## IT Courses

<table>
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<tr>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
<th>FOURTH</th>
<th>FIFTH</th>
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<th>SEVENTH</th>
<th>EIGHT</th>
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### Electives (ELT) VI Semester

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>CIS 730E</td>
<td>Cryptography &amp; Information Security</td>
</tr>
<tr>
<td>IWP 730E</td>
<td>Internet &amp; Web Security Protocols</td>
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<tr>
<td>RMP 730E</td>
<td>Robot Motion Planning</td>
</tr>
<tr>
<td>MOC 730E</td>
<td>Mobile Computing</td>
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<tr>
<td>IRS 730E</td>
<td>Information Retrieval System</td>
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<tr>
<td>CSE 730E</td>
<td>Cognitive &amp; Cognitive Systems</td>
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<tr>
<td>SLT 730E</td>
<td>Speech and Language Technologies</td>
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<tr>
<td>MOC 730E</td>
<td>Mobile Computing</td>
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<tr>
<td>PAC 730E</td>
<td>Parallel Computing</td>
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<td>HUR 730E</td>
<td>Humanoid Robotics</td>
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<tr>
<td>MDM 730E</td>
<td>Mobile Data Management</td>
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<tr>
<td>MSE 730E</td>
<td>Mobile Software Engineering</td>
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<tr>
<td>RSC 730E</td>
<td>Radar &amp; Satellite Communication</td>
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<tr>
<td>WSN 730E</td>
<td>Wireless Sensor Network</td>
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### Basic Courses

<table>
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<tr>
<th>Course</th>
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<tbody>
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<td>PHY 132E</td>
<td>Physics-1</td>
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<tr>
<td>MAT 130</td>
<td>Mathematics-1</td>
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<td>MAT 230</td>
<td>Mathematics-2</td>
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<td>MAT 330</td>
<td>Mathematics-3</td>
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<tr>
<td>PBS 432</td>
<td>Probability &amp; Statistics</td>
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### HSS Courses

<table>
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<tbody>
<tr>
<td>LCS 102</td>
<td>Language and Communication Skills</td>
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<tr>
<td>PME 220</td>
<td>Principal of Management &amp; Economics</td>
</tr>
<tr>
<td>POM 320</td>
<td>Principles of Management</td>
</tr>
<tr>
<td>POE 530</td>
<td>Principles of Economics</td>
</tr>
<tr>
<td>ORB 720</td>
<td>Organizational Behaviour</td>
</tr>
<tr>
<td>PHS 720</td>
<td>Philosophy of Science</td>
</tr>
</tbody>
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### IT Courses

- **ITC 102**: Introduction to Computers
- **ITP 102**: Introduction to Programming
- **EDC 132**: Electronic Devices & Circuits
- **CAS 130**: Circuit Analysis and Synthesis
- **DMA 230**: Discrete Mathematics
- **DST 232**: Data Structures
- **DEL 232**: Digital Electronics
- **COA 230**: Computer Organization and Architecture
- **OPS 332**: Operating System
- **TOC 330**: Theory of Computation
- **OOM 332**: Object Oriented Methodologies
- **MIP 332**: Microprocessors
- **DAA 432**: Design and Analysis of Algorithms
- **PPL 430**: Principles of Programming Languages
- **DBM 432**: Data Base Management System
- **DCOM 432**: Digital Communication
- **CNE 532**: Computer Networks
- **SOE 532**: Software Engineering
- **AIN 532**: Artificial Intelligence
- **GVC 532**: Graphics and Visual Computing
- **COD 632**: Compiler Design
- **WBT 632**: Web Technologies
- **DMW 632**: Data Mining and Warehousing
- **SIM 732**: Simulation & Modelling
- **PRO**: Mini Project

### Electives (ELT) VII Semester

- **CIS 730E**: Cryptography & Information Security
- **IWP 730E**: Internet & Web Security Protocols
- **RMP 730E**: Robot Motion Planning
- **MOC 730E**: Mobile Computing
- **IRS 730E**: Information Retrieval System
- **CCS 730E**: Cognitive & Cognitive Systems
- **SLT 730E**: Speech and Language Technologies
- **MOC 730E**: Mobile Computing
- **PAC 730E**: Parallel Computing
- **HUR 730E**: Humanoid Robotics
- **MDM 730E**: Mobile Data Management
- **MSE 730E**: Mobile Software Engineering
- **RSC 730E**: Radar & Satellite Communication
- **WSN 730E**: Wireless Sensor Network

### Basic Courses

- **PHY 132**: Physics-1
- **MAT 130**: Mathematics-1
- **MAT 230**: Mathematics-2
- **MAT 330**: Mathematics-3
- **PBS 432**: Probability & Statistics

### HSS Courses

- **LCS 102**: Language and Communication Skills
- **PME 220**: Principal of Management & Economics
- **POM 320**: Principles of Management
- **POE 530**: Principles of Economics
- **ORB 720**: Organizational Behaviour
- **PHS 720**: Philosophy of Science

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### Basic Courses

- **CIS 730E**: Cryptography & Information Security
- **IWP 730E**: Internet & Web Security Protocols
- **RMP 730E**: Robot Motion Planning
- **MOC 730E**: Mobile Computing
- **IRS 730E**: Information Retrieval System
- **CCS 730E**: Cognitive & Cognitive Systems
- **SLT 730E**: Speech and Language Technologies
- **MOC 730E**: Mobile Computing
- **PAC 730E**: Parallel Computing
- **HUR 730E**: Humanoid Robotics
- **MDM 730E**: Mobile Data Management
- **MSE 730E**: Mobile Software Engineering
- **RSC 730E**: Radar & Satellite Communication
- **WSN 730E**: Wireless Sensor Network

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### HSS Courses

- **LCS 102**: Language and Communication Skills
- **PME 220**: Principal of Management & Economics
- **POM 320**: Principles of Management
- **POE 530**: Principles of Economics
- **ORB 720**: Organizational Behaviour
- **PHS 720**: Philosophy of Science
COURSE DESCRIPTION

PHY 132
L-T-P-[C]
3-0-2-[5]

Physics – 1


Text Books:

1. Perspectives on Modern Physics, A. Beiser
2. Introduction to Electrodynamics: D J Griffiths
3. Thermal Physics, B.K. Agrawal

Lab Assignments:

