

PROPOSED COURSE STRUCTURE AND SYLLABUS

FOR M. S. PROGRAMME IN

MATHEMATICS & COMPUTING



**NATIONAL INSTITUTE OF TECHNOLOGY, YUPIA
ARUNACHAL PRADESH - 791 112**

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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

1. Best for Teaching
2. Best for Research
3. Best for Entrepreneurship & Innovation
4. Best for Services to Society

In implementing the **B formula** in letter and spirit, the framing of syllabi has been taken as **important legitimate parameter**. Therefore, extraordinary **efforts and dedications** were directed for the last one year to frame a syllabus 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:

1. The **present system is producing Academic Engineers rather than Practical Engineers**.

2. The present system of education makes the **students to run after jobs rather than making them competent to create jobs.**
3. 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 a credible syllabus has been framed in the institute in which the major innovations are introduction of:

1. 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.
2. Man making and service to society oriented compulsory credit courses of NCC/NSS, values & ethics.
3. Compulsory audit course on Entrepreneurship for all branches.
4. Many add-on courses those are (non-credit courses) to be offered in vacation to enhance the employability of the students.
5. Many audit courses like French, German, and Chinese to enhance the communication skill in global scale for the students.
6. Research and imagination building courses such as Research Paper Communication.
7. Design Course as Creative Design.

Further, the syllabi have 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 has been made available** in case to case.

The syllabus is also innovative as it includes:

1. In addition to the list of text and reference books, a list of journals and Magazines for giving students a flexible of open learning.
2. 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:

1. J.C. Bose model of teaching where practice is the first theory.
2. 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:

1. 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.
2. 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 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. Dr. C.T. Bhunia
Director, NIT, (A.P.)

1. **Preamble:** In practice and operation are:

- (a) Full Time Course
- (b) Online Course
- (c) Distance Mode
- (d) Part-Time Course

It is proposed to have a different kind of course called Holiday Course. The course will be taught in weekly holidays of Saturdays and Sundays and in other holidays except selected National Holidays (26th January & 15th August) and in vacations. Such a course will facilitate a wide flexibility to various groups of aspirants of higher degrees like (a) working people (b) economically backward candidates (c) those who are not getting opportunity to earn PG degrees in conventional mode of education.

It is proposed to start a course initially in M.S. programme in Mathematics & Computer Science (Holiday Course)

2. **Objective:** Objectives are many fold:

- (a) To optimally utilize the resources of Departmental of Mathematics and that of the Computer Science & Engineering of NIT, Arunachal Pradesh.
- (b) To offer timely needed inter disciplinary course of Mathematics & Computing which are logically dependent with each other.
- (c) To initiate a Master Programme in Science discipline without spending much investment in laboratories and other infrastructures.
- (d) To provide an unique opportunity for Master Programme for wide section of the aspirants not getting in conventional mode of education system.

3. **Admission Procedure:**

- (a) Eligibility: B. Sc. with Math./B.C.A./B.E. & B. Tech. with atleast 4 Mathematics papers/ B. Sc. (Electronics) & B. Sc. (Computer Sc.) or equivalent with minimum of 55% marks may be admitted in initial intake of 20 students.
- (b) Selection: Based on interview to be conducted by the Institute.

4. **Operational Procedure:**

- (a) Class will be conducted only on Saturdays, Sundays & Holidays including vacation except selected National Holidays (26th January & 15th August).
- (b) Semester will begin on 15th May each year.

[Odd Semester : May to October

Even Semester : November to April]

5. Course Fee: Rs 10,000/- per semester per candidate.

Incase a candidate appears final year of qualifying examination and gets selected he/she may take admission even if his/her final year result is awaited. He/She has to submit final year result with required eligibility before first semester examination, without failing.

<u>First Semester</u>						
Subject Code	Subject	Model	P	T	L	Credit
MAC 911	Abstract Algebra	S.N. Bose	0	1	3	4
MAC 912	Real Analysis	S.N. Bose	0	1	0	3
MAC 913	Complex Analysis	S.N. Bose	0	1	3	4
MAC 914	Binary Arithmetics & Logic Operations	J.C. Bose	2	0	3	4
MAC 915	Computer Programming Language	J.C. Bose	2	0	3	4
MAC 916	Data Structure	J.C. Bose	2	0	3	4
	Total credit					24
<u>Second Semester</u>						
Subject Code	Subject	Model	P	T	L	Credit
MAC 921	Linear Algebra	S.N. Bose	0	1	3	4
MAC 922	Probability & Statistics	S.N. Bose	0	1	3	4
MAC 923	Numerical Methods	J.C. Bose	2	0	3	4
MAC 924	Principles of Operating Systems	S.N. Bose	2	0	3	4
MAC 925	Design and Analysis of Algorithms	S.N. Bose	0	1	3	4
MAC 926	Soft Computing Techniques	J.C. Bose	2	0	3	4
	Total credit					24
<u>Third Semester</u>						
Subject Code	Subject	Model	P	T	L	Credit
MAC 931	Operation Research	S.N. Bose	0	1	3	4
MAC 932	Special Functions & Integral Transforms	S.N. Bose	0	1	3	4
MAC 933	Financial Computing	S.N. Bose	0	1	3	4
MAC 934	Database Management System	J.C. Bose	2	0	3	4
MAC 935	Software Engineering	J.C. Bose	2	0	3	4
MAC 936	Computer Networking	J.C. Bose	2	0	3	4
	Total credit					24
<u>Fourth Semester</u>						
Subject Code	Subject	Model	L	T	P	Credit
MAC 94X	Elective - I	S.N. Bose	3	1	0	4
MAC 94X	Elective - II	S.N. Bose	3	1	0	4
MAC 94X	Elective - III	S.N. Bose	3	1	0	4
MAC 94X	Elective - IV	S.N. Bose	3	1	0	4
MAC 946	Project	J.C. Bose	0	0	8	8
	Total credit					24

List of Electives:

1. MAC 941: Graph Theory
2. MAC 942: Quantum Computing
3. MAC 943: ERP Solutions
4. MAC 944: Entrepreneurship Practices
5. MAC 945: Internet and Web Technology
6. MAC 946: Information and System Security
7. MAC 947: Knowledge Management

Name of the Module: Abstract Algebra

Module Code: MAC 911

Semester: 1st

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics.
2. The focus of the course will be the study of certain structures called groups, rings, fields and some related structures.
3. Abstract algebra gives to student a good mathematical maturity and enables to build mathematical thinking and skill.

Learning outcomes:

Upon completion of the subject:

1. The student will be able to define the concepts of group, ring, field, and will be able to readily give examples of each of these kinds of algebraic structures.
2. The student will be able to define the concepts of coset and normal subgroup and to prove elementary propositions involving these concepts.
3. The student will be able to define the concept of subgroup and will be able to determine (prove or disprove), in specific examples, whether a given subset of a group is a subgroup of the group.
4. The student will be able to define and work with the concepts of homomorphism and isomorphism.

Subject Matter:

Unit I

Review of groups, Subgroups, Normal subgroups, Quotient group, Group Homomorphism.

Unit II

Permutation groups, Cayley theorem, Cyclic group, Direct product of groups, Finite abelian groups, Cauchy theorem and Sylow theorem.

Unit III

Ring, Zero divisor, Integral domain, Ideals, Quotient ring, Isomorphism theorems, Polynomial ring, Euclidean ring, Prime & Irreducible elements & their properties, UFD, PID and Euclidean Domain.

Unit IV

Field, Finite Fields, Field Extensions, Galois theory.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd, 2008.
2. S. Lang, Algebra, Addison Wesley.
3. J. B. Fraleigh, A First Course in Abstract Algebra.
4. C. Musili, Introduction of Rings and Modules, Narosa Publishing House.
5. M. Artin, Algebra, PHI.
6. P. B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra, Cambridge University Press, 1995.
7. J. Fraleigh, A First Course in Abstract Algebra, Pearson, 2003.
8. D. Dummit and R. Foote, Abstract Algebra, Wiley, 2004.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).

C. Journals:

1. Ganita Sandesh.

2. Journal of Rajasthan Academy of Physical Sciences.
3. Bulletin of Calcutta Mathematical Society.
4. Algebra Colloquium.
5. Applicable Algebra in Engineering, Communication and Computing.
6. Contributions to Algebra and Geometry.
7. Communications in Algebra.
8. Journal of Algebra.
9. Journal of Pure and Applied Algebra.

Name of the Module: Real Analysis

Module Code: MAC 912

Semester: 1st

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. To introduce students the fundamentals of mathematical analysis and to reading and writing mathematical proofs.
2. To introduce a mathematically rigorous approach and to lay the foundation for the subsequent study of complex analysis and functional analysis.
3. To introduce a deeper and more rigorous understanding of Calculus.

Learning outcomes:

Upon completion of the subject:

1. The student will be able to understand the properties of the real numbers and the ideas of sets, functions, and limits.
2. The student will also be able to understand the development of measure and integration theory, differentiation and integration, such as Metric Spaces, Banach Spaces, Hilbert spaces and Riemann-Stieltjes integrals.

Subject Matter:

Unit I

Metric Spaces, continuity, uniform continuity, compactness, connectedness, completeness, Heine Boral theorem, Intermediate value theorem, Baire Category theorem, Inner Product Spaces.

Unit II

Banach Spaces: The definition and some examples, Continuous linear transformations. The Hahn-Banach theorem, The natural imbedding of N in N^{**} , The open mapping theorem, The conjugate of an operator.

Unit III

Hilbert Spaces: The definition and some simple properties, Orthogonal complements, Orthonormal sets, The conjugate space H^* , The adjoint of an operator, Self-adjoint operators, Normal and unitary operators.

Unit IV

Riemann-Stieltjes integrals and their properties, mean value theorems, fundamental theorem of calculus.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill.
2. N. L. Carothers, Real Analysis, Cambridge University Press.
3. T. M. Apostol, Mathematical Analysis, Narosa Publishing.
4. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing.
5. W. Rudin, Principles of Mathematical Analysis, Mc-Graw Hill.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).

C. Journals:

1. Real Analysis Exchange.
2. Analysis Mathematica.
3. Applicable Analysis (Taylor & Francis).
4. Mathematical Physics, Analysis and Geometry.
5. Potential Analysis.
6. Sequential Analysis.
7. SIAM Journal on Mathematical Analysis.

Name of the Module: Complex Analysis
Module Code: MAC 913
Semester: 1st
Teaching Methodology/Model: S.N. Bose
Credit Value: 4 [P=0, T=1, L=3]

Objectives:

The course is design to meet the following objectives:

1. The purpose of this course is to introduce the main ideas of complex analysis.
2. Student gets the ideas to performing basic arithmetic and algebraic operations (including powers and roots) with complex numbers.
3. The emphasis will be on gaining a geometric understanding of complex analytic functions.
4. Developing computational skills in employing the powerful tools of complex analysis in particular residue calculus.
5. Appreciate how mathematics is used in design (e.g. conformal mapping).

Learning outcomes:

Upon completion of the subject:

1. Students can able to identify analytic functions and singularities.
2. Students can able to prove simple propositions concerning functions of a complex variable, for example using the Cauchy-Riemann equations.
3. Students can able to evaluate certain classes of integrals.
4. Student can able to compute Taylor and Laurent series expansions.

Subject Matter:

Unit I

Complex variables: Introduction of complex numbers, functions, continuity, differentiability, analytic function, harmonic function, Cauchy Riemann equations and properties of analytic functions.

Unit-II

Complex integration: Cauchys Theorem, Cauchys Integral Formula, Maximum Modulus Theorem, Liouvilles Theorem, Rouches Theorem.

