PG SYLLABUS
FOR
COMPUTER SCIENCE & ENGINEERING

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
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 five years back in 2010. I have therefore adopted a ‘B’ plan as stated below to achieve the primary goal of producing world class visionary engineers and exceptionally brilliant Researchers and Innovators:

**B- Plan**

- Best Teaching
- Best Research
- Best Entrepreneurship & Innovation practices
- Best Services to Society

In implementing the ‘B’ plan 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 few years to frame a syllabus in a framework which is perhaps not available in the country as of today, with an Indian perspective in a Global context.

Besides attention on ‘B’ plan 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 up to 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 that 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 syllabi are 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 flexibility of open learning.

II. System of examination in each course is conventional examination, open book examination and online examination.

Each course has been framed with definite objectives and learning outcomes. The 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 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 them.

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. Dr. C.T. Bhunia  
Director, NIT, (A.P.)

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### Proposed Course Structure for M.Tech In Computer Science & Engineering

**2 YEARS COURSE**

#### First Semester

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
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<tr>
<td>1</td>
<td>MCSE - 911</td>
<td>Advanced Data Structures and Algorithms</td>
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**Total**

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**NATIONAL INSTITUTE OF TECHNOLOGY**

(Established by Ministry of Human Resource Development, Govt. of India)

Yupia, District Papum Pare, Arunachal Pradesh – 791112

Fax: 0360 – 2284972, E-mail: nitarunachal@gmail.com
## Elective Courses

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Name of the Module: Advanced Data Structures and Algorithms

Module Code: MCSE - 911

Semester: 1st

Credit Value: 4 [P=2, T=0, L=3]

Module Leader:

A. Objectives:
The course is design to meet the objectives of:
1. Imparting theoretical and practical application to the students in the area of Data Structure application and Analysis of various algorithms paradigm.

B. Learning outcomes:
Students successfully completing this module will be able to:
1. assess performance efficiency of sequential algorithms,
2. design data structures to enable algorithms and design sequential algorithms for performance,
3. implement designing algorithms and corresponding data structures using object oriented programming languages,
4. demonstrate deployment of essential data structures such as lists, stacks, queues, and trees,
5. demonstrate the use of algorithm design methods such as divide and conquer.

C. Subject matter:

Unit I:
complexity and analysis, Asymtotic notations and their properties, best case, worse case & average case, recursive complexity, logarithmic complexity, optimal sorting, Sorting techniques complexity analysis

Unit II:
Dynamic data structures and their applications: stack, queue and their different types, tree and their different types, graph, dynamic graphs, data structures for memory optimization.

Unit III:
Dynamic programming: matrix chain multiplication, Greedy Paradigm, Graph algorithms: Strongly connected components, single source shortest paths, all pairs shortest path, Travelling salesman problems, Graph colouring; Amortized analysis.

Unit IV:
Matrix operations: Linear equations solver; Polynomials and FFT; String matching algorithms: Naïve approach, Rabin-Karp algorithm, Knuth-Morispratt algorithm, Approximation algorithms; Local search heuristics; Randomized algorithms. Introduction to P and NP, definition & characteristics of P and NP, examples and solutions.

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

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

F. Reading lists:
Books

Magazines:
1. MSDN Magazine, Microsoft and 1105 Media, USA
2. IBM system Magazine, IBM, USA

Journals:
4. IEEE Transactions on Computers, IEEE, Computer Society, United State
5. ACM Transactions on Embedded Computing Systems (TECS), ACM, United State

Name of the Module: Cryptography and Information Security
Module Code: MCSE - 912
Semester: 1st
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:
The course is designed to meet the objectives of:

1. Security breaches can be very expensive in terms of business disruption and the financial losses that may result,
2. Increasing volumes of sensitive information are transferred across the internet or intranets connected to it,
3. Networks that make use of internet links are becoming more popular because they are cheaper than dedicated leased lines. This, however, involves different users sharing internet links to transport their data,
4. Directors of business organizations are increasingly required to provide effective information security.

B. Learning outcomes:
Upon Completion of the subjects, students will be able to:
1. identify some of the factors driving the need for network security,
2. identify and classify particular examples of attack,
3. identify physical points of vulnerability in simple networks, possible threats and attacks,
4. compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems,
5. explain the implications of implementing encryption at different levels of the OSI reference mode,
6. explain what is meant by data integrity and give reasons for its importance,
7. describe methods of providing assurances about data integrity,
8. describe the use of hash functions and explain the characteristics of one-way and collision-free functions,
9. describe and distinguish between different mechanisms to assure the freshness of a message,
10. explain the role of third-party agents in the provision of authentication services,
11. discuss the effectiveness of passwords in access control and the influence of human behaviour.