1. Torsion Table - Modulus of Rigidity of the Given Wire & Moment of Inertia of an irregular body
2. Compound Pendulum - To determine the value of “g” and radius of gyration using a Bar Pendulum
3. Spiral Spring - To determine the force per unit extension & effective mass of a spiral spring using static and dynamic method
4. AC Bridge (With Capacitance) - To measure the unknown capacitance & to verify AC Bridge
5. Post Office Box (Unknown Resistance) - Measurement of unknown resistance (rheostat) using post office box
6. Specific Heat Capacity - To measure the specific heat capacity of the material of a given metal
7. Thermocouple - To measure the seebeck co-efficient of a given thermocouple
8. To determine the width of the slit using Laser Light Source
Network Theorems and Elements: Network graphs, matrices associated with graphs, incidence, fundamental cut set and fundamental circuit matrices, Kirchoff’s Laws, Node Voltage and Mesh Current Analysis, Delta-Star and Star-Delta Transformation, Source Conversion. Thevenin’s, Norton’s, Reciprocity, Superposition, Compensation, Miller’s, Tellegen’s and Maximum power transfer Theorems, Networks with dependent sources, Inductively coupled circuits - mutual inductance, coefficient of coupling and mutual inductance between portions of same circuits and between parallel branches.


Network Functions & Two Port Networks: Terminals and terminal pairs, driving point impedance transfer functions, state equations for networks, poles and zeros, Procedure of finding network functions for general two terminal pair networks, Stability & causality. Hurwitz polynomial, positive real function, Two port parameters and their interrelations - z-parameters, y-parameters, h-parameters, ABCD parameters.


Text Books:


Calculus: Review of single variable Calculus, Power series, Radius and circle of convergence of power series. Functions represented by power series. Power series solution of differential equations. Algebra of \( R^n \), Standard inner product on \( R^n \), Cauchy scharwz and Bessels inequality, Metric structure on \( R^n \), Subsets and Geometric objects in \( R^n \), Limit points of subsets, Open balls and closed balls, Matrices as linear transformations, Functions from \( R^n \) to \( R^m \), Limit of a function, Algebra of limits, Limit of compositions, Continuous functions on closed balls and their properties, Differentiability and derivative of functions from \( R^n \) to \( R^m \), Geometric meaning of derivatives, Algebra of differentiable functions, Partial derivatives, directional derivatives, gradient divergence and curl. Chain rule, mean value theorem, repeated partial derivatives, Higher order derivatives, Taylors Theorem, Jacobian matrix and Jacobian, Inverse and implicit functions, Different coordinate systems, orthogonal curvilinear coordinates, Shapes of curves and surfaces, Maxima, Minima and saddle points, Lagrange Multipliers.

Text Books:

1. Differential Equations, G. F. Simmons, Tata Mcgraw-Hill.
3. Calculus (1 & 2), Apostol, T.M
4. Calculus on Manifolds, Spivak
5. Mathematical Analysis, Malik and Arora
6. Principles of mathematical Analysis, Walter Rudin
Electronic Devices and Circuits


Carrier transport in semiconductor: diffusion current, drift current, mobility and resistivity. Generation and recombination of carriers in semiconductors. Thermal Noise, Shot Noise. Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Tunnel diode, Diode clipper and clamper circuits, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Power Supplies, Light emitting diodes, avalanche photo diode.

Bipolar Junction Transistors (BJTs): Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Current-voltage characteristics of BJT, BJT as an amplifier and as a switch. BJT Circuits at DC, Biasing in BJT amplifier circuits, Small Signal Operation of BJT: Simplified model (h-parameters and y-parameters) and its application to single stage BJT amplifiers (Common-Emitter, Common-Base and Common-Collector configurations).

Small Signal Analysis of BJTs: Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CE, CC, CB Amplifier with and without RE, Effect of RS and RL on CE Amplifier, Emitter Follower, Analysis of Cascade, Darlington Connection and Current Mirror Circuits using BJTs.

High Frequency Response of BJTs: Low and High Frequency Response of BJTs, The Unit gain - frequency (ft), Frequency Response of CS Amplifier, Frequency Response of CE Amplifier, Multistage Frequency Effects, Miller Effect Capacitance, Square Wave Testing.

Text Books:

Lab Assignments:
1. Draw the VI characteristics of 1N4007 diode.
2. To observe the waveform of Half wave Rectifier and Full wave Rectifier from 1N4007
3. Design a dual LED circuit to operate at 5VDC. Observe the gradual change in colour from RED to green by changing current through the lines.
4. To implement biased Series Positive Clipper using a 1N4007 diode and verify its waveforms using a Sinusoidal input of 10Vp-p, 1kHz.
5. To implement biased Series Negative Clipper using a1N4007 diode and verify its waveforms using a Sinusoidal input of 10Vp-p, 1kHz.
6. To implement biased Parallel Positive clipper using a 1N4007 diode and verify its waveform using a Sinusoidal input of 12Vp-p, 1kHz. To implement biased Parallel Negative clipper using a 1N4007 diode and verify its waveform using a Sinusoidal input of 12Vp-p, 1kHz.

7. To implement Positive clamper and verify its working using Sinusoidal input of 8Vp-p, 1kHz.

8. To implement Negative clamper and verify its working using Sinusoidal input of 8Vp-p, 1kHz.

9. Plot the VI characteristics of Zener Diode.

10. To plot the input and output characteristics for Common base configuration using a BC547 transistor.

11. To plot the input and output characteristics for Common emitter configuration using a BC547 transistor.

12. Plot frequency vs. gain curve for a BC547 transistor on to a semi log sheet.
Introduction to Programming

Introduction, Pseudocode, Operators, expressions and statements, if-else condition, for loop, while loop, do while loop, Jump statements, 1-d arrays, Strings, 2-d arrays, Pointers, arrays vs. pointers, Functions, Header files (math.h, time.h, custom headers), External functions, Pointers to pointers and pointers to functions, Bitwise operators, struct and union, Pre-processor directives and macros, I/O handling, Operator precedence vs. order of evaluation, Type casting, Integral promotions, Conversions (standard type and arithmetic), Dynamic memory allocation, Linked lists, Command line arguments, Standard libraries, Introduction to Python, OOP concepts in Python.

Text Books:

1. C Programming Language (Ed 2) by Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall
2. Expert C Programming: Deep C Secrets by Peter van der Linden, Prentice Hall
3. C Programming FAQs by Steve Summit, Deborah Lafferty, Addison-Wesley Professional
4. C Traps and Pitfalls by Andrew Koenig, Addison-Wesley Professional
5. The C Puzzle Book by Alan R. Feuer, Addison-Wesley Professional

Lab Assignments:

1. Commands: Find the C compiler version of your system, Use man command to see the pre-defined functions of stdio, Use man command to see the syntax of printf function, Analyze the vi commands.

