M.Phil. in Computer Science
Department of Computer Science
Vidyasagar University, Midnapore
W.e.f. (2018-2019)

Department Overview

Department of Computer Science at Vidyasagar University strives to shape outstanding computer professionals with ethical and human values to reshape nation's destiny. The training imparted aims to prepare young minds for the challenging opportunities in the IT industry with a global awareness rooted in the Indian soil, nourished and supported by experts in the field.

Vision

The Department of Computer Science endeavors to imbibe the vision of the University "**Excellence and Service"**. The department is committed to this a philosophy which pervades every aspect and functioning of the department.

Mission

"To develop IT professionals with ethical and human values". To accomplish our mission, the department encourages students to apply their acquired knowledge and skills towards professional achievements in their career. The department also molds the students to be socially responsible and ethically sound.

Introduction to Programme

Master of Philosophy (M.Phil) in Computer Science is four-semester (2 years) Programme, aimed at developing scholars into mature researchers, able to make original scientific contributions that have both practical significance and rigorous theoretical grounding. It is principally intended to be a well-founded transition into the advanced research at a doctoral level (Ph.D.), in which the researcher will aspire to a higher disciplinary and methodological competence in research. The programme is well substantiated for a smooth transition into advanced research suitable for academia, researchers and corporate associates.

Programme Objective

- Introduce research culture among the budding researchers.
- Provide a strong foundation for analysis, synthesis, and comprehension of research thoughts.
- Build a pool of technically and scientifically qualified manpower to create a strong scientific community.
- Impart sound knowledge of computer-based research tools.
- Motivate and orient youngsters to do research with proper baseline and ethical values.

Syllabus

1st year Semester-I			
Paper Code	Paper Name	Full Marks	Theory + Internal
101	Research Methodology	50	40+10
102	Advanced Computing	50	40+10
103	Elective-I	50	40+10
104	Elective-II	50	40+10
105	Computing Lab-I	50	--
1st year Semester-II			
201	Software Project management	50	40+10
202	Machine Learning	50	40+10
203	Elective-III	50	40+10
204	Seminar	50	
205	Computing Lab-II	50	--
2nd year (Semester-III and Semester-IV)			
	Dissertation (Upto 1 yr) Proposal- 25 Pre-submission- 25 Adjudication- 50	100	
Total		600	

Elective-I:
(A) Parallel Computing
(B) Mobile Computing
(C) Advanced Computer Network
(D) Embedded System

Elective-II:
(A) Multimedia Security
(B) Data Compression
(C) Soft Computing
(D) Audio Processing

Elective -III
(A) Computer Vision
(B) Data Mining
(C) Bio-informatics
(D) Digital Image Processing
(E) Natural Language Processing

Semester-I

Paper-101: Research Methodology (50 Hours)

UNIT -I Research Methodology (10 Hrs)

Research- Definition, Importance, and Meaning of Research, Characteristics of Research, Types of research, Research Approaches, the significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of good research, research problem and selection, techniques involved in defining a problem.

UNIT -II Research Design (10 Hrs)

Research Design- Meaning, research design need, features of a good design, important concept relating to research design, different research design, basic principles of experimental designs. Sampling meaning, sample design, criteria of selecting a sampling procedure, characteristics of a good sample design, different types of sample design, Hypotheses- meaning, Basic concept concerning testing of hypotheses, procedure for hypothesis testing, measure of a hypothesis test.

UNIT -III Measurement and Scaling Techniques (10 Hrs)

Measurement in research, Measurement scale, source of error in measurement, test of sound measurement, techniques of developing measurement tools, scaling, scale classification bases, important scaling techniques, scale construction techniques, different methods of data collections- interview, questionnaires, through schedules.