C. Subject matter:
Unit I:

Unit II:
Modern Symmetric Techniques, Mathematics of symmetric key cryptography, Cryptanalysis of classical ciphers, General Attacks, Secret and Private Key Cryptography, DES, Modes of operation of DES, Automatic Variable Key, Proof of DES, Merits and Demerits of DES, Quantification of Performance, TDES, Advanced Encryption Standard/AES, Comparison of Secret Key Systems, Modes of operation of AES Limitations of AES, Limitation of Secret or Private Key Crypto systems.
Asymmetric key cryptography: Mathematics of Asymmetric key cryptography, Public Key Cryptography RSA Algorithm, Limitations of RSA Algorithm, Comparison of RSA and TRAP DOOR Public Key Crypto systems, Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystems.

Unit III:
Key management: Key Transport Protocols, Needham Schroeder Protocol, Key Agreement Protocol, Diffie -Hellman Protocol, Station to Station Protocol, Merkless Puzzle Technique of key agreement, Public Key Distribution, Message integrity and message authentication, Cryptography hash function, Digital Signature, Entity Authentication.

Unit IV:

D. Teaching/ Learning/ Practice pattern:
Teaching: 60%
Learning: 40%
Practice: 0%
E. **Examination pattern:** Theoretical Examination, Open book and online.

F. **Reading lists:**

Books:

Magazines:
2. *Info Sec Magazines*, United Kingdom.

Journals:

**Name of the Module:** Discrete Mathematics

**Module Code:** MAS 902

**Semester:** 1st

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

**Module Leader:**

A. **Objectives:**

The course is designed to meet with the objectives of:

1. to extend student’s Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems,
2. apply logical reasoning to solve a variety of problems.

B. **Learning outcomes:**

Upon completion of the subject:

1. Students will have acquired greater precision in logical argument and have gained a core mathematical understanding of discrete mathematics.
2. Students will have learned and practised basic concepts of mathematical proof (direct proof, proof by contradiction, mathematical induction).
3. Students will be able to handle the standard logical symbols with some confidence.
4. Students will have learned elementary combinatorial and counting techniques and how to apply them to simple problems.
5. Students will be able to simplify complex mathematical expressions and apply general formulae to specific contexts.
6. Students will have learned how to state precisely and prove elementary mathematical statements and solve problems.
7. Students will have a basic understanding of information technology and its use in mathematical contexts.

C. Subject matter:
Unit I:

Sets: Basic Concepts of Set theory-Representations of Discrete Structures – Relation and Ordering – Functions – Hashing functions – Natural Numbers-Recursion – Recursion in Mechanical theorem proving (Recursion used to prove theorem using statement logic)

Unit II:
Algebraic structures: Introduction – Algebraic systems:Examples and general properties – Semi groups and Monoids – Grammars and Languages – Polish expressions and their compilation – Groups - Application of Residue arithmetic to compilers – Group codes

Unit III:

Unit IV:
Number theory: Greatest Common Divisors - The Euclidean Algorithm - Prime Numbers - The Fundamental Theorem of Arithmetic - Congruences - The Chinese Remainder Theorem

D. Teaching/ Learning/ Practice pattern:
Teaching:50%
Learning: 50%
Practice : 0%

E. Examination pattern: Theoretical Examination, Open book and Online.

F. Reading lists:
Books:

Magazines:
1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of She_eld).
5. +Plus magazine (University of Cambridge).

Journals:
1. Journal of Computational and Graphical Statistics
2. Groups, Geometry, and Dynamics
3. Journal of Combinatorial Theory - Series A
4. Discrete and Continuous Dynamical Systems
5. Constraints
7. Graphs and Combinatorics
8. Advances in Mathematics of Communications
9. Discrete Mathematics
10. Graphs and Combinatorics

**Name of the Module:** Probability, Statistics and Advanced Numerical Methods

**Module Code:** MAS - 903

**Semester:** 1st

**Credit Value:** 4 [P=0, T=1, L=3]

**Module Leader:**

**A. Objectives:**
The course is design to meet the following objectives:

1. imparting theoretical knowledge and practical application to the students in the area of Probability and Statistics,
2. introducing the basic notions of probability theory and develops them to the stage where one can begin, to use probabilistic ideas in statistical inference and modeling, and the study of stochastic processes,
3. providing confidence to students in manipulating and drawing conclusions from data and provide them with a critical framework for evaluating study designs and results,
4. injecting future scope and the research directions in the field of Probability and Statistics.