Unit-III

Infinite series: Sequence of functions, Series of functions, Absolute and Uniform convergence of series, Taylor theorem, Laurent's theorem, Classification of singularity, Entire

function, Meromorphic function, Analytic continuation.

Unit-IV

Contour integrals and their basic properties, Residue theorem, evaluation of standard real integrals using contour integrals. Conformal mappings, the linear fractional transformations.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. L. V. Ahlfors, Complex analysis. An introduction to the theory of analytic functions of one complex variable. McGraw-Hill Book Co., 1978.
2. J. B. Conway, Functions of one complex variable. II. Graduate Texts in Mathematics, 159. Springer-Verlag, 1995.
3. W. Rudin, Real and complex analysis. McGraw-Hill Book Co., 1987.
4. Caratheodory Constantin and F. Steinhardt, Theory and Function of a Complex Variable. Vol. 2. New York, NY:Chelsea, 1960.
5. I. Stewart and D. Tall, Complex Analysis, Cambridge University Press.
6. Murray R. Spiegel, Theory and Problems of Complex Variable, McGraw Hill Books Company, Singapore, 1981.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).
7. Mathematics Today, London Metropolitan University.

C. Journals:

1. Journal of Complex Analysis, Hindawi Publishing Corporation.
2. Complex Variable and Elliptic equations, Taylor & Francis.
3. Journal of Mathematical Analysis and Applications, Elsevier.
4. Complex Analysis and Operator theory, Springer.
5. Transactions of the American Mathematical Society, American Mathematical Society.
6. Indian Journal of Pure and Applied Mathematics, Springer.

Name of the Module: Binary Arithmetics & Logic operations

Module Code: MAC 914

Semester: 1st

Teaching Methodology/Model: J.C. Bose

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

Objectives:

The course is design to meet the following objectives:

1. To make the students to build a solid foundation about Boolean algebra.
2. To make the students to study Digital Logic Gate and Circuits.
3. To help the student develop an understanding of the nature and characteristics of the organisation and design of the modern computer systems.
4. In this module we shall focus on the Organisation & Operation of the CPU. The Intel Pentium CPU will be used as the main case study.

Learning outcomes:

At the end of this module, students are expected to be able to

1. Clear understanding & utilization of logic gates.
2. Design and develop of advanced TTL logic circuits.
3. To understand and to apply the basic metrics by which new and existing computer systems may be evaluated.
4. To understand and to evaluate the impact that languages, their compilers and underlying operating systems have on the design of computer systems.
5. To understand and to evaluate the impact that peripherals, their interconnection and underlying data operations have on the design of computer systems.
6. To demonstrate the techniques needed to conduct the design of a computer.
7. To examine different computer implementations and assess their strengths and weaknesses.

Subject Matter:

Unit I

Basic of Boolean algebra and Minimization Techniques; Combinational and sequential circuits; Introduction to finite state machine concept; Basic Digital circuits, Shift Register and Flip-flops and counters; Semiconductor memories; Logic implementation on ROM, PAL,

PLA and Gate Array.

Unit II:

Data Representation; Register, Transfer and Micro operations, Basic Computer Organization, Classification of computer architecture: SISD, SIMD, MISD, MIMD, And Instruction Cycle Forma.

Unit III:

The ALU: ALU organization, Integer representation, Serial and Parallel Adders, 1s and 2s complement arithmetic, Multiplication of signed binary numbers, floating point number arithmetic, Overflow detection, Status flags.

Instruction formats, Addressing modes, Instruction execution with timing diagram.

Unit IV:

Addressing types, I/O Organization, Memory Organization and managements techniques, Multiprocessors and its architecture.

List of Practical:

1. Verification of I/C 7400 and implementation of standard gates, Realization of Boolean expressions using only NAND gates, Binary adder, Binary subtractor, BCD adder, Binary comparator, Cascading of MUX, Latches and Flip-flops using gates and ICs, Counters, Multivibrators using IC 555.
2. Laboratory design of registers, shift registers, ALU, memory sub-systems, CPU (based on the choice of word size, instruction format, data path and control unit), Introduction to hardware description languages.

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

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

Reading List:

A. Books:

1. Hayes J. P., Computer Architecture & Organisation, McGraw Hill.
2. Hamacher, Computer Organisation, Tata Mcgraw Hill.
3. Computer Organization and System Software, EXCEL BOOKS.
4. Chaudhuri P. Pal, Computer Organisation & Design, PHI.

5. Mano, M.M., Computer System Architecture, PHI.
6. Burd- System Architecture, Vikas.
7. Computer Organization & Architecture (TMH WBUT Series), Ghosh & Pal, TMH.
8. Computer Organization and Architecture by Linda Labur, Narosa Publishing House Pvt. Ltd., Darya Ganj, New Delhi.
9. Structured Computer Organisation by Tanenbaum, Andrew S.; Prentice Hall of India, New Delhi.
10. Computer Architecture by Rafiquzzaman, M; Prentice Hall of India, New Delhi.
11. Taylor L. Booth, Introduction to Computer Engg, Wiley.
12. B. N Jain and R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 2006.
13. C. H. Roth (Jr.), Fundamentals of Logic design, Cengage Engineering, 2003.
14. M. Morris Mano, Digital Logic Design, PHI.
15. Malvino & Leach, Digital Principles and Applications, Tata McGraw Hill.
16. A. Anand Kumar, Fundamentals of Digital Circuits, PHI.

B. Magazines:

1. IEEE Micro Magazines, IEEE Computer Society, United State.

C. Journals:

1. IEEE Transactions on Computers, IEEE, Computer Society, United State.
2. ACM Transactions on Computing Systems (TECS), ACM newyork, United State.
3. Journal of Systems Architecture, Elsevier, Netherlands.

Name of the Module: Computer Programming Language

Module Code: MAC 915

Semester: 1st

Teaching Methodology/Model: J.C. Bose

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

Objectives:

The course is design to meet the following objectives:

1. Learning programming language.
2. Efficient in coding.
3. Essential algorithms in computing.

Learning outcomes:

Students who successfully complete this module will be able to:

1. Write a programme on C language in DOS as well as in linux.
2. Can manage file system.
3. Design, develop, test, and debug programs.

Subject Matter:

Unit I

Basic features of programming (Using C) - data types, variables, operators, expressions, statements, control structures, keywords functions; Advance programming features - arrays and pointers, recursion, records (structures).

Unit II:

The pre-processors, Classes and Objects; Data Hiding; Constructors and Destructors.

Unit III:

Function overloading; Operator overloading and Type conversions; Inheritance; Polymorphisms.

Unit IV:

Console oriented I/O operations, File management, Templates; Exception Handling, the pre-processor: macro statements.

List of Practical:

1. DOS System commands and Editors (Preliminaries).
2. UNIX system commands and vi (Preliminaries).

3. Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number, generate Pascals triangle, find roots of a quadratic equation.
4. Programs to demonstrate control structure : text processing, use of break and continue, etc.
5. Programs involving functions and recursion.
6. Programs involving the use of arrays with subscripts and pointers.
7. Programs using structures and files.

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

1. Theoretical Examination: Open book and on line.
2. Practical Examination: Conducting experiment and viva voice.

Reading List:

A. Books:

1. Kerningham and Ritchie, The 'C' programming language, prentice hall.
2. Balaguruswamy, Programming with 'C', Tata McGraw-Hill.
3. Govil, Agrawal, Mathur & Pathak, Computer Fundamentals and Programming in C, Jaipur Publication House(JPH).
4. Sinha & Sinha, Foundations of Computing, BPB.
5. LoisPettersion, HTML (Learn Everything you need to guide HTML assist., SAMS NET.
6. Stephen Kochan Programming in C (3rd Edition), Sams.
7. Stephen Prata, C Primer Plus, Sams.
8. K. N. King C Programming: A Modern Approach ,Norton, W. W. & Company.
9. Al Kelley/Ira Pohl A Book on C.
10. Zed Shaw Learn C The Hard Way, Addison-Wesley.

11. Mike Banahan, Declan Brady and Mark Doran The C book, Addison-Wesley Pub (Sd).
12. Steve Oualline Practical C Programming, 3rd Edition ,O'Reilly Media.

B. Magazines:

1. /C++ Users, CMP Media LLC publication, United States.

C. Journals:

1. Dr. Dobb's Journal, United Business Media publication, United States.
2. Journal of C Language, CMP Media LLC publication, United States.
3. C vu Journal, ACCU, UK.

Name of the Module: Data Structure

Module Code: MAC 916

Semester: 1st

Teaching Methodology/Model: J.C. Bose

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

Objectives:

The course is design to meet the following objectives:

1. Design principles of algorithms and data structures.
2. Efficiency and scaling of algorithms.
3. Essential algorithms in computing.
4. Generic data structures for common problems.

Learning outcomes:

Upon completion of the subject:

1. Assess performance efficiency of sequential algorithms.
2. Design data structures to enable algorithms and design sequential algorithms for performance.
3. Implement designed algorithms and corresponding data structures using object oriented programming languages.
4. Demonstrate informed deployment of essential data structures such as lists, stacks, queues, and trees.
5. Demonstrate use of algorithm design methods such as divide and conquer.

Subject Matter:

Unit I

Introduction: Basic concept of data, structures and pointers.

Arrays: Representation, Implementation of 1D, 2D, 3D and multi-dimensional, advantages and limitations, Pointer array.

Unit II:

Linked List: Static and dynamic implementation. Single, double, circular, multiple linked lists, Compaction.

Stacks and Queues: Representation of stack, Recursion and Stacks, Operations on stack, Applications of stack; Representation of Queue and its different various structures.

Unit III:

Hash Tables: Hashing techniques, Collision Resolution techniques, Open and Closed Hashing, Inverted tables.

Storage Management: Memory Management techniques, garbage collection.

Unit IV:

Trees: Binary trees, binary search trees, static and dynamic implementation. Types of Binary trees, AVL tree, B+ tree, B tree, tree operations- insert, delete, traversal and merging.

Sorting and Searching: Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort.

List of Practical: (Minimum six experiments are required to be performed)

1. Experiments should include but not limited to : Implementation of array operations:
2. Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues.
3. Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists.
4. Polynomial addition, Polynomial multiplication Sparse Matrices: Multiplication, addition. Recursive and Non recursive traversal of Trees
5. Threaded binary tree traversal. AVL tree implementation.
6. Application of Trees. Application of sorting and searching algorithms.
7. Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

1. Theoretical Examination: Open book and on line.
2. Practical Examination: Conducting experiment and viva voice.

Reading List:

A. Books:

1. Seymour Lipschutz, G A VijayalalashmiPai, Data Structure, Schaums Outlines, TMH.

2. Data Structures and Algorithms O.G. Kakde & U.A. Deshpandey, ISTE/EXCEL BOOKS.
3. Aho Alfred V., Hopperoft John E., Ullman Jeffrey D., Data Structures and Algorithms, Addison Wesley.
4. Drozdek- Data Structures and Algorithms, Vikas.
5. Heileman: data structure algorithms & Oop Tata McGraw Hill.
6. Data Structures Using C M.Radhakrishnan and V.Srinivasan, ISTE/EXCEL BOOKS.
7. Weiss Mark Allen, Algorithms, Data Structures, and Problem Solving with C++, Addison Wesley.
8. Horowitz Ellis & SartajSahni, Fundamentals of Data Structures, Galgotria Pub.
9. Tanenbaum A. S. Data Structures using C, Pearson Education.
10. Ajay Agarwal: Data structure Through, C.Cybertech.

B. Magazines:

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

C. Journals:

1. IEEE Transactions on Computers, IEEE, Computer Society, United State.
2. ACM Transactions on Embedded Computing Systems (TECS), ACM, United State.
3. Journal of Systems Architecture, Elsevier, Netherlands.
4. Journal of Discrete Algorithms (JDA), Elsevier, Netherlands.