2. Programs: Write the program to print the Hello World. Write the program to find the size of all data types. Write the program to find the minimum and maximum value of the integer and float. Write a program to analyze and find the maximum size integer can support in the system compiler. Write the program to perform the calculator operation. Write the program to read ‘n’ real numbers and print the maximum. First input is ‘n’. Write the program to find if given numbers are prime (do not use functions). Write the program to print ASCII values of each letter for a given a string (of maximum size 100 characters). Write the program to read two matrices A and B of dimension n x n. Print A + B. Write the program to read n words, each of different length. Print them according to their length. Write the program to read n unsigned characters and print the average values of the bits. Write the program to read the n numerical characters from the file and do the sum of it. Write the program to print the multiplication table using static and functions. Write the program for student mark list using structure, pointer and dynamic memory allocation. Write the python program to get the integer input n and print the odd sequence till n. Write a Python program to find first n primer numbers.
Introduction to Computers

Two credit hours lab oriented course conducted through live demo on projector PC and hands on practice in the lab. Hardware lab is setup at LT using old hardware components for the sake of demonstration and explanation of working and principles of computer hardware.

Computer Hardware Components: Motherboard, Hard Disk, RAM, Processor, Bus, Ports, Signaling, Formatting, BIOS Settings, Assembling and Troubleshooting.


OS Features & Commands: Foreground & Background Services, Shell Commands & Scripting, Physical Networking, PC Level Network Troubleshooting, IIITA Network Demonstration as Case Study, Remote Login and File Sharing on Intranet, Transfer of Contents using HTTP, FTP, SSH protocols.

Basics of Internet & Web Concept: Data Transfer on LAN, Switch & Router Operations, Web Server Concept, HTML Coding, Web Page Hosting, DNS Working, Central Authentication using LDAP, Routine Troubleshooting w.r.t. IIITA Campus LAN (specially hostels and labs).

Maintenance of Computers & Servers: Objective of Software Services & Software used at IIITA, Basic Idea of Installation and Configuration, Frequent Run Time Problems and their Possible Solutions.

Language and communication skills

Communication Process and Principles of Communication - Barriers to Communication.

Written Communication - Letter and Report Writing.

Written Analysis of Business Situation - Case Analysis

Text Books:

1. Business Correspondence and Report Writing - R.C.Sharma
2. Business Communication - M.Balasubramanyam
4. Business Communication and Report Writing - Sharma, Mohan
5. Lesikar’s Basic Business Communication - Lesikar
Principal of Management & Economics


Text Books:

4. Management Mess Ups - Mark Eppler
5. Management - W. Haynes
6. Economics; Samuelson & Nordhaus.
7. An introduction to Positive Economics; Lipsey.
9. Macroeconomics - an open economy approach; Eric Pentecost.
15. The Economics of Technological Diffusion; Stoneman.
Computer Organization and Architecture

Digital Computers and Performance Measures: Introduction, functional entities, general purpose computer, brief-review of computer development and analog-digital conversion, Performance Measures Representation of Information: Data types and classification, number system, binary and alphanumeric codes, complements, unsigned, signed, fixed-point and floating-point representation, binary arithmetic using signed and unsigned number systems, concept of overflow and normalization, Gray and other binary codes, Error detection and correction codes.

Basic Building Blocks: Boolean algebra, combinatorial logic design, flip-flops, registers, counters, decoders, ALU, arithmetic circuits and their implementation. Register transfer and micro-operations: Register transfer, Memory and bus transfer, Arithmetic, logic and shift micro-operations, Arithmetic-logic-shift (ALU) unit and design consideration.

Computer organization, design and programming: Instruction code, registers, timing and control, cycle, Input-output and interrupts, accumulator and basic computer design, addressing modes, machine language, assembly language, subroutines, assembler, programming AL operations. Micro-programmed control and CPU: Control memory, address sequencing, control unit design, register & stack organization, instruction formats, addressing modes, data transfer, program control, RICS and CISC computer.

Performance enhancement with Pipelining and vector processing: pipelining, parallel processing, pipelined data path, control, data and branch hazards and forwarding, exceptions, vector processing. Computer arithmetic and memory organization: addition, subtraction, division, multiplication algorithms, floating point and decimal arithmetic operations, asynchronous data transfer, DMA, priority interrupts, IOP, memory types, organization and management.

Text Books:

Discrete Mathematics and Mathematical Logic


Text Books:

1. Tremblay & Manoher: Discrete Mathematical Structures with Applications to Computer Science (Tata McGraw Hill)
2. Kolman, Busby & Ross: Discrete Mathematical Structures (Prentice Hall of India)
Data Structure

Programming in C. Elementary data structures: arrays and strings; packing; space arrays; algorithm development; complexity; simple examples of algorithm development; recursion. Sequential search: divide and conquer-binary search; selection and insertion sort; merge-sort; quicksort; complexity of sorting. Linear lists-stacks: stack use-postfix notation; recursion removal. Queues-circular queues. Linked lists-definition on Pascal and C; creation and deletion of nodes; circular and doubly linked lists; applications of lists.

Graphs and representation sets-UNION and FIND operations: graph algorithms; optimization and greedy method; minimum spanning tree, shortest path. Trees; binary tree traversals; search trees, AVL trees; threaded trees; heapsort; tries and B-trees; external search. Tables and information retrieval; hashing; depth first and breadth first search; examples of backtracking. String algorithms-pattern search and text editing. Structured approach to programming step wise refinement approach. Reasoning about programs, program specification, pre-and post condition, weakest pre-conditions, program assertions, loop invariants. Programming style-documentation, basic concepts of program testing.

Text Books:


Lab Assignments: Assignments based on implementation of all theoretical concepts learned.
Mathematics-II

Linear Algebra: Review of Vector Algebra in $\mathbb{R}^3$ and generalizing it to $\mathbb{R}^n$ including scalar product. Definition and examples of fields (including $\mathbb{Z}_p$, $p$ a prime). Vector space over a field. Subspaces and subspaces generated by a subset. Subspaces of $\mathbb{R}^3$ and of $\mathbb{R}^2$. Linear dependence and independence. Concept of a basis and dimension of a vector space. Sum of subspaces and Quotient of a vector space modulo a subspace. Dimension of sum of subspaces and of quotient spaces.