**B. Learning outcomes:**
Upon completion of the subject

1. students will add new interactive activities to fill gaps that we have identified by analyzing student log data and by gathering input from other college professors on where students typically have difficulties.
2. Students will add new simulation-style activities to the course in Inference and Probability.
3. Students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

Unit I:


- **Distributions**: Discrete distributions (Binomial and Multinomial Distributions, Hypergeometric Distribution, Negative Binomial, Geometric Distributions, Poisson Distribution and the Poisson Process) - Continuous (Continuous Uniform Distribution, Normal Distribution (Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial), Gamma and Exponential Distributions, Chi-Squared Distribution, Beta Distribution, Lognormal Distribution)

- **Functions of Random Variables**: Introduction-Transformations of Variables-Moments and Moment-Generating Functions

- **Fundamental Sampling Distributions and Data Descriptions**: Random Sampling- Some Important Statistics (Mean, Standard deviation, Median, Mode etc) - Sampling Distributions- Sampling Distribution of Means and the Central Limit Theorem- Sampling Distribution of \( S^2 \) – \( t \)-distribution - \( F \)-Distribution

Unit II:


Unit III:

- **Simple Linear Regression and Correlation**: Introduction to Linear Regression- The Simple Linear Regression Model - Least Squares and the Fitted Model - Properties of the Least Squares Estimators- Inferences Concerning the Regression Coefficients- Prediction

Unit IV:

D. Teaching/ Learning/ Practice pattern:
Teaching: 50%
Learning: 50%
Practice: 0%

E. Examination pattern: Theoretical Examination, Open book and on line.

F. Reading lists:
Books:
16. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists
Magazines:
1. *Current Science* (Indian Academy of Science).

Journals:
1. *Advances in Probability and Related Topics* (Marcel Dekker).
4. *Communications on Stochastic Analysis*.

**Name of the Module:** Research Paper Communication  
**Module Code:** CSE - 904  
**Semester:** 1st  
**Credit Value:** 3 \([P=0, \ T=0, \ L=3]\)  
**Module Leader:**

A. **Objectives:**  
The course is designed to meet the objectives of:  
steps in Research, Motivation, Types, good research techniques,  
methods of Data collection, Processing, Analysis techniques of raw datas,  
hypothesis, Technical writing techniques etc.

B. **Learning outcomes:**  
Upon Completion of the subjects, students will be able to:  
Write techniques of research paper.  
Collect raw data, processing data using mathematics computation, transformation, and other else.
Write Hypothesis techniques, testing techniques of Hypothesis etc.

C. 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
D. Teaching/ Learning/ Practice pattern:
   Teaching: 60%
   Learning: 40%
   Practice: 0%

E. Examination pattern: Theoretical Examination, Open book and on line.

F. Reading lists:
   Books:
   2. Ranjit Kumar, “Research Methodology”, SAGE Publications.
   5. R. Panneerselvam, “Research Methodology” PHI Publication
   6. V V Khanzode “Research Methodology- Techniques and Tools”, APH Publisher

   Magazines:

   Journals:

SECOND SEMESTER

Name of the Module: Internet Technology
Module Code: MCSE -921
Semester:
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:
The course is design to meet with the objectives of:
   1. study of Structure of Network and its different protocols,
   2. study of TCP/IP and OSI model,
   3. study of configuration of different types of server in windows and Linux based platform,
   4. study of designing of websites etc

B. Learning outcomes:
After completion of the module students will be able to:
   1. Explain the roles of key elements in data communication.
   2. Explain the uses, hardware requirements and advantages of WANs.
   3. Describe the application and operation of protocols.
   4. Describe and distinguish features of node addressing methods.
   5. Describe the standards for industry network architectures.
   6. Study of research areas in wired and wireless network structure, MANET etc.
C. Subject matter:
Unit I:
Introduction: Internet, History and Evolution of internet, Types of Network, OSI model, TCP/IP model,
Data Transmission/The Physical Layer: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments,
Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing.

Unit II:

Unit III:

Unit IV:
Introduction to Wireless LAN: How does WLAN work?, WLAN setups (Ad-hoc, infracture LAN), Use of WLAN, Benefits of WLAN, Restrictions and Problem with WLAN.
Introduction to CORBA: CORBA Architecture, Comparison between RMI and CORBA.
Inter activity tools, Multimedia and Animation, WWW and Web browser, Web publishing, CGL,
Web page design, HTML and its different examples, Server side and Client Side Programming- ASP, JSP, VB Script, Java Script etc, Different Frameworks of web site designing languages. Configuration of different types of server- Web server, Mail server, DNS server, FTP server, DHCP server etc.