UNIT -IV Processing and Analysis of Data (10 Hrs)

Processing Operations, Problem in processing, types of analysis, measure of central tendency, measure of dispersion, measure of asymmetry, measure of relationship, simple regression analysis, multiple correlation and regression, partial correlation, Chi-square as a test for comparing variance, Chi-square as a non-parametric test, ANOVA, basic principle of ANOVA, ANOVA techniques.

UNIT -V Interpretation and Report Writing (10 Hrs)

Research Reports- Types of reports, contents, Format & Styles of reporting, steps in drafting reports, Editing the final draft, Evaluating the final draft. Analysis and Interpretation of Data and Report Writing, References, and Bibliography. Checking of similarities of report / documents and addressing the same. Various tools for report writing and similarity checking.

Reference Books:

1. C.R. Kothari , “Research Methodology: Methods and Techniques”, second edition New Age International Publications.
2. H.K. Kapil, “Research Methodology”, TataMcGrawhill publications.
3. B.C. Tandon, “Research Methodology in Social Science”,5.

4. Anderso J.berry H.D. & Poole M. Wiley, "Thesis and Assignment writing",Eastern Limited, New Delhi.
5. R. Panneerselvam, *Research Methodology*, New Delhi: PHI, 2005.
6. P. Oliver, *Writing Your Thesis*,New Delhi:Vistaar Publications, 2004.
7. F. Mittelbach and M. Goossens,*The LATEX Companion*, 2nd. ed. Addison Wesley, 2004.
8. J. W. Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3nd. ed. Sage Publications, 2008.
9. Kumar, *Research Methodology: A Step by Step Guide for Beginners*, 2nd. ed. Indian: PE, 2005.
10. B. C. Nakra and K. K. Chaudhry, *Instrumentation, Measurement and Analysis*,2nd. ed. New Delhi: TMH publishing Co. Ltd., 2005.

Paper-102: Advanced Computing (60 Hours)

UNIT- I: Advanced Operating Systems (15 Hrs)

Virtual memory management, Synchronization and communication, File systems, Distributed Operating System. Real Time Operating System.

UNIT- II: Advanced Database Systems (15 Hrs)

Overview of emerging database applications and challenges, Mobile, Database, Management, Spatial Indexing Techniques, Data Clustering, Algorithms, Stream databases

UNIT- III: Advanced Data structures (18 Hrs)

AVL trees, B tree, KD Tree, Splice, Red-Black tree, Hashing techniques/Indexing techniques, Graph Algorithms, Graph Search Technique.

UNIT- IV: Emerging Technologies* (12 Hrs)

Grid and cloud computing, Knowledge management and business intelligence, Green computing, Storage technologies, Real time Systems.
* Subjected to change based on recent trends.

Reference Books:

1. A. Silberschatz ,P. B. Galvin,G. Gagne,Operating System ConceptsEssentials, 8th ed.John Wiley & Sons, Inc. 2010.
2. A. S. Tanenbaum, Distributed Operating system, 3rd ed. Prentice hall 2008.
3. Mark A. WeissAddison-Wesley, Data Structures and Algorithm Analysis in Java, 2/E,2007.
4. Silberschatz, Korth and Sudarshan,Database System Concepts, 6thed.McGraw-Hill.
5. E. Bertino, L. Martino, Object- Oriented Database Systems: Concepts and Architectures, Addison-Wesley Publication, 2012.
6. R. L. Kruse, Data Structures and Program Design, PHI-2007.
7. DoeppnerOperating Systems in Depth: Design and Programming, 1st ed. Wiley: 2010.

Paper-103: Elective-I (45 Hours)

A. Parallel Computing: (45 Hrs)

Unit I - Parallel computer model (11 Hrs)
The state of computing, Multiprocessors and Multicomputer, Multivector and SIMD computers PRAM and VLSI models, Architectural development Tracks. Program and Network properties:Conditions of Parallelism, program partitioning and scheduling, program flow mechanism, System interconnect architectures.