Text Books:

5. Serg, Lang, Introduction To Linear Algebra.
Lab Assignments:

1. For Linear Algebra: 1) Write a program to check if a natural number \( n \) is prime and if so to find the multiplicative inverse of an element \( r \neq 0, r \in \mathbb{Z}_n \). Implement it to find the inverse 20 in \( \mathbb{Z}_{2^{16}+1} \) and 21 in \( \mathbb{Z}_{641} \). 2) Write a program to reduce a matrix in echelon and also to normal form. 3) Write a program to check if a system of 3 linear equations in 3 variables is consistent and if so to find the solution set. 4) Write a program to find the inverse of a square 3 \( \times \) 3 matrix if possible. 5) Write a program to find square root of a real symmetric matrix.

2. For Numerical Methods: Write down an algorithm and specific computer programs in C or C++ for each method discussed in the theory lecture.
Digital Electronics

Number System: Introduction to Binary Numbers, Data Representation, Binary, Octal, Hexadecimal and Decimal Number System and their Conversion. Boolean Algebra and Logic Gates: Basic Logic Operation and Identities, Algebraic Laws, AND, OR, NOR, NAND, EX-OR, EX-NOR Gates, Useful Boolean Identities, Algebraic Reduction, Complete Logic Sets, Arithmetic Operation using 1's and 2's Compliments, Signed Binary and Floating Point Number Representation, Introduction to logic families: DTL, TTL, MOS, CMOS, ECL.


Memory Elements and Arrays: General Properties, Latches, Flip Flops: RS Flip Flop, D Flip Flop, T Flip Flop, JK Flip Flop, Clock and Synchronization, Master-Slave and Edge-triggered Flip-flops, Registers, RAM and ROMs: different types, Programmable logic array, C-MOS Memories. Sample and Hold circuits, Analog to Digital Converters and Digital to Analog Converters.

Text Books:
1. Digital Design by M. Morris Mano.

Lab Assignments:
1. Realization of logic gates using IC. Implementation of all gates using universal gates.
2. Construction of Half/Full Adder and Half/Full Subtractor.
3. Realization of circuit for binary to gray conversion and vice-versa
4. To design 4-bit binary adder and subtractor using IC 7483
5. To construct circuit for 9s complement of a BCD number.
6. To construct a full adder using 3x8 decoder.
7. To construct a 4:1 multiplexer circuit.
8. To construct SR and D flip-flop, JK and T flip-flop.
9. To design a binary converter using IC 7473 and 7400.
MAT 330
L-T-P-[C]
3-0-0-[3]

Mathematics -III

LAPLACE TRANSFORMS: Definition and properties, Sufficient condition of Existence, Transforms of derivatives and integrals, Derivatives and integrals of transforms, Inverse Laplace Transforms, Exponential shifts, Convolutions, Applications: Differential and Integral Equations, Abel Mechanical Problem, Circuit Theory.

FOURIER SERIES: Periodic Functions, Fundamental Period, Trigonometric series, Fourier Series, \( L^2[0, 2\pi] \), Bessel’s Inequality, orthonormal and orthogonal set, Euler Formulas, Functions with arbitrary periods, Even and odd Functions, Half Range Expansions, Fourier Coefficients without integration, Approximation by Trigonometric polynomials, Application to Differential equation.


Z TRANSFORMS: Z transforms, properties, Inverse Z-transforms, relationship with Fourier transforms.


Text Books:

Microprocessors

General architecture of microcomputer system, evolution of Intel microprocessors, stored program concept, microcomputer applications. 8086/88 software architecture: memory space, data types and organization, segmented memory concept, dedicated, reserved and general use memory, addressing modes. Instruction set: data transfer, arithmetic, logical, string, control transfer instructions and processor control instructions.

Microprocessor program specification, design and coding: conceptualization and modularization of problem, coding, assembling, testing, debugging and documentation. Arithmetic & logical programming, timing delays, data tables, procedure and macros, modular programming. Assembly language programming examples, case studies and product development. 8086/88 hardware organization and design: three bus architecture, system clock and reset signal generation, bus types and buffering techniques, minimum and maximum modes of operations.

Input/output and main memory design, parallel, serial, programmed, interrupt driven I/O (8279) and DMA based data transfer (8237). Peripheral controllers for 8086/88: 8237, 8251, 8255, 8259, and 8279. Coprocessors: Numeric data processor (8087), I/O Processor (8089). Introduction to other Intel microprocessors.

Text Books:


Lab Assignments:

1. Assembly language programming of 8086.
2. Interfacing of 8086: memory interfacing, design of I/O modules and interfacing of different peripherals, parallel interfacing using A/D and D/A converters.
3. Mini Project based on microcontroller and microprocessor.
Operating System


Text Books:


Lab Assignments:

1. Write c programs for the following: 1) Simulate First come First Serve CPU scheduling algorithm (a) Assume that all arrived at the same time (b) Simulate with different arrival times. 2) Simulate Shortest Job First CPU Scheduling algorithms. 3) Simulate Round Robin CPU Scheduling algorithm. 4) Simulate Priority based CPU Scheduling algorithm. 5) Combine all CPU Scheduling approaches in a single C Program. 6) Write a c program to simulate Bankers Safety Algorithm. 7) Simulate Bankers Resource Request Algorithm. 8) Simulate Producer Consumer problem with all possible solutions. 9) Simulate Readers Writers problem with all possible solutions. 10) Simulate Sleeping Barber problem with all possible solutions. 11) Simulate Dining Philosopher problem with all possible solutions. 12 Implement First Come First Serve Disk scheduling algorithm. 13) Implement Shortest Seek Time First Disk scheduling algorithm. 14) Implement Scan Disk Scheduling algorithm. 15) Implement Look Disk Scheduling algorithm. 16. Write a c program to simulate FIFO page replacement algorithm. 17) Simulate LRU page replacement algorithm. 18) Simulate Optimum page replacement algorithm.
OPS 332  
Continued

2. MINIX OS: 1) Study of the directory structure of Minix Operating System. 2) Change the root banner in Minix. 3) Create an user account in Minix. 4) Modifying prompt message displayed by Minix when it boots. 5) Modifying output format of cal command. 6) How to Add a New System Call in Minix explain with example. 7) Modify the tty driver so that control-W erases the previous word typed by the user. 8) Modify the F6 key to output your name and current version of Minix. 9) How to implement a System Call (SC) on Minix 3 that returns the PID (Process ID) and the PPID (Parent Process ID). 10) Write a command to show the size and date of last modification of the contents of each directory along a given path. 11) Write a system call to change the priority of the process. 12) How to Exchange Data with Other Operating Systems to Minix. 13) Modify the mined editor in Minix. 14) Explain how we can restore the previous settings in Minix.