D. List of practicals:
1. Experimental study of application protocols such as HTTP, FTP, SMTP, using network packet sniffers and analyzers such as Ethereal. Small exercises in socket programming in C/C++/Java.
2. Experiments with packet sniffers to study the TCP protocol. Using OS (netstat, etc) tools to understand TCP protocol FSM, retransmission timer behavior congestion control behaviour.
3. Introduction to ns2 (network simulator) - small simulation exercises to study TCP behavior under different scenarios.
4. Setting up a small IP network - configure interfaces, IP addresses and routing protocols to set up a small IP network. Study dynamic behaviour using packet sniffers.
5. Experiments with ns2 to study behaviour (especially performance of) link layer protocols such as Ethernet and 802.11 wireless LAN.
6. Practical on Server Configuration Example, Web Server, Mail Server, FTP Server etc.
7. Practice on Cisco Packet Tracer simulator.

E. Teaching/ Learning/ Practice pattern:
Teaching: 60%
Learning: 40%
Practice: 0%

F. Examination pattern: Theoretical Examination, Open book and on line.

G. Reading lists:

Books:
7. W.R.Stevens, “TCP/IP Illustrated”, Addison-Wesley

Magazines:
1. Network World, IT, United states, Massachusetts
2. Network Magazine, Indian Express, India

Journals:
3. Journal of Computer Networks and Communications, Elsevier, Netherland

Name of the Module: Virtualization and Cloud Computing
Module Code: MCSE -922
Semester: 2nd
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:
A. Objectives:
The course is designed 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,

B. Learning outcomes:
Upon completion of the subjects, students will be able to:
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.

C. Subject matter:
Unit I:
Data Centre foot prints & Concepts
Introduction To cloud Virtualization concepts
   Types of Virtualization & its benefits
   Introduction to Various Virtualization OS
   Vmware , KVM etc
   HA/DR using Virtualization
   Moving VMs
   SAN backend concepts
Cloud Fundamentals:
   Cloud Building Blocks
   Understanding Public & Private cloud environments
Unit II:
Cloud as SaaS
Private Cloud Environment
   Basics of Private cloud infrastructure
   QRM cloud demo
Public Cloud Environment
   Understanding & exploring Amazon Web services
   Managing and Creating Amazon EC2 instances
   Managing and Creating Amazon EBS volumes
   Tata Cloud details & demo
Managing Hybrid Cloud environment
Unit III:
Setting up your own Cloud
How to build private cloud using open source tools
Understanding various cloud plugins
Setting up your own cloud environment
   Auto provisioning
Custom images
Integrating tools like Nagios

Integration of Public and Private cloud

Unit IV:
Future directions
Cloud Domain and scope of work
Cloud as PaaS, SaaS
Cloud Computing Programming Introduction
Trends and market of cloud

D. Teaching/ Learning/ Practice pattern:
   Teaching: 60%
   Learning: 40%
   Practice: 0%

E. Examination pattern: Theoretical Examination, Open book and on line.

F. Reading lists:
Books
2. Gupta, Pranab Kumar Das, Nayak, Manojranjan, Pattnaik, Sabyasachi, “Cloud Computing-Based Projects Using Distributed Architecture”, PHI

Magazines:
1. Cloud Computing Magazine, USA

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

Name of the Module: Distributed Operating System
Module Code: MCSE -923
Semester: 2\textsuperscript{nd}
Credit Value: 4 \{P=2, T=0, L=3\}
Module Leader:

A. Objectives:
The course is design to meet the objectives of:
1. study of basic structure of Operating System,
2. difference between OS and Distributed Operating Systems,
3. study of Memory Management, Synchronization, Fault Tolerance, Deadlock,
4. study of Multiprocessor Operating System, its Architecture and Management.

B. Subject matter:
   Upon Completion of the subjects:
   1. Students will be able to work in threats programming.
   2. Student will able to understand and work in Distributed File System.
   3. Student will able to work in UNIX base Operating Systems.
   4. Student will understand Fault Tolerance under UNIX.

C. Subject matters:
Unit I:
Introduction: Function of an operating system, Design approaches, concepts of processes, threats, Critical Section problem, Other synchronization problem, Communicating sequential processes.

Unit II
Distributed Mutual Exclusion: Classifications of Mutual Exclusion, Preliminaries, Solutions of Mutual Exclusions- Non token based algorithm, Lamport’s Algorithm, Maekawa’s Algorithm, Token Based Algorithm etc.