Name of the Module: Linear Algebra

Module Code: MAC 921

Semester: 2nd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. To improve the ability to think logically, analytically, and abstractly.
2. To improve the ability to communicate mathematics, both orally and in writing.
3. Concepts for solving systems of linear equations.
4. Basic ideas of vector spaces.
5. The basic concepts of linear transformations, linear functional and linear operator.
6. Present the concept of and methods of computing determinants.
7. Present methods of computing and using eigenvalues and eigenvector.

Learning outcomes:

Upon completion of the subject:

1. Student is able to solve systems of linear equations.
2. Student is able to work within vector spaces and to distill vector space properties.
3. Student is able to manipulate linear transformations and to distill mapping properties.
4. Student is able to manipulate and compute determinants.
5. Student is able to compute eigenvalues and eigenvectors.

Subject Matter:

Unit I

Introduction to vector space over a field, Subspace, linear combination, linear dependence and independence, basis and dimension, Properties of finite dimensional vector space, Replacement theorem, Extension theorem, Co-ordinates of vectors, Complement of a subspace, Quotient space.

Unit-II

System of linear equations, Solution of homogeneous and non-homogeneous systems, Application to geometry. Inner-product spaces (real and complex), orthogonal and orthonormal set of vectors, Scalar component of a vector, Gram-Schmidt process.

Unit-III

Linear transformations, matrix representation of linear transformations, linear functional, dual spaces.

Unit-IV

Eigen values and Eigen vectors, rank and nullity, inverse and linear transformation, Cayley-Hamilton Theorem, norms of vectors and matrices, transformation of matrices, adjoint of an operator, normal, unitary, hermitian and skew-hermitian operators, quadratic forms.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. K. Hoffman and R. Kunze; Linear Algebra; Prentice-Hall of India, Pvt Ltd.
2. A. R. Rao and P. Bhimashankaram; Linear Algebra and Applications; TMH Edn.
3. B. C. Chatterjee; Linear Algebra, Dasgupta & Co., Calcutta, 1967.
4. F. G. Florey ; Elementary Linear Algebra, Prentice Hall Inc, 1979.
5. R. Paul Halmos; Finite Dimensional vector space, Van Nostrand Co., 1974.
6. S. K. Mapa; Higher Algebra, Sarat Book Distributors, 2005.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).
7. Mathematics Today, London Metropolitan University.

C. Journals:

1. Linear Algebra and its Applications, Elsevier.
2. Linear and Multilinear Algebra, Taylor & Francis.
3. Electronic Journal of Linear Algebra, ILAS-The International Linear Algebra Society.
4. Advances in Linear Algebra & Matrix Theory, Scientific Research Publishing (SCIRP).
5. Proceedings of the American Mathematical Society, American Mathematical Society.
6. Proceedings of the London Mathematical Society, London Mathematical Society.
7. Annals of Mathematics, Princeton University & Institute for Advanced Study.

Name of the Module: Probability and Statistics

Module Code: MAC 922

Semester: 2nd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. Imparting theoretical knowledge and practical application to the students in the area of Stochastic Process.
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 stochastic process.

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.

Subject Matter:

Probability:

Unit I

Probability Theory: Random Experiment, Sample space, Event (exclusive & exhaustive), Classical, Frequency and Axiomatic definition of probability Related theorem, Independent events. Bayes theorem, Compound experiment, Bernoulli trial, Binomial Law, Multinomial law.

Random variables: Definition of random variables, distribution function (discrete and continuous) and its properties. Probability mass function; Probability density function. Transformation of random variables (One and two variable); Chebychev inequality and problems.

Unit II:

Distributions: Binomial, Poisson, Uniform, Exponential, Normal, t and χ^2 . Expectation and Variance (t and χ^2 excluded); Moment generating function; Reproductive Property of Binomial; Poisson and Normal Distribution. Binomial approximation to Poisson distribution and Binomial approximation to Normal distribution; Central Limit Theorem; Law of large numbers (Weak law); Simple applications.

Statistics:

Unit III:

Sampling Theory: Population; Sample; Statistic; Estimation of parameters (consistent and unbiased); Sampling distribution of sample mean and sample variance.

Estimation Theory: Point estimate, Maximum likelihood estimate of statistical parameters and interval estimation (Binomial, Poisson and Normal distribution).

Correlation and Regression: Simple idea of Bivariate distribution; Correlation and Regression; and simple problems

Unit IV:

Testing of Hypothesis: Simple and Composite hypothesis; Critical Region; Level of Significance; Type I and Type II Errors; Best Critical Region; Neyman-Pearson Theorem (proof not required); Application to Normal Population; Likelihood Ratio Test (proof not required); Comparison of Binomial Populations; Normal Populations; Testing of Equality of Means; χ^2 -Test of Goodness of Fit (application only).

Stochastic Process: Random Process, Poisson Process, Discrete and Continuous Parameters Markov Chains, Birth and Death Process, Concept of Queues, M/G/I queuing system.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2000.
2. Khazanie, Ramakant. Basic Probability Theory and Applications Santa Monica, CA: Goodyear, 1976.
3. Ross, Sheldon M. Introduction to Probability Models, New York, NY: Academic Press, 1972, 1985. Third Edition.
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

5. Cramer, Harald. Random Variables and Probability Distributions, New York, NY: Cambridge University Press, 1970. Third Edition.
6. Parzen, Emanuel. Modern Probability Theory and Its Applications New York, NY: John Wiley, 1960.
7. Rothschild, V. and Logothetis, N. Probability Distributions New York, NY: John Wiley, 1986.
8. Bailey, Norman T.J. The Elements of Stochastic Processes with Applications to the Natural Sciences New York, NY: John Wiley, 1990.
9. Bhat, U. Narayan. Elements of Applied Stochastic Processes, New York, NY: John Wiley, 1984. Second Edition.
10. Karlin, Samuel and Taylor, Howard M. A First Course in Stochastic Processes, New York, NY: Academic Press, 1975. Second Edition.
11. Karlin, Samuel and Taylor, Howard M. A Second Course in Stochastic Processes New York, NY: Academic Press, 1981.
12. J. Medhi, Stochastic Processes, 3rd Ed., New Age International, 2009.
13. Ross, Sheldon M. Stochastic Processes New York, NY: John Wiley, 1983.
14. N.G. Das, Statistical Methods, Vol-I & Vol-II, Mc Graw Hill.
15. Murray R. Spiegel, Probability and Statistics, McGrawHill, Schaums Outline Series.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).

C. Journals:

1. Advances in Probability and Related Topics (Marcel Dekker).
2. Annals of Applied Probability (Institute of Mathematical Statistics).
3. Annals of Probability (Institute of Mathematical Statistics).

4. Communications on Stochastic Analysis.
5. Electronic Journal of Probability.
6. Sminaire de Probabilits (Lecture Notes in Mathematics, Springer-Verlag).
7. Stochastic Modelling and Applied Probability (Springer-Verlag).
8. Stochastic Processes and their Applications.
9. Stochastics: An International Journal of Probability and Stochastic Processes (Taylor & Francis).
10. Theory of Probability and its Applications (SIAM).
11. Stochastic Processes and their Applications, Elsevier.
12. Stochastics: An International Journal of Probability and Stochastic Processes, Taylor Francis Online.
13. International Journal of Stochastic Analysis, Hindwai Publishing Corporation.
14. Journal of the American Statistical Association.
15. Journal of the Royal Statistical Society, Series A, Statistics in Society.
16. Journal of the Royal Statistical Society, Series B, Statistical Methodology.
17. Journal of the Royal Statistical Society, Series C, Applied Statistics.

Name of the Module: Numerical Methods

Module Code: MAC 923

Semester: 2nd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. Introducing the basic concepts of roundoff error, truncation error, numerical stability and condition, Taylor polynomial approximations; to derive and apply some fundamental algorithms for solving scientific and engineering problems: roots of nonlinear equations, systems of linear equations, polynomial and spline interpolation, numerical differentiation and integration, numerical solution of ordinary differential equations.
2. Application of computer oriented numerical methods which has become an integral part of the life of all the modern engineers and scientists. The advent of powerful small computers and workstation tremendously increased the speed, power and flexibility of numerical computing.
3. Injecting future scope and the research directions in the field of numerical methods.

Learning outcomes:

Upon completion of the subject:

1. Students will be skilled to do Numerical Analysis, which is the study of algorithms for solving problems of continuous mathematics.
2. Students will know numerical methods, algorithms and their implementation in C++ for solving scientific problems.
3. Students will be substantially prepared to take up prospective research assignments.

Subject Matter:

Unit I

Definition and sources of errors, Propagation and control of round off errors, Overflow and underflow, Approximation in numerical computation, Truncation and round off errors, Chopping and rounding off errors, Pitfalls (hazards) in numerical computations (ill conditioned and well conditioned problems).

Numerical Solution of Algebraic and Transcendental Equations: Method of iteration, Bisection Method; Secant Method; Regula-Falsi Method; Newton-Raphson Method, Rate of convergence.

Unit II:

Finite differences, interpolation and extrapolation, polynomial interpolation, Hermite interpolation, spline interpolation.

Numerical Differentiation: Use of Newtons forward and backward interpolation formula,

Numerical integration: Newtons - Cotes formula, Trapezoidal and Simpson's rules.

Unit III:

Numerical Solution of System of Linear Equations: Gauss elimination method; Matrix Inversion; Operations Count; LU Factorization Method (Crouts Method); Gauss-Jordan Method; Gauss-Seidel Method.

Unit IV:

Numerical solution of Order Ordinary Differential Equations: Picard, Euler; modified Euler, Runge-Kutta methods, multistep methods, Predictor-Corrector method.

List of Practical: (Minimum six experiments are required to be performed)

1. Assignments on Interpolation: Newton forward & backward, Lagrange.
2. Assignments on Numerical Integration: Trapezoidal Rule, Simsons 1/3rd Rule.
3. Assignments on Numerical solution of a system of Linear Equations: Gauss elimination, Gauss Jordan, Matrix Inversion, Jacobi, Gauss Seidel.
4. Assignments on Solution of Algebraic Equations: Bisection, Secant, Regula-Falsi, Newton- Raphson Methods.
5. Assignments on Ordinary Differential Equations: Taylor Series, Eulers Method, Runge-Kutta (4th Order).

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

1. Theoretical Examination : Theoretical Examination and open book examination.
2. Practical Examination : Conducting Experiments and Viva-Voce.

Reading List:**A. Books:**

1. D. Kincaid and W. Cheney, Numerical Analysis: Mathematics of Scientific Computing, 3rd Ed., AMS, 2002.

2. K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.
3. S. D. Conte and C. de Boor, Elementary Numerical Analysis - An Algorithmic Approach, McGraw-Hill, 1981.
4. C.M. Bender and S.A. Orszag, Advanced Mathematical Methods for Scientists and Engineers, McGraw-Hill Book Co., 1978.
5. John H. Mathews, Numerical Methods for Mathematics Sciences and Engineering 2nd ed. Prentice Hall of India, New Delhi 2003.
6. M.K.Jain, S.R.K. Iyengar and R.K. Jain, Numerical method for Scientific and Engineering Computation, New Age International Pvt. Ltd. 3rd edition, 1993.
7. V Rajaraman, Computer Oriented Numerical Methods, Pearson Education 3rd edition, 2013.
8. Steven C. Chapra, Numerical Methods for Engineers, 4th Ed., McGraw Hill, 2002.
9. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Prentice Hall, 2006.
10. GntherHmmerlin and Karl-Heinz Hoffmann, Numerical Mathematics, Springer-Verlag, 1991.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).
7. Mathematics Today, London Metropolitan University.