3. Study and development of various android apps.

TOC 330
Theory of Computation

Regular languages: Introduction: Notion of a formal language, DFAs and notion for their acceptance, informal and formal definitions. Class of regular languages, Closure of the class under complementation, union and intersection. Strategy for designing DFAs, Pumping lemma for regular languages, NFAs. Notion of computation trees. Definition of languages accepted. Construction of equivalent DFAs of NFAs. NFAs with epsilon transitions, Regular expressions, Closure properties for regular languages, Myhill-Nerode theorem as characterization of regular languages, States minimization of DFAs.


Turing machines, Recursively enumerable languages, undecidability. Informal proofs that some computational problems cannot be solved. Turing machines (TMs), their instantaneous descriptions. Language acceptance by TMs. Church-Turing hypothesis and its foundational implications, Codes for TMs. Recursively enumerable (r.e.) and recursive languages. Existence of non-r.e. languages. Notion of undecidable problems. Universal language and universal TM. Separation of recursive and r.e. classes. Notion of reduction. Some undecidable problems of TMs. Rice's theorem, Undecidability of Post's correspondence problem (PCP), some simple applications of undecidability of PCP.

Text Books:

Object Oriented Methodologies

The Course introduces the characteristic differences between Procedural and Object Oriented approach for programming. Concepts of Class, Objects and Object Oriented Characteristics. Building upon basic programming skills in OO, specifically using basic Java programming constructs for object oriented problem solving (e.g., Classes: Abstraction, inheritance, interfaces, polymorphism), Methods in OO Programming: Method overloading and overriding.

To appreciate the role of Object orientation in problem solving and to be able to design and implement a Java program to model a real world system, and subsequently analyse its behaviour. Java implementation for GUI, Event handling and Applets for Web enabled applications. Developing Applications with GUI and Database connectivity.

This module focuses on the design and analysis of larger, more complex programs using Object Oriented Modeling with UML. Why build models of software, Why should we build comprehensive designs before coding Static and Dynamic modeling diagrams and role of Use Case Diagrams.


Text Books:

2. UML distilled by Martin Fowler.
Principles of management


International Business and its Environment - globalization & WTO-. Dynamics of development Global business environment-. Internal and External analysis.


Staffing and Directing: Staffing as a Function of Management - Requirement of Effective Direction - Functions of Direction - Principles of Direction - Supervisor and his Qualities - Supervisors Role and Functions - Effective Supervision.


Text Books:

5. James A. Stoner, Edward Freeman, Daniel Gilbert, Management, PHI Learning, New Delhi, 2007
Probability & Statistics


Special discrete distributions: Bernoulli, Binomial, Geometric, Negative binomial, Hyper-geometric, Poisson, Uniform. Special continuous distributions: Uniform, Exponential, Gamma, Normal, Weibull, Reyleigh. Random vector: Joint distributions, Marginal and conditional distributions, Moments, Independence of random variables, Covariance, Correlation, Functions of random variables. Law of Large Numbers: Weak law of large numbers, Levy’s Central limit theorem (i.i.d. finite variance case), Normal and Poisson approximations to Binomial.


Text Books:

Digital Communication

Introduction to Digital Communication, Sampling, Quantization, Pulse Code Modulation, Delta Modulation, adaptive delta modulation.

Line coding techniques (RZ, NRZ, AMI, and Manchester), Spectra of digital signals, Spectral shaping by precoding, Binary and M-ary error probability, Matched filters, Nyquist pulse shaping, Equalization, Optimum terminal filters and correlative coding, synchronization techniques.

Optimum detection and MAP receivers, digital multiplexing, Digital continuous wave modulation techniques: ASK, FSK, PSK, staggered and non staggered QPSK, /4-QPSK, MSK, GMSK, coherent and non coherent systems, Spread Spectrum, Jamming considerations, CDMA fundamentals.

Information measure and source coding techniques, mutual information, Binary symmetric channel, Channel capacity, Shannon Hartley law.

Principle of error control coding, BEC and FEC systems. Introduction to block codes, Cyclic Codes, Convolution codes and trellis coded modulation.

Text and Reference Books:

2. Digital Communication, B. P. Lathi.

Lab Assignments:

1. To be performed on bread-board: Perform Amplitude modulation, Perform Frequency modulation, Implement ASK Modulator using RC shift Oscillator IC LF398, Implement BPSK Modulator using IC LF398 & IC 741 FSK Modulator using IC LF398, Implement a circuit to generate Convolution Coder output bit sequence using 7486, Implement Mixer circuit using 565 PLL IC and study its working characteristics, Implement Digital Phase Detector using IC-741 & IC-7486.

2. MATLAB/C++ Programming: Write a MATLAB and C++ program to generate output of ASK, FSK & PSK, Write C++ program for Huffman encoding, Write a C++ program for implementing Linear Block Code and illustrate encoding & decoding
Design and Analysis of Algorithms


Models of computation: RAM model and its logarithmic cost. Formal introduction to algorithmic paradigms: divide and conquer, recursion, dynamic programming, greedy, branch and bound, etc. Advanced data structures: Fibonacci heap, union-find, splay trees. Amortized complexity analysis Randomized algorithms: Randomized algorithms to be introduced a bit early, i.e., before NP-completeness to highlight randomization as an algorithmic technique.

Application areas: Geometric algorithms: convex hulls, nearest neighbor, Voronoi diagram, etc. Algebraic and number-theoretic algorithms: FFT, primality testing, etc. Graph algorithms: network flows, matching, etc. Optimization techniques: linear programming

Reducibility between problems and NP-completeness: discussion of different NP-complete problems like satisfiability, clique, vertex cover, independent set, Hamiltonian cycle, TSP, knapsack, set cover, bin packing, etc. Backtracking, branch and bound, Approximation algorithms: Constant ratio approximation algorithms. Miscellaneous: Introduction to external memory algorithms, parallel algorithms.

Text Books:
2. Sedgewich, Algorithms in C.

Lab Assignments:
1. Sorting the list of given numbers using Heap sort & merge sort.
2. Sorting the list of characters using Heap sort & merge sort.
5. Travelling sales person using dynamic programming.
7. Generating optimal binary search trees.
8. 8 queens problem using backtracking.
9. 5 puzzle problem using Branch & Bound.
10. 0-1 Knapsack using backtracking.
Principles of Programming Languages

Classification of Programming Languages: Imperative and Declarative languages; Procedural and Object Oriented languages; Concurrency; Functional and Logic Programming and other languages; Data Types: Static and Dynamic Types; Early and Late binding; Type Conversion; Records, Union, Array and Pointers; Dangling References and Garbage Collection; Concept of Objects and Classes; Abstract Data Types and Classes; Hierarchy and Inheritance; Constructors; Kinds of access; C++ and Java Comparison. RAM and PRAM. Concept of Concurrency, Concurrent Programming Languages. Functional Programming Languages: LISP. Logic Programming: PROLOG. Event Handling and Languages. Exception Handling. Specialized Languages: Intro to XML, PHP, etc.