Unit III:
Distributed Shared Memory: Architecture and Motivation, Algorithm for Implementing of DMS,Memory Coherence, Coherence Protocol, Case Studies- IVY, Mirage, Clouds.

Unit IV:
Failure Recovery: Classification of Failures, Backward and Forward Error recovery, Recovery in concurrent systems, Check points.
Multiprocessor System Architecture: Motivations, Basic Architecture, Caching, Hypercube Architecture,

D. Teaching/ Learning/ Practice pattern:
   Teaching: 60%
   Learning: 40%
   Practice: 0%
E. Examination pattern: Theoretical Examination, Open book and online.

F. Reading lists:
Books

Magazines:
1. Apple Mac OS X Lion 10.7.4, PC

Journals:
3. IEEE Transactions on Parallel and Distributed Systems, IEEE
Elective Courses

Name of the Module: Quantum Computing
Module Code: MCSE 950
Semester: Second Semester
Credit Value: 3 \([P=0, T=0, L=3]\)
Module Leader:

A. Objectives:
The course is designed 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.

B. 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.
3. Work with Quantum Simulator like Revkit 1.3, JQuantum etc to design and verify different quantum circuits.

C. Subject matter:
Unit I:
Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.

Unit II:

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:

D. **Teaching/ Learning/ Practice pattern:**
   - Teaching: 60%
   - Learning: 40%
   - Practice: 0%

E. **Examination pattern:** Theoretical Examination, Open book and on line Examination.

F. **Reading lists:**
   **Books**

   **Magazines:**
   1. Cosmos, Australia.

   **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).*
   5. *International Journal of Quantum Information, Print ISSN: 0219-7499, Online ISSN: 1793-6918*
Name of the Module: Image Processing
Module Code: MCSE-951
Semester:
Credit Value: 3 \( [P=0, T=0, L=3] \)
Module Leader:

A. Objectives:
The course is designed to meet the objectives of:
1. give the students a general understanding of the fundamentals of digital image processing,
2. introduce the student to analytical tools which are currently used in digital image processing as applied to image information for human viewing,
3. develop the students ability to apply these tools in the laboratory in image restoration, enhancement and compression,
4. understand differences between computer vision and image processing,
5. know the basic components of an image processing system.

B. Learning outcomes:
Upon Completion of the subjects:
1. Understand the basics of the human visual system as they relate to image processing; including spatial frequency resolution and brightness adaptation.
2. Understand how images are represented; including optical images, analog images, and digital images. Understand image types such as binary images, gray-scale images, color and multi-spectral images.
3. Know the key concepts in image file formats.
4. Understand the model for an image analysis process.
5. Understand why preprocessing is performed and know about image geometry, convolution masks, image algebra and basic spatial filters.
6. Understand image quantization in both the spatial and brightness domains.
7. Know about the 2-D Fourier, discrete cosine, Walsh-Hadamard and wavelet transforms; including implied symmetry, phase, circular convolution, vector inner and outer products and filtering.
8. Know why log remapping is necessary for viewing spectral image data.
9. Understand lowpass, highpass, bandpass, notch filters; including ideal and non-ideal filters such as the Butterworth.

C. Subject matter:
Unit I:

Unit II:
Image transforms and enhancement

Unit III:


Unit IV:
Image compression & segmentation


D. Teaching/ Learning/ Practice pattern:
Teaching: 60%
Learning: 40%
Practice: 0%

E. Examination pattern: Theoretical Examination, Open book and on line.

F. Reading lists:
Books:

Magazines:
2. IET Digital Library: IET Image Processing
3. IEEE Signal Processing Magazine

Journals:
1. Image Processing, IEEE Transactions
2. Computer Vision, Graphics, and Image Processing, Science Direct
3. International Journal of Image Processing (IJIP), ISSN - 1985-2304

Name of the Module: Soft Computing
Module Code: MCSE-952
Semester:
Credit Value: 3 \( [P=0, T=0, L=3] \)
Module Leader:

A. Objectives:
The course is designed to meet with the objectives of:
1. introducing the fundamental concepts of Soft Computing;
2. equip with the knowledge and skills in logic programming;
3. exploring the different paradigms in knowledge representation and reasoning;
4. understanding the contemporary techniques in machine learning;
5. evaluating the effectiveness of hybridization of different artificial intelligence techniques.
6. fundamentals of non-traditional technologies and approaches to solving hard real-world problems, namely of fundamentals of artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms

