Structure for M.Tech in Mobile Communication & Computing

## First Semester

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
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<th>P</th>
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<td>CSE 900</td>
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### Elective Programme Subjects:

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<th>Sl No</th>
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<tr>
<td>1</td>
<td>Cloud Computing.</td>
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<tr>
<td>2</td>
<td>Mobile Databases.</td>
<td>CSE 951</td>
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<tr>
<td>3</td>
<td>Multimedia Computing.</td>
<td>CSE 952</td>
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<tr>
<td>4</td>
<td>Green Computing.</td>
<td>CSE 953</td>
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<tr>
<td>5</td>
<td>Security in Wireless &amp; Mobile System.</td>
<td>CSE 954</td>
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<tr>
<td>6</td>
<td>Programming Mobile Devices.</td>
<td>CSE 955</td>
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<tr>
<td>7</td>
<td>Embedded Systems.</td>
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<td>8</td>
<td>Wireless and Mobile Protocol</td>
<td>CSE 957</td>
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<td>9</td>
<td>Broad Band Network.</td>
<td>CSE 958</td>
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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:

Objectives:
The course is designed 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 4G wireless standards.

Subject Matter:
Unit I:
Cellular Communications

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
5. Lee- Mobile Communication & Networking. TMH
7. J. Schiller, “Mobile Communications”, Pearson Education.
10. Leo-Garcia & Widjaja, Communication Networks, TMH

B. Magazines:
2. “Communication Arts”, 10 Constitution Drive, Menlo Park, CA 94025.
5. Telecommunication Magazine.

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

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:  

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 online.

**Reading List:**

**A. Books**
1. Deo N, “Graph Theory with Applications to Engineering and Computer Science”, PHI
3. E.Balaguruswamy, “Numerical Methods”, TMH
8. W.D Wallis, “A Beginner’s guide to Graph Theory”, Boston

**B. Magazines:**
1. “Mathematic Magazine”, Washington DC 20036
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:**
2. Journal of Graph Theory.
4. Theoretical Computer Science
5. Annals of Functional Analysis
7. Journal of Dynamics and Differential Equations
8. Differential Equations
Name of the Module: Mobile Computing
Module Code: CSE 902
Semester:
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

Objectives:
The course is designed 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 applications
4. Creatively analyze mobile and wireless networks
5. Critically analyze security issues of mobile and wireless computing systems

Subject Matter:
Unit I:
Mobility of Bits and Bytes:

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:

Teaching/ Learning/ Practice Pattern:
Teaching: 60%
Learning: 40%
Practice: 0%
Examination Pattern: Theoretical Examination, Open book and on line.

Reading List:
A. Books
9. J. Schiller, “Mobile Communications”, Pearson Education,

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:

Objectives:
The course is design to meet the objectives of:

1. Steps in Research, Motivation, Types, good research techniques.
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

Sampling Design

Unit II: Measuring and Scaling Techniques

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

Processing and Analysis of Data

Unit III: Sampling Fundamentals

Testing of Hypothesis

Unit IV: Analysis of Variance and Co-varience
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
2. Ranjit Kumar, “Research Methodology”, SAGE Publications.
5. R. Panneerselvam, “Research Methodology” PHI Publication
6. V.V Khanzoe“Research Methodology- Techniques and Tools”, APH Publisher

B. Magazines:

C. Journals:
Name of the Module: Wireless Communication Laboratory
Module Code: Semester: CSE 905
Credit Value: 2 [P=3, T=0, L=0]
Module Leader:

**Objectives:**
The course is designed 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

  - 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**

**B. Magazines:**
2. Communication Arts, 10 Constitution Drive, Menlo Park, CA 94025.

**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)

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:

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

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
**Teaching/ Learning/ Practice Pattern:**
- Teaching: 60%
- Learning: 40%
- Practice: 0%

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

**Reading List:**

**A. Books**

**B. Magazines:**
- Cosmos, Australia.

**C. Journals:**
- Journal of Quantum Information Science, Scientific Research, ISSN Print: 2162-5751, ISSN Online: 2162-576X
- The Future of Quantum Information Processing, Science (Special Issue).
- The IEEE Journal of Quantum Electronics, IEEE
- 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. Medium access protocol, networking protocol, routing protocol, cross layer design, integration with 4G.
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, uncast routing algorithms, Multicast routing hierarchical routing, quos aware routing.