Unit II - Parallel Computing paradigms (11 Hrs)
Synchronous computation, Taxonomy of parallel algorithms, Design of parallel algorithms, parallel programming support, and paradigms for parallel algorithm: Binary tree paradigm, Growing by doubling, Pointer jumping technique, divideand conquer, partitioning,Design of simple algorithms: Scalar product of vectors, Matrix multiplication, partial sums, Binomial coefficients and Range minima problem.

Unit III - Tree Algorithms (11 Hrs)
Euler circuits, Rooting a tree, Post order numbering, number of descendants, Lowest common ancestor, Tree Contraction, Arithmetic Expression Evaluation.

Unit IV - Searching and Sorting Algorithms (12 Hrs)
Sequential searching, Parallel search in CREW PRAM, Parallel search in more data, searching in unsorted array, Merging by Ranking, Bitonic merging, Sequential sorting algorithms – Bubble sort,Insertion sort, Shell Diminishing increment sort, Heap Sort, Merge sort, Sorting networks.

Reference Books:
1. C. Lin, L. Snyder,*Principles of Parallel Programming*, Pearson, Addison Wesley, 2009.
2. D. B. Kirk, Wen-mei W. Hwu, *Programming Massively Parallel Processors*, Morgan Kaufmann, 2010.
3. J. L. Hennessy and D. A. Patterson, *Computer Architecture: A Quantitative Approach*, 4th ed. Morgan Kaufmann Publishers, 2007.

B. Mobile Computing: (45 Hrs)

UNIT - I Introduction to Mobile Communications and Computing (5 Hrs)
Introduction to Mobile Computing, novel applications, limitations, and architecture. GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

UNIT - II (Wireless) Medium Access Control (10 Hrs)
Motivation for a specialized MAC: Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, CDMA.

UNIT - III Mobile Network Layer (10 Hrs)
Mobile IP: Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP).

UNIT - IV Mobile Transport Layer (10 Hrs)
Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT - V Mobile Ad hoc Networks (10 Hrs)
Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Reference Books :

1. JochenSchiller,"Mobile Communications",Addison-Wesley,second edition, 2004
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004,
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden ,Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
5. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, second edition, 2003.
6. MartynMallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.
7. K. Pahlavan and P. Krishnamurthy, Principles of Wireless Networks, Prentice Hall.

C. Advanced Computer Network: (45 Hours)

UNIT- I: Review (5 Hrs)
Review of networking Technologies and Internetworking Concepts and Architectural Model, Application level and Network level Interconnection, Properties of the Internet, Internet Architecture, and Interconnection through IP Routers.

UNIT- II: ARP and RARP (10 Hrs)
Internet Addresses, Mapping Internet addresses to Physical addresses, Universal identifiers, three Primary classes of IP addresses, network and Broadcast Addresses, Limited Broadcast, Dotted decimal Notation, weakness in Internet addressing, Loopback addresses, resolution through Direct Mapping, Resolution Through Dynamic Binding, address resolution cache, ARP to other protocols, Reverse address resolution protocol, timing, RARP transaction, Primary and backup RARP severs.

UNIT- III: Routing (10 Hrs)
Internet Protocol, Connectionless Datagram Delivery, Routing IP Datagrams, The concepts of unreliable delivery, purpose of the internet protocol, Routing in an internet, direct and indirect delivery, table driven IP routing, Next Hop Routing, default routes, host specific routes, The IP routing Algorithm, handling incoming datagram"s, Establishing routing tables.

UNIT- IV: ICMP Protocol (10 Hrs)

Internet Protocol, Error and Control Message (ICMP), Subnet and Supernet Address, ICMP, Error reporting versus error detection, ICMP message format, Detecting and reporting various network problems through ICMP, Transparent Router, Proxy ARP, subset addressing, implementation of subnets with masks representation, Routing in the presence of subsets, a unified algorithm.