B. Learning outcomes:
Students successfully completing this module will be able to:
1. understand the history, development and various applications of Soft Computing.
2. familiarize with propositional and predicate logic and their roles in logic programming;
3. learn the knowledge representation and reasoning techniques in rule-based systems, case-based systems, and model-based systems;
4. appreciate how uncertainty is being tackled in the knowledge representation and reasoning process, in particular, techniques based on probability theory and possibility theory (fuzzy logic);
5. master the skills and techniques in machine learning, such as decision tree induction, artificial neural networks, and genetic algorithm;
6. understand neural network(NN) paradigms, fuzzy logic, genetic algorithm(GA), evolutionary programming, classifier systems, genetic programming parse trees, mathematical foundation of GA variants of GA

C. Subject matter:
Unit I:
Artificial Neural Network: Basic concept of Soft Computing: Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer, multilayer, competitive layer; Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Neuron.
Unit II:

**Pattern Recognition:** Pattern Classification, Pattern Association, Clustering, Simple Clustering algorithm, k-means & k-medoid based algorithm.

**Models Of Neural Network:** Architecture, Algorithm & Application of --- McCulloh-Pitts, Hebb Net, Perceptron (with limitations & Perceptron learning rule Convergence theorem), Backpropagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet, Kohonen Self Organizing Maps, ART1, ART2.

Unit III:

**Fuzzy Sets & Logic:** Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable, basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; De-fuzzification methods; FAM;

Unit IV:

**Genetic Algorithm:** Basic concept; role of GA in optimization, Fitness function, Selection of initial population, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation; Genetic Programming; Schema theorem; Multiobjective & Multimodal optimization in GA; Application—Travelling Salesman Problem, Graph Coloring problem;

**Hybrid Systems:** Hybrid systems, GA based BPNN(Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN—fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A;

D. **Teaching/ Learning/ Practice pattern:**
   - Teaching: 40%
   - Learning: 10%
   - Practice: 50%

E. **Examination pattern:**
   1. Theoretical Examination: Regular Examination.
   2. Practical Examination: Conducting experiment and viva voice

F. **Reading list:**

   **Books**

**Magazines:**

28
1. *AI Magazine* - *Association for the Advancement of Artificial Intelligence, AAAI Press, USA*
2. *IEEE Intelligent Systems Magazine, Computer Society, United State*

**Journals:**
1. *Artificial Intelligence*, Elsevier, Netherland, ISSN: 0004-3702
2. *Artificial Intelligence in medicine*, Elsevier, Netherland, ISSN: 0933-3657
3. *Journal of Artificial Intelligent Research(JAIR)*, AAAI Press, USA, ISSN 1076-9757

**Name of the Module:** Multimedia & Multimedia Communication

**Module Code:** MCSE-953

**Semester:**

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

**Module Leader:**

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**A. Objectives:**
The course is designed to meet with the objectives of:
1. basic of Multimedia, Digital media & Hypermedia, different file formats of multimedia, data compression, media I/O technologies,
2. study of different networking protocols in multimedia application.

**B. Learning outcomes:**
By the end of the module,
1. Students are able to understand the basics concepts of multimedia communications.
2. They will be able to judge if specific applications can be deployed on specific networks.
3. The students also gain a deep understanding of how to close the gap between application requirements and network support.

**C. Subject matter:**

**Unit I:**

**Unit II:**
- Image authoring and editing tools, image file formats, JPEG, TIFF,,GIF, PNG, Layers,RGB, CMYK; contrast, brightness, HUE, Slicing, Contrast Ratio. Aspect ratio. Gray Scale filters, blending tools, Image enhancing designing technique.
Unit III:

Unit IV:

D. Teaching/ Learning/ Practice pattern:
Teaching: 40%
Learning: 10%
Practice: 50%

E. Examination pattern:
1. Theoretical Examination: Regular Examination.
2. Practical Examination: Conducting experiment and viva voice

F. Reading lists:
Books

Magazines:
1. IEEE Multi Media Magazine, IEEE Computer Society, United State

Journals:
1. International Journal of Mobile Computing and Multimedia Communications (IJMCMC)

Name of the Module: Advanced DBMS and Data Mining
Module Code: MCSE-954  
Semester:  
Credit Value: 3\[P=0, T=0, L=3\]  
Module Leader:

A. Objectives:  
The course is designed to meet the objectives of:  
1. to understand classical models and algorithms in data warehousing and data mining,  
2. to enable students to analyse the data, identify the problems, and choose the relevant models and algorithms to apply,  
3. to assess the strengths and weaknesses of various methods and algorithms and to analyse their behaviour.