Unit III:
End-End Delivery And Security

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
10. Aggelou, “Mobile Ad Hoc Networks”, Tata McGraw-Hill Education

B. Magazines:

C. Journals:
2. Mobile Adhoc Networks, IFRSA.
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:

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:

Architectures:

Unit II:
Networking Sensors:

Unit III:
Infrastructure Establishment:
Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

Unit IV:
Sensor Network Platforms and Tools:

Teaching/ Learning/ Practice Pattern:
Teaching: 60%  
Learning: 40%  
Practice: 0%
**Examination Pattern:** Theoretical Examination, Open book and on line.

**Reading List:**

A. Books

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:**

**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

**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:**

UNIT 2:


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; Haddop 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
2. Gupta, Pranab Kumar Das, Nayak, Manojranjan, Pattnaik, Sabyasachi, “Cloud Computing-Based Projects Using Distributed Architecture”, PHI
B. Magazines:
1. Cloud Computing Magazine, USA

C. Journals:
2. International Journal of Cloud Computing, ISSN online: 2043-9997, ISSN print: 2043-9989

Name of the Module: Mobile Databases
Module Code: Semester: CSE 951
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

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**

**B. Magazines:**

**C. Journals:**

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

**Name of the Module: Multimedia Computing**
**Module Code: Semester: CSE 952**
**Credit Value: 3 [P=0, T=0, L=3]**

**Module Leader:**

**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:**

**Three-Dimensional Concepts**
Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations –
Three-Dimensional Viewing – Color models – Animation.

**Unit II:**
**Multimedia Systems Design**

**Unit III:**
**Multimedia File Handling**

**Unit IV:**
**Hypermedia**

**Teaching/ Learning/ Practice Pattern:**
- Teaching: 60%
- Learning: 40%
- Practice: 0%

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

**Reading List:**

**A. Books**

**B. Magazines:**

**C. Journals:**
1. ACM Transactions on Multimedia Computing, Communications and Applications, ACM
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:
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

Objectives:
The course is designed 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 e.g. Data centers, 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:
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, Telecomputing.
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.


Unit IV:
Green Networking: Where to save energy in Wired Networking, Taxonomy of Green Networking research:

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


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

Examination Pattern: Theoretical Examination, Open book and online.

Reading List:
A. Books
5. Greg Schulz, “The Green and Virtual Data Center”, CRC Press

B. Magazines:

C. Journals:
1. International Journal of Green Computing
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:

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:
Security Issues in a Mobile IPV6 Network,
Unit II:
Secure Mobile Commerce: MCommerce and its Security Challenges, Security of the radio interface

Unit III:

Unit IV:

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

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

Reading List:
A. Books

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:

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 Symbion 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:**

**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

**B. Magazines:**
1. Android Magazine, Imagine Publishing Ltd, Dorset

**C. Journals:**
2. Journal of Programmable Devices, Circuits, and Systems, ICGST

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

**Module Code:** CSE 956

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

Objectives:
The course is designed 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


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 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 online.
Reading List:

A. Books

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:
2. International Journal of Reconfigurable and Embedded Systems (IJRES), ISSN: 2089-4864, IAES

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:

Objectives:
The course is design to meet the objectives of:
2. Flow control, congestion control, error control, etc.
3. Typical routing algorithms, delay modelling, multiple-access principles, basic queueing theory etc.

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:

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
5. Perkins, Perkins Charles E., “Mobile IP”, Pearson Education India

B. Magazines:

C. Journals:
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:

Objectives:
The course is designed 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
2. James Trulove, “Broadband Networking”, Auerbach

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.

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