C. Journals:

1. NumerischeMathematik.
2. ActaNumerica.
3. SIAM Review.
4. Journal of Computational Physics.

5. SIAM Journal on Numerical Analysis.
6. SIAM Journal on Scientific Computing.
7. IMA Journal of Numerical Analysis.
8. Mathematics of Computation.
9. Foundations of Computational Mathematics.

Name of the Module: Principles of Operating Systems

Module Code: MAC 924

Semester: 2nd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

On completing this course the students should have acquired the following capabilities:

1. An appreciation of the role of an operating system.
2. Become aware of the issues in the management of resources like processor, memory and input-output.
3. Should be able to select appropriate productivity enhancing tools or utilities for specific needs like filters or version control.
4. Obtain some insight into the design of an operating system.

Learning outcomes:

On completion of this course the students will be able to:

1. High level understand what is an operating system and the role it plays.
2. A high level understanding of the structure of operating systems, applications, and the relationship between them.
3. Some knowledge of the services provided by operating systems.
4. Exposure to some details of major OS concepts.

Subject Matter:

Unit I

Introduction to Operating System; Operating System Structures, Different types of Operating Systems: batch, multi programmed, time sharing, real time, distributed, and parallel.

Unit II:

Process management: Processes, Threads, Process scheduling, Process Synchronization, synchronization hardware, classical problems of synchronization, semaphores Inter Process Communication (IPC).

Unit III:

CPU Scheduling: Pre-emptive and non pre-emptive scheduling, Scheduling algorithm, Multi processor scheduling.

Deadlock: Deadlock prevention and avoidance, detection, and recovery from deadlocks
Memory Management: Logical and physical address space, swapping, continuous memory

allocation, paging, segmentation, Virtual memory, page replacement policies, thrashing.

Unit IV:

File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance, I/O Management, Disk management.

Case Studies: Dos & UNIX.

List of Practical:

1. Shell programming: creating a script, making a script executable, shell syntax.
2. Process: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. Signal: signal handling, sending signals, signal interface, signal sets.
4. Semaphore: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. POSIX Threads : programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. Inter-process communication: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO).

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

1. Theoretical Examination: Open book and on line.
2. Practical Examination: Conducting experiment and viva voice.

Reading List:

A. Books:

1. Milenkovic M., Operating System : Concept & Design, McGraw Hill.
2. Tanenbaum A.S., Operating System Design & Implementation, Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., Operating System Concepts, Wiley.
4. Dhamdhare: Operating System TMH

5. Stalling, William, Operating Systems, Maxwell McMillan International Editions, 1992.
6. Dietel H. N., An Introduction to Operating Systems, Addison Wesley.
7. J. Peterson, A. Silberschatz, and P. Galvin. Operating System Concepts, Addison Wesley, 3rd Edition, 1989.
8. M. J. Bach. Design of the Unix Operating System, Prentice Hall of India, 1986.
9. A.Silberschatz and P. Galvin. Operating System Concepts, Addison Wesley, 4th Edition, 1994.
10. Modern Operating Systems (1992), Tanenbaum A.S, Pearson Prentice Hall

B. Magazines:

1. SIGOPS - Operating Systems Review, ACM New York, USA.

C. Journals:

1. TOCS - ACM Transactions on Computer Systems, ACM, United State.
2. TPDS - IEEE Transactions on Parallel and Distributed Systems, IEEE Computer Society, United State.

Name of the Module: Design & Analysis of Algorithm

Module Code: MAC 925

Semester: 2nd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet with the objectives of:

1. Specification of the concept of algorithm and analysis of its computational complexity.
2. Design principles of algorithms and their application to computing problems.
3. Analysis accessible to all levels of readers.

Learning outcomes:

On completion of this course the students will be able to:

1. Design algorithms for difficult problems.
2. Analyze and understand their complexity.
3. Will able to implement the algorithms in practice.

Subject Matter:

Unit I

Asymptotic Notation: time and space complexity, Big-O, omega, theta etc.; finding time complexity of well known algorithms like- heapsort, search algorithm etc.

Algorithm Design techniques: Recursion- Definition, Use, Limitations, Examples: Hanoi problem. Tail Recursion.

Divide and Conquer: Basic method, use, Examples: Merge sort, Quick Sort, Binary Search.

Unit II:

Dynamic Programming: Basic method, use, Examples: matrix-chain multiplication, All pair shortest paths, single-source shortest path, Travelling Salesman problem.

Branch and Bound: Basic method, use, Examples: The 15-puzzle problem.

Backtracking: Basic method, use, Examples: Eight queens problem, Graph coloring problem, and Hamiltonian problem.

Unit III:

Greedy Method: Basic method, use, Examples: Knapsack problem, Job sequencing with deadlines, Prim's and Kruskal's algorithms.

Lower Bound Theory: Bounds on sorting and sorting techniques using partial and total orders.

Disjoint Set Manipulation: Set manipulation algorithm like UNION-FIND, union by

rank, Path compression.

Graph traversal algorithms: BFS and DFS.

Unit IV:

Matrix manipulation algorithms: Different types of algorithms and solution of simultaneous equations, DFT & FFT algorithm; integer multiplication schemes.

Notion of NP-completeness: Non deterministic algorithm, COOKs theorem, P class, NP-hard class, NP-complete class, CNF Satisfiability problem, proof a problem to be NP hard, Clique Decision Problem.

Approximation algorithms: Necessity of approximation scheme, performance guarantee, Polynomial time approximation schemes: 0/1 knapsack problem.

Teaching/Learning/Practice Pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

Examination Pattern:

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

Reading List:

A. Books:

1. A.Aho, J.Hopcroft and J.Ullman The Design and Analysis of algorithms, AK Peters.
2. D.E.Knuth The Art of Computer Programming, Addison-Wesley Vol. I & Vol.2.
3. Horowitz Ellis, SahaniSartaz, R. Sanguthevar” Fundamentals of Computer Algorithms”, Galgotia Publications.
4. Goodman: Introduction to Design and Analysis Of Algorithms TMH, Mcgraw-Hill College.
5. K.Mehlhorn, Data Structures and algorithms, Addison-Wesley Vol. I & Vol. 2 .
6. S.Baase Computer algorithms, O’Reilly Media .
7. E.Horowitz and Shani Fundamentals of Computer algorithms, Galgotia .
8. E.M.Reingold, J.Nievergelt and N.Deo- Combinational algorithms- Theory and Practice, Prentice Hall, 1997.
9. A.Borodin and I.Munro, The computational complexity of Algebraic and Numeric problems, American Elsevier.
10. The Algorithm Design Manual: Text - Steven S. Skiena, Springer.

B. Magazines:

1. Slaves to the algorithm - Aeon Magazines.
2. Algorithm Articles - Offshore Magazines.

C. Journals:

1. Journal of Algorithms, Elseviers, Netherland.
2. Algorithms Open Access Journal, MDPI, Basel, Switzerland.
3. TIT - IEEE Transactions on Information Theory, IEEE Computer Society, United State.
4. SIAMCOMP - Siam Journal on Computing.

Name of the Module: Soft Computing Techniques

Module Code: MAC 926

Semester: 3rd

Teaching Methodology/Model: J.C. Bose

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

Objectives:

The course is design to meet with the objectives of:

1. To introduce the fundamental concepts of Soft Computing;
2. To equip students with the knowledge and skills in logic programming;
3. To explore the different paradigms in knowledge representation and reasoning;
4. To understand the contemporary techniques in machine learning;
5. To evaluate the effectiveness of hybridization of different artificial intelligence techniques.

Learning outcomes:

At the end of this lesson the student 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.

Subject Matter:

Unit I

Machine Learning AI - Introduction, hierarchical perspective and foundations. Rote Learning, Learning by advice, Learning in problem solving inductive learning, explanation based learning, learning from observation and discovery, learning by analogy, introduction to formal learning theory. Biological neurons and brain, models of biological neurons, artificial neurons and neural networks, Early adaptive nets Hopfield nets, back error propagation

competitive learning lateral inhibition and feature maps, Stability - Plasticity and noise saturation dilemma, ART nets, cognition and recognition.

Unit II:

Neural nets as massively parallel, connectionist architecture, Application in solving problems from various are as e.g., AI, Computer Hardware, networks, pattern recognition sensing and control etc.

Unit III:

Basics of Fuzzy Sets: Fuzzy Relations - Fuzzy logic and approximate reasoning - Design Methodology of Fuzzy Control Systems - Basic structure and operation of fuzzy logic control systems.

Unit IV:

Concepts of Artificial Neural Networks: Basic Models and Learning rules of ANN's. Single layer perception networks - Feedback networks - Supervised and unsupervised learning approaches - Neural Networks in Control Systems. Basics of Genetic Algorithms: Evolution of Genetic Algorithm Applications.

List of Practical:

1. Simulate DFS
2. Simulate BFS
3. Simulate A*
4. Simulate 8- Puzzle Problem
5. WAP to implement and function using ADALINE with BIPOLAR inputs and outputs
6. WAP to implement and function using MADALINE with BIPOLAR inputs and outputs
7. WAP to implement discrete Hopfield network and test for input patterns
8. Write a programme to implement fuzzy set operation and properties
9. Write a programme to implement composition of fuzzy and crisp relations.
10. WAP to perform MAX-MIN composition of two matrices obtained from Cartesian product.
11. Write a programme for maximizing $f(x) = x^2$ using GA where x is ranges from 0 to 31 perform only 5 iteration.

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%
Practice: 50%

Examination Pattern:

Theoretical Examination: Regular Examination.

Practical Examination: Conducting experiment and viva voice

Reading List:

A. Books:

1. P H Winston - Artificial Intelligence - Pearson Education.
2. Bishop, Neural Networks for Pattern Recognition, OUP.
3. Cohen, Empirical Methods for AI, PHI.
4. Haykin, Neural Network, Pearson Education/PHI.
5. E Charniak and W. Midermott - Introduction to Artificial Intelligence - Pearson Education.
6. Hagan, Neural Network Design, Vikas.
7. Shivanandan, Artificial Neural Network, Vikas Bose - Neural Network fundamentals with graphs, Algorithms and Applications - TMH.
8. Artificial Intelligence, by Elaine Rich and Kevin Knight, (2006), McGraw Hill Companies Inc.
9. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norving, Prentice Hall.
10. Computational Intelligence: A logical Approach, by Davin Poole, Alan Mackworth, and Randy Goebel, Oxford University Press.

B. Magazines:

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

C. Journals:

1. Artificial Intelligent by Elsevier, Netherland
2. Artificial Intelligent in medicine by Elsevier, Netherland
3. Journal of Artificial Intelligent Research(JAIR) , AAAI Press, USA
4. Applied Soft Computing - Journal - Elsevier, Netherland

Name of the Module: Operation Research
Module Code: MAC 931
Semester: 3rd
Teaching Methodology/Model: S.N. Bose
Credit Value: 4 [P=0, T=1, L=3]

Objectives:

The course is design to meet the following objectives:

1. To make the students introduction of the methods of Operations Research.
2. Emphasize the mathematical procedures of nonlinear programming search techniques.
3. Introduce advanced topics such as probabilistic models (Markov chain & queuing theory) and dynamic programming.
4. A scientific approach to decision making, which seeks to determine how best to design and operate a system, usually under conditions requiring the allocation of scarce resources.