Text Books:

Database Management Systems


SQL and PL/SQL: Introduction to SQL constructs (SELECT FROM, WHERE GROUP BY HAVING ORDER BY), INSERT, DELETE, UPDATE, DROP, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references, Triggers, Embedded SQL and Application Programming Interfaces.

PL/SQL: Variables literals data types advantages of PL/SQL; Control statements: if ; iterative control loop, while, for, goto; exit when; Cursors: Types implicit, explicit parameterized cursors cursor attributes; Exceptions: Types internal, user-defined, handling exceptions raise statement; PL/SQL tables and records: Declaring PL/SQL tables - referring PL/SQL tables, inserting and fetching rows using PL/SQL table, deleting rows; records - declaration of records - deleting records; Sub programs: Functions - procedures - in, out, inout parameters; purity functions - packages - package specification - advantages of packages - private and public items - cursors in packages.

Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security & Authorization in SQL. Relational Database design - Logical, Conceptual and Physical database design, Normalization, Various Normal Forms & Design discussions. Database performance issues. Transaction Management & Distributed database, Storage management in Database, User Interface for Database, connectivity issues & Database access from Smartphone and Database on Cloud. Data Warehouse and Data Mining, Information storage and retrieval. (Evaluation for DBMS Theory will be done through Assignments, Quizzes, Mid Semester and End Semester examinations )

Text Books:


Lab Assignments:


2. Mini Project implementation (Details of following are given to the students with functional components with Project Tasks : Draw ER Diagram, Schema of each table required in Project, Normalize all table up to 3NF, Implementation Task: User Interface creation and Report generation.
Computer Networks


Data Link Layer: Framing, Error Control, Error Detection and Correction, Flow Control.


Text Books:

2. Computer Networks by Andrew S. Tanenbaum.
Software Engineering


Text and Reference Books:

Principles of Economics


National Income and Accounting: Concepts and Indicators (gross domestic product (GDP), gross national product (GNP) and gross national income (GNI)).

Macroeconomic Analysis: Macroeconomic Equilibrium; Inflation and Unemployment; Economic Growth and Productivity.


Text Books:

1. Economics; Samuelson & Nordhaus.
Artificial Intelligence

Part A: Searching, Planning and Uncertainty


Informed Search: Informed/Heuristic Search, Heuristic Search, A* Search, Memory bounded heuristic search, heuristic functions, local search and optimization, hill-climbing, simulated annealing, local beam search, online search, online depth first search.


Planning: The planning problem, language specification and PDDL, examples of planning problems, forward search, backward search, heuristics, partial order planning, planning graphs, heuristics from planning graphs, Graphplan algorithm. Uncertainty: Uncertainty, probability basics, axioms of probability, inference using full joint distributions, independence, Bayes’ rule, Naive Bayes.


Reinforcement Learning: Reinforcement Learning, Passive Reinforcement Learning, Direct utility estimation, Active Dynamic Programming, Temporal Difference Learning, Active Reinforcement Learning, Exploration and Exploitation, Q-Learning.

Part B: Knowledge Representation, Expert Systems, Logic and Inferences, Basics of ANN and Prolog Programming

Frame-based Expert systems: Inheritance in frame-based expert systems, Methods and
demons, Interactions of frames and rules, Example. Artificial Neural Network and Neural
Expert Systems: How brain works, the Neuron as a single computing element, Perceptron,
Multilayer FFNN, Backpropagation algorithm, Recurrent networks, Neural expert system.
Introduction to Prolog Programming language: Syntax and meaning of Prolog Programs,
Using Data Structures, Controlling Backtracking, Input and Output, Built-in Predicates,
Using Prolog Grammar Rules.

Text Books:

2. M. Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, Addison Wes-
ley.
3. D. Khemani, A first course in Artificial Intelligence, McGraw Hill Education (India)
Pvt. Ltd.

Lab Assignments:

using Uniform Cost Search. Searching using A* Algorithm and Heuristic Search. Constraint

2. Part B: Programming in Prolog (based on following topics covered in the class):
design: Using the Expert System Shell (JESS/CLIPS) for development of an Expert System (in domains like Financial, Industrial, Social or other Engineering problems).
Graphics and Visual Computing


Illumination: Light Sources, Basic Illumination Reflection Models, Ambient Light, Diffuse Reflection (Lambert’s cosine law), Specular Reflection and the Phong Model. Combined Diffuse and Specular Reflections with Multiple Light Sources, Intensity Attenuation, Color Considerations, Transparency, Shadows, Texture mapping, Polygon-Rendering Methods. Ray Casting / Ray-Tracing Methods, Basic Ray-Tracing Algorithm, Ray-Surface Intersection Calculations.


Text Books:

Compiler Design

Compiler Structure: analysis-synthesis model of compilation, various phases of compiler, other related basic concepts related to compilers such as interpreters, preprocessors, macros etc. Lexical Analysis & concepts related to Regular expressions and Finite Automata relevant to Compiler construction. Syntactic specification of Languages: Context Free Grammar/ language, ambiguity, associatively, precedence, basic parsing techniques, LEX.

Top-down parsing: Backtracking parser, drawbacks, Top-down parser without backtracking: LL (1) parsing, Problem of Left recursion, Left factoring of Common prefixes, problem solving. Bottom-up parsing: Handle of a rightmost sentential form, Shift-reduce parsing, LR (0) parsing, Conflicts, SLR (1) parsing, limitations, LR(1) and LALR(1) parsing, problem solving, YACC.

Semantic Analysis and Syntax Directed Translation: Static & Dynamic Checks, Typical Semantic errors, Scoping, Type Checking; Syntax directed definitions (SDD) & Translation (SDT), Attribute Types: Synthesized & Inherited, Annotated Parse Tree, S-attributed and L-attributed grammar, Ordering the evaluation of Attributes, Applications of syntax directed translation. Symbol Table Design: Function of Symbol Table (ST), Information provided by ST, Attributes of ST, Data Structures for ST: Unsorted list, Sorted list, Linked list, Search trees, Hash table; Scoping, Methods to deal with Scope.