UNIT- V: User Datagram Protocol (UDP) and Stream Transport service (TCP) (10 Hrs)
Format of UDP message, UDP pseudo header, UDP encapsulation and Protocols layering, UDP checksum computation, UDP multiplexing, De-multiplexing and Ports. The Transmission control Protocol, pots, Connections and Endpoint, passive and active opens the TCP segment format, TCP implementation issues.

Reference Books:

1. Douglas E.Comer, Internetworking with TCP/IP: Principles, Protocols, PHI Pub.
1. Forouzan, TCP-IP, Protocol Suit, TMH.
2. Comer, Internetworking with TCP-IP Vol. 3.
3. W. Richard Stevens, UNIX Network Programming.
4. Stallings, SNMP, Pearson.
5. Hunt Craig, TCP-IP Network Administration.
6. Loshin, Harwurt, TCP-IP Cleanly Explained.

D. Embedded System: (45 Hrs)

UNIT-I: Introduction (5 Hrs)
Microcontroller and microprocessor Architecture , Assembly language Programming (with some exercises), Microcontroller peripherals , Analog Design, Digital Design, Compilers, Assemblers, Cross compilers.

UNIT-II: Understanding Embedded Systems (10 Hrs)
Overview of Processors & Microcontrollers, Memory (RAM, ROM, EPROM, EEPROM, FLASH), I/O Interface, ATMEL 8051, AVR, PIC, ARM Microcontroller Architecture, RISC Architecture of AVR, PIC, ARM family, Addressing modes, Instruction Set, Assembly Programming, Programming Exercises.

UNIT-III: Different Peripheral Devices (10 Hrs)
Buffers and latches, Crystal, Reset circuit, Chip select logic circuit, timers and counters and watch dog timers, Universal asynchronous receiver, transmitter (UART), Pulse width

modulators, LCD controllers, Keypad controllers. Design tradeoffs due to thermal considerations and Effects of EMI/ES etc.

UNIT-IV: Embedded Software Development Environments (10 Hrs)
Real time operating systems, Kernel architecture: Hardware, Task/process control subsystem, Device drivers, File subsystem, system calls, Embedded operating systems, Task scheduling in embedded systems: task scheduler, first in first out, shortest job first, round robin, priority based scheduling, Context switch: Task synchronization: mutex, semaphore, Timers, Types of embedded operating systems, Programming languages: assembly languages, high level language.

UNIT–V: Development For Embedded Systems (10 Hrs)
Embedded system development process, Determine the requirements, Design the system architecture, Choose the operating system, Choose the processor, Choose the development platform, Choose the programming language, Coding issues, Code optimization, Efficient input/output, Testing and debugging, Verify the software on the host system, Verify the software on the embedded system.

Reference Books

1. Frankvahid/Tony Givargis, “Embedded System Design- A unified Hardware/software Introduction”.
2. David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
3. Dreamteach Software team,” Programming for Embedded Systems” AVR 8515 manual
4. J.W. Valvano, "Embedded Microcomputor System: Real Time Interfacing"
5. Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.

Paper-104: Elective-II (45 Hours)

A. Multimedia Security: (45 Hrs)

UNIT-I: Introduction to Digital Rights Management (DRM) (5 Hrs)
Induction to Digital Right Management Products & Laws, Introduction to DRM Products, Introduction to DRM Laws

UNIT-II: Digital Watermarking & Multimedia Security (12 Hrs)
Introduction to Digital Watermarking, Introduction to Multimedia Security, Digital Watermarking: Basics, Models of Watermarking, Basic Message Coding, Error Correction Coding, Digital Watermarking: Theoretic Aspects, Mutual Information and Channel Capacity, How to Design a Good Digital Watermark, Information Theoretical Analysis of Digital Watermarking

UNIT-IV: Digital Watermarking Schemes (12 Hrs)

Spread Spectrum Watermarking, DCT-Domain Watermarking, Quantization Watermarking, Digital Watermarking: Protocol, An Efficient and Anonymous Buyer-Seller Watermarking Protocol. Media-Specific Digital Watermarking, Video Watermarking, Audio Watermarking, Binary-Image Watermarking, Advanced Digital Watermarking, Watermarking with Side Information, Improved Spread Spectrum, Robustness to Temporal and Geometric Distortions, Affine-Resistant Watermarking.