Learning outcomes:

Upon completion of the subject:

1. Student will be able to identify and develop operational research models from the verbal description of the real system & use mathematical software to solve the proposed models.
2. Student will understand the mathematical tools that are needed to solve optimisation problems.
3. Student can develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Subject Matter:

Unit I

Linear Programming problem: Formulation, Linear Programming, Graphical Method, Simplex Method, Big-M method, Two phase method, Degeneracy, Sensitivity Analysis, Duality Theory (Results Only). Transportation problem-Vogels approximation method, MODI method, Assignment problem-Hungarian method.

Unit II:

Network Analysis: Shortest Paths, Maximal Flow including PERT-CPM. Integer programming concepts, formulation, solution and applications.

Game Theory: 2 persons zero sum games, Minimax principle, Games with mixed strategies, Dominance Theory solution using linear programming.

Unit III:

Inventory problems and their analytical structure, Simple deterministic inventory model, Economic lot size models with uniform rate of demand with different rate of demand in different cycle.

Unit IV:

Queuing Theory: Introduction, basic definitions & notations, axiomatic derivation of the arrival & departure distributions for Poission Queue, Poission Queuing model, M/M/I queues in series, application.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:**A. Books:**

1. P. K. Gupta and Man Mohan, Operations Research (Ed.4)-Sultan Chand & Sons,1980.
2. Hamdy A. Taha, Operations Research, Fifth edn., Macmillan Publishing Company, 1992.
3. V.K. Kapoor– Operations Research.
4. Kanti Swaroop– Operations Research.
5. Hadley G., Linear Programming, Narosa Publishers, 1987.
6. Hillier & LiebermanIntroduction to Operations Research, 7/e (with CD),TMH.
7. Hiller F. and Liebermann G. J., Operation Research, Holder Day Inc, 1974.
8. Operations Research Schaum outline series, MH.
9. Kalshi, Operations Research with C,VIKAS.
10. Chakraborty & Ghosh, Linear Programming & Game Theory, Moulik Library.
11. S. Kalavathy, Operations Research, Vikas Publishing House Pvt. Ltd.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).

3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).
7. Mathematics Today, London Metropolitan University.

C. Journals:

1. European Journal of Operational Research.
2. Journal of the Operational Research Society.
3. American Journal of Operations Research, Scientific Research.
4. Journal of Optimization, Hindwai Publishing Corporation.
5. Mathematical Methods of Operations Research.
6. Operations Research Letters.
7. SORT. Statistics and Operations Research Transactions (formerly Questiiio).
8. Annals of Operations Research.
9. Computers & Operations Research.

Name of the Module: Special Functions and Integral Transforms

Module Code: MAC 932

Semester: 3rd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. To investigate the properties of special functions and integral transforms.
2. To introduce from the point of view of applications to differential and integral equations.

Learning outcomes:

Upon completion of the subject:

1. Students can able to understand the properties of Integral Transforms and Special functions.
2. Student can able to demonstrate a firm understanding of the solution techniques for ordinary and partial differential equations.
3. Student can able to understand the mathematical framework that supports engineering, science, and mathematics.

Subject Matter:

Unit I

Legendres polynomial, Associated Legendres functions, Bessels functions, Recurrence relations, orthogonal properties, Hermite and Laguerre polynomials, their generating functions and general integral properties, Hyper-Geometric functions.

Unit-II

Laplace Transform and inverse Laplace Transform, definition and properties, Laplace transform of derivatives and integrals, inverse Laplace transform, convolution theorem, complex inversion formula, theorems of Laplace transform.

Unit-III

Fourier integral theorem, Fourier Transform and inverse Fourier Transform, Fourier sine and cosine transform, convolution theorem, Fourier transform of derivatives, Hankel Transform, definition and elementary properties, inversion theorem, Hankel transform of derivatives, Parsevals theorem.

Unit-IV

Application of Laplace transform to the solution of ordinary differential equations with constant coefficients and with variable coefficients, simultaneous ordinary differential equations,

application of Fourier transform to the solution of boundary value problems, partial differential equations.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. E. D. Rainville, Special Function, Macmillan, New York.
2. I. N. Sneddon, The Use of Integral Transform, Tata McGraw Hill.
3. M. R. Spigel, Theory and Problems of Laplace transform.
4. Sharma and Vasistha, Integral Transforms, Krishna Prakashan, Meerut.

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).

C. Journals:

1. Ganita Sandesh.
2. Journal of Rajasthan Academy of Physical Sciences.
3. Bulletin of Calcutta Mathematical Society.
4. Integral Transforms and Special Functions.
5. Journal of Integral Equations and Applications.
6. Differential and Integral Equations.
7. Integral Equations and Operator Theory.

Name of the Module: Financial Computing

Module Code: MAC 933

Semester: 3rd

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

1. To understand the basic concepts of quantitative finance and financial engineering.
2. Be aware of the major decision, hedging, and pricing problems in finance, know how to formulate these problems as mathematical models, and understand the computational techniques to solve the arising models.

Learning outcomes:

Upon completing this course students should be able to:

1. Apply basic computational techniques to solve quantitative managerial accounting problems.
2. Draw from financial information to construct a debit/credit transaction in good form.
3. Analyze a firm's financial activities using financial statement analysis tools.
4. Identify and describe the three costs associated with a manufactured product.

Subject Matter:

Unit I

Applied Probability and Stochastic Calculus:

Random walks and transition probability density functions; Forward and Backward Kolmogorov equations. Similarity reduction method for solving diffusion equations. Stochastic Differential Equations (SDEs) - drift, diffusion, Itos Lemma, Ito Integral and Ito Isometry. Simulating asset price SDEs in Excel.

Financial Products and markets:

Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange and commodities. Options contracts and strategies for speculation and hedging.

Unit-II

Black-Scholes framework:

Black-Scholes PDE: simple European calls and puts: put-call parity. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega rho and their role in hedging. The mathematics of early exercise - American options: perpetual calls and puts; optimal exercise strategy and the

smooth pasting condition. Volatility considerations - actual, historical and implied volatility; local volatility and volatility surfaces.

Unit-III

Computational Finance:

Solving the pricing PDEs numerically using Explicit Finite Difference Scheme. Stability criteria. Introduction to Monte Carlo technique for derivative pricing.

Unit-IV

Fixed-Income Products:

Introduction to the properties and features of fixed income products; yield, duration convexity; yield curves forward rates; zero coupon bonds. Stochastic interest rate models; bond pricing PDE; popular models for the spot rate (Vasicek, CIR and Hull White); solutions of the bond pricing equation. Calibration/yield curve fitting: the importance of matching theoretical and market prices; time dependent one factor models (Ho Lee, extended Vasicek). Multi-factor interest rate modelling: Two-factor Interest rate models and Bond pricing equation.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%

Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. Paul Wilmott, Introduces Quantitative Finance, Wiley, 2007.
2. Justin London, Modeling Derivatives using C++, Wiley publishers.
3. John Hull, Options, Futures and Other Derivatives.
4. Keith Cuthbertson, Quantitative Financial Economics: Stocks, Bonds and Foreign Exchange.
5. M. S. Joshi, The Concepts and Practice of Mathematical Finance.

B. Magazines:

1. Chartered Institute of Management Accountants, CIMA.
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).

5. +Plus Magazines (University of Cambridge).

C. Journals:

1. The SIAM Journal on Financial Mathematics, SIAM.
2. Mathematics and Financial Economics, Springer.
3. Journal of Multinational Financial Management, Elsevier.
4. The Journal of Computational Finance, Risk.net.
5. Journal of Mathematical Finance, Scientific Research.

Name of the Module: Database Management System.

Module Code: MAC 934

Semester: 3rd

Teaching Methodology/Model: J.C. Bose

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

Objectives:

The course is design to meet with the objectives of:

1. Explain the purpose of a database management system (DBMS).
2. Explain the role of the database administrator.
3. Explain what is meant by data consistency, data integrity, data redundancy and data independence.
4. Explain the concept of entity relationships and data normalisation.
5. Explain the concept of a client/server database.
6. Recall the relevant advantages of a client/server database over a non-client/server database.

Learning outcomes:

After completion of this module students will be able to:

1. Define a Database Management System.
2. Give a description of the Database Management structure.
3. Define a Database.
4. Define basic foundational terms of Database.
5. Understand the applications of Databases.
6. Know the advantages and disadvantages of the different models.
7. Compare relational model with the Structured Query Language (SQL).
8. Know the constraints and controversies associated with relational database model.
9. Know the rules guiding transaction ACID.
10. Identify the major types of relational management systems.
11. Compare and contrast the types of RDBMS based on several criteria.

12. Understand the concept of data planning and Database design.
13. Know the steps in the development of Databases.
14. Trace the history and development process of SQL.
15. Know the scope and extension of SQL.

Subject Matter:

Unit I

Introduction of Data Base Management System, Data Models, Relational model, RDBMS, Database Administrator, Database Users, Three Schema architecture of DBMS, Entity-Relationship Model : Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Unit II:

Data Base language: DML relational algebra, tuple relational calculus, domain relational calculus, SQL, Query optimization, DDL, Integrity Constraints: domain, trigger, assertion, referential integrity Database security application development using SQL, Stored procedures and triggers.

Unit III:

Functional dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.

Unit IV:

Relational data base design Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking. Recovery system, Data storage: storage and file structure, indexing and hashing.

List of Practical:

1. Structured Query Language.
2. Creating Database.
 - (a) Creating a Database.
 - (b) Creating a Table.
 - (c) Specifying Relational Data Types.
 - (d) Specifying Constraints.
 - (e) Creating Indexes.
3. Table and Record Handling.
 - (a) INSERT statement.
 - (b) Using SELECT and INSERT together.
 - (c) DELETE, UPDATE, TRUNCATE statements.

- (d) DROP, ALTER statements.
- 4. Retrieving Data from a Database.
 - (a) The SELECT statement.
 - (b) Using the WHERE clause.
 - (c) Using Logical Operators in the WHERE clause.
 - (d) Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause.
 - (e) Using Aggregate Functions.
 - (f) Combining Tables Using JOINS.
- 5. Database Management
 - (a) Creating Views.
 - (b) Creating Column Aliases.
 - (c) Creating Database Users.
 - (d) Using GRANT and REVOKE Cursors in Oracle PL / SQL.
- 6. Writing Oracle PL / SQL Stored Procedure.

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

1. Theoretical Examination: Open Book and online Examination.
2. Practical Examination: Conducting experiment and viva voice.

Reading List:

A. Books:

1. Henry F. Korth and Silberschatz Abraham, Database System Concepts, Mc.Graw Hill.
2. ElmasriRamez andNovatheShamkant, Fundamentals of Database Systems, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System, McGraw-Hill.
4. Gray Jim and Reuter Address, Transaction Processing : Concepts and Techniques, Moragan Kauffman Publishers.

5. Jain: Advanced Database Management System, CyberTech.
6. Date C. J., Introduction to Database Management, Vol. I, II, III, Addison Wesley.
7. Ullman JD., Principles of Database Systems, Galgottia Publication.
8. James Martin, Principles of Database Management Systems, 1985, Prentice Hall of India, New Delhi.
9. Fundamentals of Database Systems, RamezElmasri, ShamkantB.Navathe, Addison Wesley Publishing Edition.
10. Database Management Systems, ArunK.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill.

B. Magazines:

1. IBM Systems Magazines, IBM, New York, U.S.
2. IT - Data Management Magazines, IBM, New York, U.S.
3. Relational Database Management Systems (RDBMS and DBMS), IBM, New York, U.S.

C. Journals:

1. ACM Transactions on Database Systems.
2. Data and Knowledge Engineering.
3. Journal of Database Management (JDM).
4. DATA BASE for Advances in Information Systems.
5. International Journal of Database Management Systems (IJDMS).
6. Database Systems Journal.