Code Optimization: Criteria for code improving transformation, Basic blocks, Flow graphs, Function-Preserving Transformations: common sub-expression elimination, copy propagation, dead-code elimination and constant folding; Loop optimizations: Code motion, Induction variable elimination and Reduction in strength; Peephole optimization e.g., Flow-of-Control optimization, Algebraic simplification; Data flow analysis.

Text Books:

3. J.R. Levine, T. Mason and D. Brown, Lex and Yacc, OReilly.
Web Technologies

Web fundamentals and applications: The internet and the world wide web as its dominant application, Basics of Clients, Servers, and Communications, Static, Dynamic and active websites and their latest applications like Current Dynamic web services: a) for transactions like e-shopping b) Digital content delivery like advertising, tracking of goods, services, patents/research papers. c) Telemetry like sms for stock quotations. E-Banking etc.


Web Services: Need for web services, WSDL, SOAP, SOAP XML and HTTP, UDDI, RDF, Web feeds, Blogs, The server side: the server choices, setting up UNIX and Linux web servers, Logging users, dynamic IP. Architecture of Apache Web Server including TOMCAT. Case Study of Search engines and Blogs.

Text Books:

1. Fifth Edition of Data communication and networking By Behrouz A Forouzan The McGraw-Hill USA.
2. http://www.w3schools.com/
3. Web enabled commercial application dev. using: HTML, DHTML, JAVASCRIPT, PERL CGI by Ivan Bayross.
5. Foundation Website Creation: With CSS, XHTML, And Javascript: By Jonathan Lane, Meitar Moscovitz.
Data Mining & Warehousing

Overview: Motivation (for Data Mining), Data Mining- Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction: Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

Concept Description: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases. Association rule mining: mining Single-Dimensional Boolean Association rules from Transactional Databases Apriori Algorithm, Mining Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases.


Data Warehousing: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snowflakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting. Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

Text Books:
1. M.H. Dunham, Data Mining: Introductory and Advanced Topics Pearson Education.
2. Jiawei Han, Micheline Kamber, Data Mining Concepts & Techniques, Elsevier
Simulation & Modelling

Definition of Systems: Types of system, continuous and discrete modeling process and definition of model. Common type of mathematical models used for engineering and non-engineering system (such as differential and partial differential equation models). Simulation Process: Discrete and continuous simulation procedures, random number generation and its testing discrete and continuous random variables, density and distributive functions, study of few distributions such as Poisson, Normal.

Simulation of Queuing Systems: Specification and measures of queuing system, Structure of basic queuing system, simulation. Example of time sharing computer system, Elementary idea about networks of Queuing with particular emphasis to computer system, environment. Verification and Validation: Design of simulation experiments and validation of simulation experiments comparing model data units and real system data.

Simulation Languages: A brief introduction to important discrete and continuous languages such as GPSS (Study & use of the language), Use of data base & AI techniques in the area of modeling and simulation.

Text Books:


Lab Assignments:

1. MATLAB SIMULINK tool box.
2. Hardware Simulation using FPGA.
3. Simple Simulation program calculating using different probabilistic approaches in C or C++.
Philosophy of Science

Science: Creation or Discovery? Facts (Data) and Theories; Induction: Naive ideas about Induction; the ambiguity of Induction; Probability and the Reflections on the use of probability; Inventing Explanations, and the Search for Laws: Critique of 'data-fitting' and Induction as views of science; Descartes’ method of hypotheses, Newton’s criticism; Contemporary views; The advantages and disadvantages of Bayesianism;

Ancient and Modern Relativity: Aristotelian relativity; Anomalies of Aristotle’s world-picture; Galilean relativity: What is relative, and what absolute?; Newton’s view of Absolute Space and Time; Darwinism: Change and chance: new forms of theory; Darwin’s basic principles; Genetics: modelling nature on many levels; Philosophical lessons and disputes; The Shift In Historical Perspective: Kuhn’s description of how sciences develop; Rivalry among paradigms;

Is Science A Search For Truth Or For Consensus?; A Short Intro to Epistemology; First Proposal for what a search for truth is; Second Proposal; Epistemic dilemmas; the pragmatist turn; Is Science A Search For Causes Or For Satisfying Explanations? Scientific explanation: the traditional view; Kuhnian solution;

Text Books:

1. World Changes: Thomas Kuhn and the nature of science, Horwich
2. Scientific knowledge: basic issues in the philosophy of science, Kourany
3. On the Origin of Species, Darwin
4. To save the phenomena, Duhem
5. The Copernican Revolution, Kuhn
6. Science and hypothesis: historical essays on scientific methodology, Laudan
7. Inference to the best explanation, Lipton
8. Historical introduction to the philosophy of science, Losee
9. The Essential Darwin, Ridley
10. Introduction to the philosophy of time and space, van Fraassen
Organizational Behavior


Text Books:

2. Luthans Fred - Organizational Behaviour (Tata McGraw Hill)
6. Greenberg Jerald and Baron Robert A. - Behavior In Organisations: Understanding and Managing the Human Side of Work (Prentice Hall of India)
Optimization Techniques

Introduction: Engineering application of optimization, statement of an optimization problem with example for minimum weight and optimum cost consideration, classification of optimization problems and techniques, Single variable optimisation, multi-variable optimization with equality and inequality constraints and without constraints.


Unconstrained optimization Techniques: Introduction; Standard form of the problem and basic terminology; Direct search method- Simplex method, Random search method, Univariate and pattern search method Indirect search method-Steepest Descent (Cauchy) method, Conjugate gradient method, Newtons method, Application to engineering problems.

Constrained Optimization Introduction: Standard form of the problem and basic terminology; Direct method: Sequential Linear Programming; Generalised Reduced gradient method, Methods of feasible direction Indirect method: Penalty function method Interior and exterior penalty function method, Convex programming problem, Check for convergence Application to engineering problems.

Introduction to non-traditional methods: Genetic Algorithm: Introduction, Representation of design variables, objective function and constraints, Genetic operators and numerical results. Introduction to Neural network based optimization.

Text Books:

Control System Engineering

Control System Modeling: Basic Elements of Control System Open loop and Closed loop systems, Transfer Functions: Poles and Zeros, Block diagram reduction Techniques, Signal flow graph, Modelling of various control systems.


State Variable Analysis And Design: Concept of State, State Variables, and State Model, State space representation of Continuous Time systems State equations Transfer function from State Variable Representation Solutions of the state equations - Concepts of Controllability and Observability State space representation for Discrete time systems.