B. Learning outcomes:  
Upon completion of the subjects:  
1. Learn implementation of classical algorithms in data mining and data warehousing;  
2. Learn to identify the application area of algorithms, and apply them.

C. Subject matter:  
Unit I:  
**DBMS:** Introduction to DBMS, Purpose of DBMS, Advantages of DBMS over different approaches, Data Models, Query and SQL optimization: SQL standards, Data types, DDL, DML, Static Vs Dynamic Query, Query optimization, PL/SQL.

Unit II:  
**Transaction Processing and Concurrency Control:** Properties of Transaction, Serialization, Locking Mechanism - Two phase Commit protocol, Deadlock.  
**Data Warehousing:** Data warehousing Components – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools – Metadata.

Unit III:  
**Data Mining:** Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues – Data Preprocessing.

Unit IV:  
**Association Rule Mining and Classification:** Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Backpropagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.  
**Clustering and Applications and Trends in Data Mining:** Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – Kmeans – Partitioning Methods – Hierarchical Methods - Density-Based Methods – Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

D. Teaching/ Learning/ Practice pattern:  
Teaching: 40%  
Learning: 10%  
Practice: 50%
E. Examination pattern:
1. Theoretical Examination: Regular Examination.
2. Practical Examination: Conducting experiment and viva voice

F. Reading lists:
Books:
1. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, TataMcGraw
2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, SecondEdition,
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction To Data Mining”, Person
4. K.P. Soman, Shyam Diwakar and V. Ajay “, Insight into Data mining Theory and Practice”,
5. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition,

Magazines:
1. Big Data Innovation Magazine
2. IBM Systems Magazine, IBM, New York, U.S.
3. IT - Data Management Magazines, IBM, New York, U.S.
4. Relational Database Management Systems (RDBMS and DBMS), IBM, New York, U.S.
5. Why “Big Data” Is a Big Deal, Harvard Magazine

Journals:
1. Knowledge and Data Engineering, IEEE Transactions, ISSN: 1041-4347
2. Data Mining and Knowledge Discovery, Springer, ISSN: 1384-5810 (Print) 1573-756X
   (Online)
3. International Journal of Data Mining, Modelling and Management, ISSN online: 1759-1171,
   ISSN print: 1759-1163
4. Journals in Database Management & Info Retrieval - Springer, United States
5. International Journal of Database Management Systems (IJDMS), Academy & Industry
   Research Collaboration Center (AIRCC)
6. Journal of Database Management (JDM), IGI, Hershey-New York, USA

Name of the Module: Advanced Software Engineering
Module Code: MCSE-955
Semester:
Credit Value: 3[P=0, T=0, L=3]
Module Leader:

A. Objectives:
The course is design to meet with the objectives of:
1. to solve the software crisis where software is delivered late, with faults, and over budget. Software engineering aims to deliver fault free software, on time and within budget, meeting the requirements and needs of the client. The software is developed keeping in mind the future maintenance that is involved,

2. to design, implement, and modify software that is high quality, affordable, and maintainable. It's applying the engineering discipline to software such that consistently high quality software can be built within a calculated time and budget.

B. Learning outcomes:
At the end of this lesson the student will be able to:
1. Identify the scope and necessity of software engineering.
2. Identify the causes of and solutions for software crisis.
3. Differentiate a piece of program from a software product.

C. Subject matter:
Unit I:
System Design: Problem Partitioning, Top-Down and Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object-Oriented approach.

Unit II:

Unit III:
Technical Issues And Object Oriented Software Engineering:
UML 2.0 and the Unified Process: Overview of UML 2.0, Unified Process
Inception: Use cases, Supplementary specification, Glossary and Vision
Elaboration Iteration 1 – Domain Model: System Sequence Diagrams, Domain Model, Contracts for System Operations
Elaboration Iteration 1 – Design Patterns, Design patterns
Elaboration – Iteration 1 Design Model: Use Case Realization, Use case realizations
Elaboration – Iteration 1 Design Model: Design Class Diagram, Design class diagram
Elaboration Iteration 1 – Implementation Model, Mapping design to code
Elaboration Iterations 2 and 3, Iteration 2 and its requirements, Iteration 3 and its requirements, Package structures
Design With Layers, Logical Architecture and Software Architecture, Applying UML: Package Diagrams, Design with Layers
N+1 Views

Unit IV:
Software Project Management: Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.
Software modelling: with Unified Modelling Language.
CASE TOOLS: Concepts, use and application.