Name of the Module: Software Engineering

Module Code: MAC 935

Semester: 3rd

Teaching Methodology/Model: J.C. Bose

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

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.

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.

Subject Matter:

Unit I

Introduction of Software Engineering: Software Engineering Discipline Its Evaluation and Impact, Emergence of Software Engineering, System Development Life Cycle, Waterfall Model, Spiral Model, V model, Evolutionary Model, Prototyping model, Comparison of different life cycle.

Software Project Management: Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, Empirical Estimation Techniques, Heuristic Estimation Techniques, Analytical Techniques Halsteads Software Science, Staffing Level Estimation, Nordens model, Putnams model, Jensens Model .

Unit II:

Requirements analysis and specification: Requirements Gathering & Analysis, Formal and Informal Specification, Formal System Specification: Axiomatic Specification, Algebraic Specification, Problem Partitioning, Top-Down And Bottop-Up design, Technique of representing complex logic: Decision Tree, Decision Table and Structured English, Cohesion, Coupling.

Function Oriented Software Design: Data Flow Diagram (DFD), Data Dictionary, Process Organization & Interactions, Structured Design.

Object Modelling using UML: Basics object orientation Concept, UML Diagrams: Use case Diagram, Class Diagram, Interaction Diagram, Activity Diagrams, State Chart Diagram, Design Pattern: MVC Pattern, Domain modelling, Boochs Object Identification Method.

Unit III:

Coding & Documentation: Coding standards and guidelines, Code review techniques, Software Documentation classes, Gunnings Fog Index. Structured Programming, OO Programming, Information Hiding, Reuse.

Testing: Levels of Testing, Integration Testing, Test case Specification, White box approach, Black box approach, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control, Performance Testing.

Debugging: Debugging approach, Debugging guidelines.

Unit IV:

Software Reliability: Reliability Metrics, Reliability Growth Modelling,

Software Quality management system: Evolution of Quality Systems, ISO 9000, ISO 900, CMM Levels, and Six Sigma.

Software Maintenance: Maintenance model, Reverse Engineering, Maintenance cost estimation.

Software Reuse: Different Reuse approaches, Client Server software, Middleware standards-CORBA and COM/DCOM, Service oriented Architecture: Software as a Service approach.

Teaching/Learning/Practice Pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

Examination Pattern:

Theoretical Examination: Regular Examination, Online, open book.

Reading List:

A. Books:

1. Software Engineering A practitioners approach by Roger S Pressman, McGraw-Hill Higher Education.
2. Software Engineering Rajiv Mall, PHI.
3. Fundamentals of Software Engineering by Ghezzi, jazayeri, Mandrioli, Prentice Hall PTR.
4. Software Engineering by Sommerville, Pearson Education.
5. R. G. Pressman Software Engineering, TMH.

6. Behforooz, Software Engineering Fundamentals, OUP.
7. Ghezzi, Software Engineering, PHI.
8. PankajJalote An Integrated Approach to Software Engineering, NAROSA.
9. Object Oriented & Classical Software Engineering(Fifth Edition),SCHACH, TMH.
10. Vans Vlet, Software Engineering, SPD.
11. Uma, Essentials of Software Engineering, Jaico.
12. Sommerville, Ian Software Engineering, Pearson Education.
13. Benmenachen, Software Quality, Vikas.
14. IEEE Standards on Software Engineering, IEEE Computer Society Press.

B. Magazines:

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

C. Journals:

1. International Journal of Software Engineering, World Scientific Publishing Co. Pte Ltd, Singapore.
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: Computer Networking

Module Code: MAC 936

Semester: 2nd

Teaching Methodology/Model: J.C. Bose

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

Objectives:

The course is design to meet with the objectives of:

1. To know Communication between applications on different computers.
2. To understand state-of-the-art in network protocols, architectures, and applications.
3. Examine and comprehend the following networking concepts -basic computer networking concepts including Circuit-switching and Packet-switching, Protocol layer stack, Client-Server paradigm, and Packet-switched network delay calculation application-layer applications including Telnet, FTP, DNS, HTTP, SMTP -Other state of arts topics including Wireless and Mobile Networks, and Security in Computer Network.
4. Examine and analyze the following transport-layer concepts: -Transport-Layer services Reliable vs. un-reliable data transfer -TCP protocol -UDP protocol.
5. Examine and synthesize the following network-layer concepts: -Network-Layer services Routing -IP protocol -IP addressing.
6. Examine and evaluate the following link-layer and local area network concepts: -Link-Layer services Ethernet -Token Ring -Error detection and correction -ARP protocol.

Learning outcomes:

On completion of this course the students will be able to:

1. Explain the roles of key elements in data communication.
2. Explain the difference between local area and wide area networks.
3. Explain the uses of WANs with respect of current practice.
4. Explain the uses, hardware requirements and advantages of WANs.
5. Describe the application and operation of protocols.
6. Distinguish types of networks.
7. Compare network topologies.
8. Describe and distinguish features of node addressing methods.

9. Describe the standards for industry network architectures.

Subject Matter:

Unit I

Introduction: Introduction to Computer Network and Physical Layer.

Types of Networks: Broadcast and Point-to-point- LAN-MAN-WAN- Wireless networks.

Layered Architecture and Reference Models: Layered architecture- OSI reference model, TCP/IP reference model Internet Protocol Stack Network Entities in Layers- Connection oriented and Connection less services.

ATM:Protocol Architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Adaptation Layer, Traffic and Congestion Control, ATM LAN Emulation.

Internetworking: Principles of Internetworking, Connectionless Internetworking, The Internet Protocol, Routing Protocol, IPv6 (IPng), ICMPv6

Unit II:

Data Transmission/The Physical Layer: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Guided Transmission Media, Wireless Transmission, Communication Satellites, The Public Switched Telephone Network, The Mobile Telephone System, Cable Television.

Data Encoding: Digital Data: Digital and Analog Signals, Analog Data: Digital and Analog Signals, Spread Spectrum.

Data Communication Interface: Asynchronous and Synchronous Transmission, Line Configurations, Interfacing.

Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time- Division Multiplexing.

Circuit Packet and Switching: Switched Networks, Circuit-Switching Networks, Switching Concepts, Routing in Circuit-Switched Networks, Control Signalling, Packet-Switching Principles, Routing, Congestion Control, X.25 282.

Frame Relay: Frame Relay Protocol Architecture, Frame Relay Call Control, User Data Transfer, Network Function, Congestion Control.

Unit III:

LAN Technology and Systems: LAN Architecture, Bus/Tree LANs, Ring LANs, Star LANs, Wireless LANs, Ethernet and Fast Ethernet (CSMA/CD), Token Ring and FDDI, 100VG-AnyLAN, ATM LANs, Fibre Channel, Wireless LANs, Bridge Operation, Routing with Bridges.

Protocols and Architecture: Protocols, OSI, TCP/IP Protocol Suite.

Examples of networks: Novell Netware, Arpanet, and Internet. Examples of Data Communication Services: X.25 Networks, Frame relay, Broad band ISDN and ATM. Physical Layer: Transmission media- Narrow band ISDN: Services-Architecture- Interface, Broad band ISDN and ATM- Virtual Circuits versus Circuit Switching Transmission in ATM networks. FDDI.

Link Layer and Local Area Networks Data link layer: Service provided by data link layer-Error detection and correction Techniques-Elementary data link layer protocols -Sliding Window protocols - Data link layer in HDLC, Internet and ATM . Multiple Access protocols: Channel partitioning protocols: TDM-FDM-Code Division Multiple Access

(CDMA). Random Access protocols: ALOHACCSMA and CSMA/CD. Local area Network: LAN addresses- Address Resolution Protocol-Reverse Address Resolution Protocol. Ethernet: Ethernet Technologies-IEEE standards- Hubs-Bridges and Switches.

Distributed Applications: Abstract Syntax Notation One (ASN.1), Network Management-SNMPV2, Electronic Mail-SMTP and MIME, Uniform Resource Locators (URL) and Universal Resource Identifiers a. (URI), Hypertext Transfer Protocol (HTTP).

Unit IV:

Network Layer and Routing: Network Service model, Routing protocols, multicast routing, Network Address Translators (NATs)-IPv6 packet format-transition from IPv4 to IPv6-Mobile IP.

Transport Layer: Transport Layer Services-Relationship between Transport Layer and Network Layer-Transport Layer in Internet-Multiplexing and De multiplexing. Connection-less Transport: UDP-Segment structure-Checksum Connection Oriented Transport: TCP-TCP connection-TCP Segment Structure-Round trip Time estimation and Time out-Reliable Data transfer-Flow control-TCP connection Management. Congestion Control: Causes and costs of congestion- Approaches to congestion control- TCP congestion control: Fairness-TCP delay modelling. ATM ABR congestion control. ATM AAL Layer protocols.

Application Layer and Network Security: Application Layer Protocols - WWW and HTTP-File transfer Protocol: FTP Commands and Replies Domain Name System (DNS) - SMTP - SNMP- multimedia. Remote Procedure Call. Security in Computer Networks: Principles of Cryptography-Symmetric key-Public key-authentication protocols -Digital Signatures Firewalls. Security in different Layers: Secure E-mail- SSL IP security.

List of Practical:

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 behaviour 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.

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

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

Reading List:

A. Books:

1. C T Bhunia, Information Technology Network & Internet, New Age International Publications, New Delhi.
2. James F. Kurose and Keith W. Ross, Computer Networking A Top-Down Approach Featuring the Internet, 2/e Pearson Education, 2003.
3. S. Keshav, An Engineering Approach to Computer Networking, Pearson education, 2002.
4. F. Halsall, Data Communication, Computer Networks and Open Systems, Addison Wesley, 1996.
5. Andrew S. Tanenbaum, Computer Networks, 4/e, Pearson education, 2003.
6. Behrouz A. Fourouzan, Data Communications and Networking, 2/e Tat McGrawhill, 2000.
7. TCP/IP Illustrated, by W.R.Stevens, Addison-Wesley.
8. Internetworking with TCP/IP, by Douglas Comer, Prentice Hall.
9. Internet Routing Architectures, Second Edition, by Sam Halabi and Danny McPherson, Cisco Press.
10. Emerging Communication Technologies, by Uyles Black, Prentice Hall.
11. Computer Networks: A System Approach, by Larry L. Peterson and Bruce S. Davie, Morgan Kaufmann Publishers.

B. Magazines:

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

C. Journals:

1. Computer Networks - Journal - Elsevier, Netherland.
2. Journal of Network and Computer Applications - Elsevier, Netherland.
3. Journal of Computer Networks and Communications, Elsevier, Netherland.

ELECTIVES

Name of the Module: Graph Theory

Module Code: MAC 941

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the following objectives:

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

Learning outcomes:

Upon completion of the subject:

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.

Subject Matter:

Unit I

Basic concepts, degree, incidence, isomorphism, subgraph, walk, path, cycle, operations on graphs, degree sequences, connectivity, cut vertices and cut edges, Eulerian and Hamiltonian graphs, Trees, Spanning trees, Cayley formula.

Unit II:

Covering numbers and matching, perfect matching, colour of a graph, edge colouring, Vizing Theorem, Independent sets, vertex colouring, chromatic polynomial, planer and non-planer graphs, Eulers formula, Kuratowskis theorem, five colour theorem, history of four colour theorem.

Unit III:

Directed graphs.

Unit IV:

Matrices and graphs, eigen values of graphs.

Teaching/Learning/Practice Pattern:

Teaching: 70%

Learning: 30%
Practice: 0%

Examination Pattern:

Theoretical Examination and open book examination.