Text Books:


Natural Language Processing

Characteristics of Natural Languages; Components of languages; Syntax and Semantics; SOV and SVO languages; Indian Languages and their comparisons; Language Modeling: Grammar based and Statistical Models;

Morphological Analysis; POS Tagging; Syntactic Analysis; Parsing: Shallow and Deep Parsing; Grammars for Parsing: Lexical Functional Grammar; X-Bar Theory and Paninian Grammar; Statistical Parsing;

Semantic Analysis; Types of Ambiguities and Disambiguation; Word Sense Disambiguation and Phrase and Sentence level disambiguation;

Machine Translation: Transformation Approaches and Statistical approaches; Analysis of some Translation Systems; English to Indian Languages and Indian Languages to English Translation Systems; Translation among Indian Languages.

Language Generation: Various approaches; Text Summarization and Classification.
Image & Vision Processing


Robotics & Industrial Automation


Soft Computing


Early ANN architectures (basics only)-McCulloch & Pitts model, Perceptron, ADALINE, MAdALINE.

Backpropagation networks: architecture, multilayer perceptron, backpropagation learning, input layer, hidden layer, output layer computations, calculation of error, training of ANN, BP algorithm, momentum and learning rate, Selection of various parameters in BP networks. Variations in standard BP algorithms- Adaptive learning rate BP, resilient BP, Levenberg-Marquardt, and conjugate gradient BP algorithms (basic principle only)-Applications of ANN.

Fuzzy Logic: Crisp & fuzzy sets, fuzzy relations, fuzzy conditional statements, fuzzy rules, fuzzy algorithm. Fuzzy logic controller: fuzzification interface, knowledge base, decision making logic, defuzzification interface design of fuzzy logic controller, case studies.

Genetic algorithms: basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Elitism. Inheritance operators, Crossover-different types, Mutation, Bit-wise operators, Generational cycle, Convergence of GA, Applications of GA case studies. Introduction to genetic programming, basic concepts.

Text and Reference Books:


7. B. Yegnanarayana, Artificial Neural Networks. Prentice Hall of India, New Delhi
Cognition and Cognitive Process Modelling

Introduction to Cognition and Cognitive Processes; Perceptual, Attention and Cognitive Processes; Computational Theory of Mind; Connectionist Models.

Learning and Memory Models; Short term and Long term Memory Models; Knowledge Acquisition and Deployment; Learning and Forgetting; Implicit and Explicit Learning; Intelligence Modelling; Social Cognition and Social Intelligence; Evolution and Evolving Machines; Thinking Machines; Modelling Emotion in computation.

Computational Cognitive Architectures: SOAR Architecture for Modelling General Intelligence; ACT-R Architectures; CLARION Architecture; Applications in Intelligent and Interactive Systems: ECA and Talking computers.

Cryptography & Information Security


Text Books:

1. Introduction to Modern Cryptography by J. Katz and Y. Lindell.
IWP 730E

Internet & Web Security Protocols


RMP 730E

Robot Motion Planning


Planning using Optimization Techniques: Introduction to optimization and Genetic Algorithm, Individual representation, variable sized individual, fitness function, evolutionary operators, planning using grammatical evolution.

Mobile Computing


Text Books:


Information Retrieval System

Information retrieval: definition, differences from question answering system and database retrieval, IR models: classical, non-classical and alternative models, basics of Boolean retrieval model; indexing, inverted index structure, creation of dictionary and postings, Posting merge algorithm., use of skip pointer for efficient merge.

Tokenization, stop word elimination, case folding, stemming and lemmatization, Handling Phrase queries, biword and positional indexes. Tolerant retrieval: Permuterm and k-gram indexes, spelling correction - edit distance algorithm and its implementation (calculation of minimum edit distance through dynamic programming). Heuristics to efficiently retrieve low edit-distance dictionary terms, Soundex algorithm for handling phonetic errors.

Term weighting and Vector Space Retrieval: tf-idf weighting, frequency and length normalization, term-document matrix representation of documents (Steps involved to arrive this representation), inner product and cosine similarity, Heuristics to cut down number of documents for which to calculate cosine similarity - Champion list, cluster pruning, IDF cutoff etc.).

Evaluation: evaluation Criteria, Recall and Precision, Calculating recall-Precision points, F-measure, E-measure, R-precision, 11 point - interpolated average precision.

Query Expansion; Interactive IR; Cross-lingual Information Retrieval; Introduction to Image Retrieval and Speech Retrieval Systems.
Humanoid Robotics


Open SIM: Three tutorials, concepts of forward kinematics, inverse kinematics, forward dynamics and inverse dynamics. Assignments. Concept of Synchronization, Design procedure of CPG (Central Pattern Generator).

Multimodal Human-Robot interactions: Gesture recognition problem using HMM: all the three problems: Forward Backward Algorithm, Viterbi Algorithm, BaumWelch algorithm and their applications in gesture recognition, Gesture creation(using If THEN Rules), interactive Gesture executions. (It will be presumed that the students already have undergone the courses either RIA or Mathematical Foundation of Robotics)

Cognitive robotics: Reactive approach - Subsumption Architecture, Potential field based architecture, Deliberative approach, hybrid deliberative/Reactive approach for creating intelligent behaviors.

KALMAN Filter, SLAM (Simultaneous Localization and Mapping).

Speech and Language Technologies

Mobile Data Management

Mobile Software Architectures: Mobile Computing Models: Software architectures ranging from client-servers and proxies to software mobile agents are introduced. Environmental Awareness: Concepts such as application-awareness of location and disconnection, and adaptation to varying connectivity conditions Web Browsing: realization of mobile architectures and concepts through their deployment in the design of an example web-browsing application. Disconnected Operation and Weak Connectivity: Techniques for sustaining frequent network disconnections and weak connectivity within the context of file, database management, workflow management, object-based, and web systems. Mobility: relocating data and computation, Failure Recovery and distributed checkpointing. Case studies on CMU’s Coda file system Coda, IBM’s WebExpress web browsing system and Xerox’s Bayou weak replication storage system Location and handoff management. Concurrency control mechanism schemes. Transaction management. Mobile database recovery.

Text Books:

3. Research papers.

Mobile Software Engineering

Wireless Sensor Network


Models of programmability in sensor network: Differences between sensor network and traditional network, Need for sensor network programming, Major models of programming, Framework of system level prog. Localization in WSN, Application layer protocols, Localisation protocols, Positioning and location tracking in WSN. Configuring Wireless sensor network, Simulators in WSN, Tools and languages in WSN.


References