D. Teaching/Learning/Practice pattern:
Teaching: 60%
Learning: 40%
Practice: 0%

E. Examination pattern:
1. Theoretical Examination: Regular Examination.
2. Practical Examination: Conducting experiment and viva voice

F. Reading lists:
Books:

Magazines:
1. CrossTalk Magazine
2. Software Quality Engineering
3. Better Software Magazine

Journals:
2. TSE - IEEE Transactions on Software Engineering, IEEE Computer Society, United States
3. ACM Sigsoft Software Engineering Notes, ACM, United States
4. SPE - Software - Practice and Experience

Name of the Module: Green Computing
Module Code: MCSE-956
Semester:
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. 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 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.
B. 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.

C. 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, Telecommputing.
Thin Clients: Introduction of thin clients, Characteristics of thin clients, Thin Clients variants.
Dynamic Voltage/Frequency Scaling - DVFS, DVF, DVS in microprocessor and small handheld gazettes.

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:

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


Introduction to reversible computing and quantum computing in energy saving

D. Teaching/ Learning/ Practice pattern:
Teaching: 60%
Learning: 40%
E. Examination pattern: Theoretical Examination, Open book and on line.

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

Magazines:

Journals:
2. Sustainable Computing: Informatics and Systems, Elsevier, ISSN: 2210-5379
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: Parallel Algorithms
Module Code: MCSE -957
Semester:
Credit Value: 3[P=0, T=0, L=3]
Module Leader:

A. Objectives:
The course is design to meet with the objectives of:
1. basics of parallel and distributed computing,
2. study different aspects of Parallel Models,
3. study different aspects of Interconnection Architecture,
4. analyse a number of fundamental parallel algorithms from various application domains,
5. principles of parallel and distributed algorithms and their time complexity.

B. Learning outcomes:
After completion of the course student will be able to:
1. Understand the role of computation models in parallel computation.
2. Understand the circuit and comparison network models.
3. Understand the basics of merging and sorting networks.

C. Subject matter:
Unit I:
Parallel Models (SIMD, MIMD, PRAMs, Interconnection Networks);
Performance Measures (Time, Processors, Space, Work);
Sequential model, need of alternative model, parallel computational models such as PRAM,
LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model,
Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model
from another one.

Unit II:
Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Costoptimality, An
eample of illustrate Cost-optimal algorithms such as summation, Min/Max on various models.
Techniques (Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Pipelining,
Systolic Computation, Acccelerated Cascading, Prefix Computation, List
Ranking, Euler Tour, Tree Contraction);

Unit III:
Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting
Networks on CREW/EREW/MCC/, linear array

Unit IV:
Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix
Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication,
Solution of Linear Equation, Root finding. Graph Algorithms - Connected Graphs, search and
traversal, Combinatorial Algorithms- Permutation, Combinations, Derrangements, Complexity
(Lower bounds, NC Class and P-Completeness).

D. Teaching/ Learning/ Practice pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

E. Examination pattern:
1. Theoretical Examination: Regular Examination.
2. Practical Examination: Conducting experiment and viva voice

F. Reading lists:
Books
5. V. Kumar, A. Grama, A. Gupta, G. Karypis, “Introduction to Parallel Computing”, The

Magazines:

Journals:
1. International Journal of Parallel Programming, Springer, United State
2. Journal of Parallel and Distributed Computing, Elsevier, Neitherland
3. Parallel Computing, Elsevier, ISSN: 0167-8191

Name of the Module: Mobile Adhoc Networks
Module Code: MCSE -958
Semester:
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. 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.

B. 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.

C. Subject matter:
Unit I: Introduction
Introduction to Adhoc networks – definition, characteristics features, Application, Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models, WLAN, Bluetooth, Short range ADHOC networks- Body area network, Wireless Personal area network.
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: Decentralized Routing Algorithm, Global routing algorithm, Proactive vs. reactive routing, uncast routing algorithms, Multicast routing hierarchical routing, Link state
routing, distance vector routing, QoS aware routing, Routing and mobile management in mobile wireless network

**Unit III:**  
**End-End Delivery and Security**  
Transports layer: Issues in designing- transport layer classification, adhoc transport 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.

**D. Teaching/ Learning/ Practice pattern:**

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

**E. Examination pattern:** Theoretical Examination, Open book and on line.

**F. Reading lists:**

**Books:**
10. Aggelou, “Mobile Ad Hoc Networks”, Tata Mcgraw-Hill Education

**Magazines:**

**Journals:**
2. Mobile Adhoc Networks, IFRSA.
3. Mobile ad hoc networking: milestones, challenges, and new research directions, IEEE, ISSN: 0163-6804
5. International Journal of Smart Sensors and Ad Hoc Networks