Reading List:

A. Books:

1. Berge, Claude. Hypergraphs: Combinatorics of Finite Sets Amsterdam: North-Holland, 1989.
2. Berge, Claude. Graphs, New York, NY: Elsevier Science, 1985. Second Revised Edition.
3. Biggs, Norman L. Algebraic Graph Theory New York, NY: Cambridge University Press, 1974.
4. Bollobas, Bela. Graph Theory: An Introductory Course New York, NY: Springer-Verlag, 1979.
5. Chartrand, Gary and Lesniak, Linda. Graphs Digraphs, Belmont, CA: Wadsworth, 1986. Second Edition.
6. Gibbons, Alan. Algorithmic Graph Theory New York, NY: Cambridge University Press, 1985.
7. Harary, Frank. Graph Theory Reading, MA: Addison-Wesley, 1969. Narosa (1988).
8. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications. North-Holland, 1976.
9. J. M. Aldous. Graphs and Applications. Springer, LPE, 2007.
10. D. B. West, Introduction to Graph Theory, Prentice-Hall (Indian Edition 1999).

B. Magazines:

1. Current Science (Indian Academy of Science).
2. The Mathematics Student (Math Student) (Indian Mathematical Society).
3. Mathematical Spectrum (The University of Sheffield).
4. Mathematics Magazines (Mathematical Association of America).
5. +Plus Magazines (University of Cambridge).
6. Ganithavahini (Ramanujam Mathematical Society).

7. Mathematics Today, London Metropolitan University.

C. Journals:

1. Combinatorica
2. Discrete Applied Mathematics.
3. Discrete Mathematics.
4. European Journal of Combinatorics.
5. Graphs and Combinatorics.
6. Journal of Combinatorial Theory, Series A.
7. Journal of Combinatorial Theory, Series B.
8. Journal of Graph Theory.
9. SIAM Journal on Computing.
10. SIAM Journal on Discrete Mathematics.
11. Theoretical Computer Science.

Name of the Module: Quantum Computing

Module Code: MAC 942

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

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 Mechanics- The postulates of quantum mechanics, application: Super dense coding, The density operator.

Quantum Computation

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

database.

Unit II:

Quantum Computers

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

Unit III:

Quantum Information

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

Unit IV:

Quantum Error Correction

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

Teaching/Learning/Practice Pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

Examination Pattern:

1. Theoretical Examination, Open book and on line.

Reading List:

A. Books:

1. C. T. Bhunia, Introduction To Quantum Computing, Publisher New Age International Pvt Ltd Publishers, ISBN 9788122430752.
2. Micheal A. Nielsen. & Issac L. Chiang, Quantum Computation and Quantum Information, Cambridge University Press, Fint South Asian edition, 2002.
3. David McMahan, Quantum Computing Explained, Wiley.
4. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge Series on Information and the Natural Sciences.
5. Eleanor G. Rieffel, Wolfgang H. Polak, Quantum Computing: A Gentle Introduction (Scientific and Engineering Computation), The MIT Press.
6. Susan Shannon, Trends in Quantum Computing Research, Nova Publishers, 2006.

7. Julian Brown, Quest for the Quantum Computer, Simon & Schuste.
8. Marco Lanzagorta, Jeffrey Uhlmann, Quantum Computer Scienc, Morgan & Claypool Publishers,2009.
9. Phillip Kaye, Raymond Laflamme , Michele Mosca , An Introduction to Quantum Computing, Oxford.
10. Sahni, Quantum Computing, Tata McGraw-Hill Education, 2007.

B. Magazines:

1. Cosmos, Australia.

C. Journals:

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

Name of the Module: ERP Solutions

Module Code: MAC 943

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

Objectives:

Introduce the student to the rationale for acquiring and implementing ERP systems, selection of ERP software, and integration of processes and transactions in the ERP system. Enable the student to understand the challenges associated with the successful implementation of global Supply Chain ERP software with an emphasis on leadership and managerial implications/actions.

Learning outcomes:

After completion of the course the student will be able to make use of ERP.

Subject Matter:

Unit I

Introduction To ERP

Introduction to ERP ,Evolution of ERP, What is ERP? Reasons for the growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, Advantage of ERP.

Unit II:

ERP and Related Technologies

Business process Reengineering (BPR), Management Information System (MIS), Decision Support Systems (DSS), Executive Support Systems (ESS), Data Warehousing, Data Mining, Online, Analytical Processing (OLTP), Supply Chain Management (SCM) Customer Relationship Management (CRM).

Unit III:

ERP modules & Vendors

Finance, Production planning, control & maintenance, Sales & Distribution, Human Resource, Management (HRM), Inventory Control System, Quality Management ERP Market.

Unit IV:

ERP Implementation Life Cycles

Evaluation and selection of ERP package, Project planning, Implementation team training & testing, End user training & Going Live, Post Evaluation & Maintenance.

Unit IV:

ERP Case Studies and Future Directions in ERP

Post implementation review of ERP Packages in Manufacturing, Services, and other Organizations. New markets, new channels, faster implementation methodologies, business modules and BAPIs, convergence on windows NT, Application platform, new business segments, more features, web enabling, market snapshot.

Teaching/Learning/Practice Pattern:

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

Examination Pattern:

1. Theoretical Examination: Regular Examination, on-line and open book.

Reading List:

A. Books:

1. Ray, R (2011) Enterprise Resource Planning Text & Cases Mc Graw Hill.
2. Gard, V.K. & Venkitakrishnan, N.K (2011) ERP Ware: ERP Implementation Framework, McGraw Hill.
3. Leon, J.W (2009). ERP Concepts and Planning , Pearson
4. Enterprise Resource Planning: Text and Cases by Rajesh Ray: Tata ...
www.abebooks.com/Enterprise-Resource-Planning-Text-Cases-Rajesh/.

B. Magazines:

1. Technology Review
2. Windows IT Pro
3. Smart Computing
4. PC Magazine
5. 21st Century
6. Discover Magazine
7. Information week
8. Info World
9. MIT Technology Review
10. Tech News World

C. Journals:

1. Journal of Information Management.
2. Information system and e-Business Management.

3. Computational Management Science.
4. Information systems Frontier.
5. Information Technology and Management.
6. International Journal of Computer Science and Security.
7. Information Systems Research.
8. Journal of Computer Assisted Learning.
9. MIS Quarterly.
10. Interdisciplinary Journal of Knowledge and Learning Objects.
11. Journal of Engineering and Technology Management.
12. Online Information Review.
13. Information & Management.
14. e-Services Journal.
15. E-learning Strategies for Delivering Knowledge in the Digital Age.
16. Journal of Asynchronous Learning Networks.
17. Computers in Human Behavior.
18. International Journal of Learning Environments Research.
19. European Journal of Information Systems.
20. Information Systems Journal.
21. Information Systems Research.
22. Journal of the AIS.
23. Journal of Information Technology.
24. Journal of Management Information Systems.
25. Journal of Strategic Information Systems.
26. Management Information Systems Quarterly.

Name of the Module: Entrepreneurship Practices

Module Code: MAC 944

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet the objectives of:

1. Give insights into the personality characteristics of an entrepreneurs and entrepreneurial manager.
2. Develop an understanding of how business opportunities are found by entrepreneurs and how they exploit them.
3. To enable the students in managing the growth of entrepreneurial firm.

Learning outcomes:

Upon Completion of the subjects:

1. Identify business opportunities and act upon those opportunities.
2. Write a business plan by identifying an opportunity.
3. Establishing and managing the growth of entrepreneurial firms

Subject Matter:

Unit I

Introduction to Innovation and Creativity in Entrepreneurship

Idea versus opportunity, sources of ideas and opportunities, identification, evaluation and selection of opportunities, exploiting and growing with opportunities, Business plan. Innovation and its forms Myths and realities, Understanding the process, How corporate entrepreneurship differs and where to find entrepreneurship within a company, The creative individual in an organization and the entrepreneurial personality, Creating an entrepreneurial work environment, HRM policies and practices for innovation & corporate entrepreneurship.

Unit II:

The Entrepreneurial Perspective and Entrepreneurial Management

Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; the entrepreneurial process, entrepreneurial motivation and competencies, entrepreneurship as a career option, future of entrepreneurship, traits & qualities of a successful entrepreneur, Manager Vs. Entrepreneur, difference between entrepreneurial manager and entrepreneur, qualities of a successful entrepreneurial manager, managerial versus entrepreneurial decision making.

Unit III:

The World of Opportunity, Business Plan and Entrepreneurial Support System

The opportunity, Idea versus Opportunity, sources of ideas and idea generation techniques, sources of opportunities, identification and selection of opportunities, the Business Plan, Components of a business plan, How to develop a good business plan?, Role of Entrepreneurial Institutions in Entrepreneurship Development, Director of Industries; DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC, Various Schemes and Incentives.

Unit IV:

Starting, Managing, and Growing with an Entrepreneurial Firm

The Entrepreneurial Team, dealing with the legal issues of a new venture creation, entrepreneurial finance, venture capital, initial public offering, creative sources of financing & funding: leasing, government grants & strategic partners, generating and exploiting new entries, strategies for growth and managing the implications of growth, franchising, internal versus external growth strategies, licensing and strategic alliances & joint ventures, and exit strategies.

Teaching/Learning/Practice Pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

Examination Pattern:

1. Theoretical Examination: Regular Examination, on-line and open book.

Reading List:

A. Books:

1. Morris Michael H. Kuratko, Donald F. & Covin Jeffrey G (2008) Entrepreneurship and Innovation in Corporations., Cengage Learning.
2. Desai, V.(2010), Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi.
3. Kaulgud, A. (2003). Entrepreneurship Management. Vikas Publishing House, Delhi.
4. Cynthia, L. G. (2004). Entrepreneurship Ideas in Action. Thomson Asia Pvt. Ltd., Singapore.
5. Timmons, J. A., and Spinelli, S. (2009). New Venture Creation: Entrepreneurship for the 21st Century, 8th Edition, Boston, MA: Irwin McGraw-Hill.
6. Barringer, D (2009) Entrepreneurship: Successfully Launching New Ventures, Pearson Education Publishing.

7. Hisrich, M (2001) Entrepreneurship, Tata McGraw Hill, New Delhi
8. Innovation and Entrepreneurship - Peter F. Drucker - Google Books
books.google.com Business & Economics Entrepreneurship?

B. Magazines:

1. Longe Magazine.
2. Home Business Magazine.
3. Entrepreneur.

C. Journals:

1. Entrepreneurship Theory and Practice.
2. Journal of Business Venturing.
3. Entrepreneurial Business Law Journal.
4. Entrepreneurship and Regional Development.
5. International Journal of Entrepreneurial Behaviour & Research.
6. International Journal of Entrepreneurship.
7. Journal of Applied Management and Entrepreneurship.
8. Journal of Developmental Entrepreneurship.
9. Journal of Entrepreneurship Education.
10. Journal of International Entrepreneurship.
11. New England Journal of Entrepreneurship.
12. Small Business Economics.
13. Journal of Product Innovation Management.

Name of the Module: Internet and Web Technology

Module Code: MAC 945

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet with the objectives of:

1. To complete an in-depth knowledge of web technology.
2. To know and to have the idea for different web application that most web developers are likely to use.
3. To be aware of, and to have used, the enhancements of the web applications.
4. To know the different types of web application software.

Learning outcomes:

At the end of the course the participant will:

1. Develop client/server applications
2. Update and retrieve the data from the databases using SQL
3. Develop server side programs in the form of servlets

Subject Matter:

Unit I

Network Layer and Routing protocol: Network Service model Datagram and Virtual circuit service- Routing principles- Link state routing-distant vector routing-hierarchical routing-multicast routing-IGMP Internet Protocol (IP): IPv4 addressing-routing and forwarding datagram-datagram format-datagram fragmentation, ICMP, DHCP.

Unit II:

Network Address Translators (NATs, Tunnelling: Dual stack and Header Translation, IPv6 packet format-transition from IPv4 to IPv6-Mobile IP., Routing in the Internet: Intra Autonomous System Routing : RIP and OSPF-Inter Autonomous System Routing : BGP Network layer in ATM.

Unit III:

Introduction to HTML: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;

Java & Java Beans: Scripts, Objects in Java Script, Dynamic HTML with Java Script & Introduction to Java Beans, Advantages of Java Beans, JDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans

API, Introduction to EJBs

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.

Unit IV:

Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Servlet, JSDK, The Servlet API, The javax.servelet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat.

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages Sharing Session and Application Data Memory Usage Considerations.

Teaching/Learning/Practice Pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

Examination Pattern:

1. Theoretical Examination: Regular Examination, on-line and open book.

Reading List:

A. Books:

1. C T Bhunia, Information Technology Network & Internet, New Age International Publications, New Delhi.
2. James F. Kurose and Keith W. Ross, Computer Networking A Top-Down Approach Featuring the Internet, 2/e Pearson Education, 2003.
3. S. Keshav, An Engineering Approach to Computer Networking, Pearson education, 2002.
4. F. Halsall, Data Communication, Computer Networks and Open Systems, Addison Wesley, 1996.
5. Andrew S. Tanenbaum, Computer Networks, 4/e, Pearson education, 2003.
6. Web Technology & Design - Xavier C., New Age Publication.
7. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers.

8. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech.
9. The complete Reference Java 2 Fifth Edition by Patrick Naughton and Herbert Schildt. TMH (Chapters:25).
10. Java Server Pages Hans Bergsten, SPD OReilly.
11. Internet and World Wide Web How to program by Dietel and Nieto PHI/Pearson Education Asia.
12. The XHTML 1.0 Web Development Sourcebook, by Ian Graham, Wiley.
13. The XML Specification Guide, by Ian Graham and Liam Quin, Wiley.
14. The HTML Stylesheet Sourcebook, by Ian Graham, John Wiley and Sons.

B. Magazines:

1. Digital Web Magazines, Nick Finck, United State.

C. Journals:

1. International Journal of Information Technology and Web Engineering (IJITWE), Information Resources Management Association,.
2. Journal of Web Semantics - Elsevier, Netherland.

Name of the Module: Information & System Security

Module Code: MAC 946

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

Objectives:

The course is design to meet with 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.

Learning outcomes:

By the end of the subject, students should be able to:

1. Identify some of the factors driving the need for network security.
2. Identify and classify particular examples of attacks.
3. Define the terms vulnerability, threat and attack.
4. Identify physical points of vulnerability in simple networks.
5. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.
6. Explain the implications of implementing encryption at different levels of the OSI reference mode.
7. Explain what is meant by data integrity and give reasons for its importance.
8. Describe methods of providing assurances about data integrity.
9. Describe the use of hash functions and explain the characteristics of one-way and collision-free functions.

10. Describe and distinguish between different mechanisms to assure the freshness of a message.
11. Explain the role of third-party agents in the provision of authentication services.
12. Discuss the effectiveness of passwords in access control and the influence of human behaviour.
13. Identify types of firewall implementation suitable for differing security requirements.
14. Apply and explain simple filtering rules based on IP and TCP header information.
15. Distinguish between firewalls based on packet-filtering routers, application level gateways and circuit level gateways.

Subject Matter:

Unit I

Introduction of Information Security, Cryptography, Conventional Encryption, Symmetric key cipher: Traditional technique: Substitution cipher, Transmission cipher, Stream Cipher, Block Cipher, Roaster Machine, Asymmetric Key Cipher, Rabin, Elgamal, ECC.

Unit II:

Modern Symmetric Techniques, Substitution Codes, Transposition codes, 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, IDEA.

Unit III:

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, Key Transport Protocols, Needham Schroeder Protocol, Key Agreement Protocol, Diffie-Hellman Protocol, Station to Station Protocol, Merkle Puzzle Technique of key agreement, Public Key Cryptography RSA Algorithm, Limitations of RSA Algorithm, Comparison of RSA and TRAP DOOR Public Key Crypto systems.

Unit IV:

Public key cryptographic mechanisms, Message Authentication: Hash Function, MAC, Digital Signature, Digital Signature under RSA algorithm ; check functions for authenticity, integrity and non repudiation of the message content, Non repudiation by digital signature of RSA, Strength of Mechanism ; PGP (Pretty Good Privacy) Modern Crypto Systems, Integrated Solution of Security and Error Control; Internet Security, IPsec, SSL, TLS .

Teaching/Learning/Practice Pattern:

Teaching: 40%

Learning: 10%

Practice: 50%

Examination Pattern:

1. Theoretical Examination: Regular Examination, on-line and open book.

Reading List:

A. Books:

1. C.T. Bhunia - Information Technology Network & Internet New Age Publication.
2. Atul Kahate-Cryptography and Network Security - Tata McGraw-Hill Education, 07-2008.
3. Information Warfare: How to Survive Cyber Attacks by Michael Erschloe.
4. Hacking Linux Exposed by Brian Hatch, James Lee and George Kurtz, Osborne/McGraw-Hill.
5. Incident Response by Kenneth R. van Wyk and Richard Forno, O'Reilly Media.
6. Incident Response: Investigating Computer Crime by Kevin Mandia, Chris Prosise, mcgraw-Hill Professional.
7. Hacker's Challenge by Mike Schiffman, McGraw-Hill/Osborne.
8. CERT Guide to System and Network Security by Julia Allen, Addison-Wesley Educational.
9. Authentication: From Passwords to Public Keys by Richard E. Smith, Addison-Wesley.
10. Web Hacking: Attacks and Defense by Stuart McClure, Saumil Shah, Shreeraj Shah, Addison-Wesley Professional.
11. Anti-Hacker Tool Kit by Mike Shema, Bradley C. Johnson, Keith J. Jones, mitp-Verlag.

B. Magazines:

1. Information Security - SC Magazines, Haymarket Media Inc., United State.
2. InfoSec Magazines, United Kingdom.

C. Journals:

1. Journal of Computer Security, IOS press, Netherland.
2. International Journal of Information Security - Springer, United State.
3. Journal of Information Security and Applications - Elsevier, Netherland.

Name of the Module: Knowledge Management

Module Code: MAC 947

Semester: 4th

Teaching Methodology/Model: S.N. Bose

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

Objectives:

This course focuses on how knowledge is created, captured, represented, stored and reused so as to fully leverage the intellectual assets of a firm. The tools and techniques for knowledge acquisition, assessment, evaluation, management, organization and dissemination are applied to business situations. Topics include knowledge generation, knowledge coordination and codification, knowledge transfer and reuse, technologies and knowledge management and knowledge management strategies.

Learning outcomes:

On the successful completion of the course, the student would be able to

- Develop basic conceptual and behavioral skills that are necessary for the development and utilization of organizational knowledge.
- Students are expected to be able assess an organizations knowledge capabilities, and to formulate strategies for their elective development, deployment, and utilization.

Subject Matter:

Unit I

Knowledge Economy-Concept of Knowledge; the Data-Information-Knowledge-Wisdom Relationship (Knowledge Hierarchy); Organizational Knowledge; Characteristics of Organizational Knowledge; Components of Organizational Knowledge (Tacit vs. Explicit Knowledge), Knowledge Management Strategy- Prioritizing knowledge strategies knowledge as a strategic asset. KM Strategy and Metrics, Guiding principles for managing knowledge Leadership and KM.

Knowledge and economics, Knowledge and learning, Knowledge networks, Knowledge and employment, Knowledge production, Knowledge transmission, Knowledge transfer.

Unit II:

Transformation of an Enterprise through Knowledge Management-Concept of Knowledge Management; Characteristics of Knowledge Management; Knowledge attributes- Fundamentals of Knowledge formation, knowledge sourcing, Knowledge Management application, Need for a Knowledge Management System; the Knowledge Management Process Framework; Knowledge Management Process; Knowledge Life Cycle.

Unit III:

The Knowledge Organization-Knowledge Organization; Characteristics of Knowledge Organization; Knowledge Management and Organizational Learning; developing and sustaining knowledge culture, knowledge culture enablers, knowledge culture enhancement program, Knowledge Management Strategy and its Development; the Knowledge Managers En-

abling Knowledge Management through Information Technology-Role of Information Technology in Creating Knowledge-Management Systems; Organizational Culture for Knowledge Management-Need for Organizational Culture for Knowledge Management; Ways to Develop Knowledge-Sharing Culture. **Unit IV:**

Looking Ahead: Knowledge careers, practical implementation of knowledge management system, Future of Knowledge Management-Challenges to Knowledge Management; Future of Knowledge Management, KM Today and Tomorrow-Attention management, Idea factories/incubators.

Customer relationship management (CRM), KM and organizational learning of the future (KM and e-learning, learning management systems, just-in-time learning, learning objects) KM and life-long learning, From killer applications to killer existence.

Teaching/Learning/Practice Pattern:

Teaching: 60%

Learning: 40%

Practice: 0%

Examination Pattern:

1. Theoretical Examination: Open book and on line.

Reading List:

A. Books:

1. Bhunia, C.T (2003). Introduction to Knowledge Management, Everest Publishing House.
2. Tiwana, A (2001),: The Knowledge Management Toolkit (Orchestrating IT, Strategy, and Knowledge Platforms, Pearson Education Limited.
3. D. Morey, M. Maybury, & B. Thuraisingham (Eds) (1993) Knowledge Management (Classic and Contemporary Works), Universities Press (India) Limited.
4. Gogula,R (2002) : Knowledge Management A New Dawn, The Institute of Chartered Financial Analysis of India (ICFAI) Press.
5. Awad,E,M, Ghaziri,H.M (2007). Knowledge Management, Pearson Education Limited.
6. Natrajan, G & Shekhar, S(2009). Knowledge Management (Enabling Business Growth, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Schreiber, G.; Akkermans, H.; Anjewierden, A.; de Hoog, R.;Shadbolt, N.; de Velde, W. V. & Wielinga, B. (1999), Knowledge. Engineering and Management, Universities Press (India) Limited.
8. H. C. Chaudhary,H.C (2005), : Knowledge Management for Competitive Advantage (Changing the world through Knowledge), Excel Books.

9. Rao, M.(2003). Leading with Knowledge (Knowledge Management Practices in Global InfoTech Companies), Tata McGraw-Hill Publishing Company Limited New Delhi.
10. Goyal, O.P (2007). Knowledge Management (Analysis Design for Indian Commercial Banking Sector), Kalpaz Publications, Delhi
11. Bukowitz, W.R and Williams,R.L(1999):The Knowledge Management Fieldbook, Pearson Education limited.
12. Davenport, T.H., and Prusak, L(1998). Working Knowledge: How Organizations Manage What They Know, NetLibrary Incorporated, Boulder, CO
13. Groff, T.R., and Jones, T.P(2003). Introduction to Knowledge Management, Butterworth-Heinemann, San Diego, CA
14. Knowledge Management Systems: Information and Communication
books.google.com Computers Databases General?

B. Magazines:

1. Knowledge Management Magazine
2. KMWorld Magazine
3. Inside knowledge
4. Knowledge Management Review

C. Journals:

1. Journal of Information & Knowledge Management.
2. Journal of Knowledge Management
3. International Journal of Learning and Intellectual Capital
4. International Journal of Knowledge Management Studies,
5. Journal of Knowledge Management
6. International Journal of Knowledge Management Studies
7. International Journal of Knowledge Management
8. Knowledge Management for Development Journal