UNIT-V: Steganography & Steganalysis (16 Hrs)
Steganography, Introduction to Steganalysis Schemes, Fingerprinting & Digital Forensics Fingerprinting, Non-Intrusive Digital Forensics, Cryptography & Multimedia Encryption, Introduction to Cryptography, Multimedia Encryption.

Reference Books:

1. Multimedia Systems by Ralf Steinmetz and Klara Nahrstedt
2. "Multimedia Communications: Directions and Innovations" by J. D. Gibson
3. "Introduction to Data Compression" by K. Sayood
4. "Multimedia Systems, Standards, and Networks" by A. Puri and T. Chen
5. "Handbook of Multimedia Computing" by Borivoje Furht

B. Data Compression: (45 Hrs)

UNIT-I: Introduction (5 Hrs)
Compression Techniques, Lossless and Lossy Compression; Measures of Performance; Modeling and Coding;

UNIT-II: Mathematical Preliminaries for Lossless Compression (8 Hrs)
Introduction to Information Theory ; Average Information ; Models ; Physical , Probability, Markov, Composite Source Models ; Coding ; Uniquely Decodable Codes, Prefix Codes; The Kraft-McMillan Inequality ;

UNIT-III: Lossless Compression (8 Hrs)
Huffman coding, Adaptive Huffman coding, Arithmetic coding, Dictionary based compression techniques – LZ77, LZ78, LZW etc.

UNIT-IV: Context-Based Compression (8 Hrs)
Introduction, Prediction with Partial Match (*ppm*); The Burrows-Wheeler Transform ; Move-to-Front Coding ; Dynamic Markov Compression

UNIT-V: Lossy Compression (8 Hrs)
Lossy Compression, JPEG Compression, Discrete Cosine Transform, Quantization, Coding, The Zig-Zag Sequence; Fractal based image coding; sound and video compression techniques

UNIT-VI: Wavelet-Based Compression (8 Hrs)

Introduction; Wavelets; Multiresolution Analysis and the Scaling Function; Implementation Using Filters; Scaling and Wavelet Coefficients; Families of Wavelets; Image Compression; Embedded Zerotree Coder; Set Partitioning in Hierarchical Trees; JPEG 2000

Reference Books:

1. Handbook of Data Compression, David Salomon and Giovanni Motta
2. Introduction to data compression, Khalid Sayood
3. The data compression book, Mark Nelson
4. A Guide to Data Compression Methods, David Salomon

C. Soft Computing: (45 Hrs)

UNIT-I (Artificial Neural Network) (07 Hrs)

Introduction – Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network. Supervised Learning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis

UNIT- II (Artificial Neural Network) (08 Hrs)

Associative Memory Networks: Training Algorithms for Pattern Association – Autoassociative Memory Network – Heteroassociative Memory Network – Bidirectional Associative Memory – Hopfield Networks – Iterative Autoassociative Memory Networks – Temporal Associative. Memory Network. Unsupervised Learning Networks: Fixed weight Competitive Nets –Kohonen Self-Organizing Feature Maps – Learning Vector Quantization – Counter propagation, Networks – Adaptive Resonance Theory Networks – Special Networks.

UNIT- III (Fuzzy Set Theory) (15 Hrs)

Introduction to Classical Sets and Fuzzy sets – Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations – Noninteractive Fuzzy sets – Membership Functions:Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods. Fuzzy Arithmetic and Fuzzy Measures: Fuzzy Rule Base and Approximate Reasoning: Truth values and Tables in Fuzzy logic – Fuzzy Propositions – Formation of Rules – Decomposition and Aggregation of rules – Fuzzy Reasoning – Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

UNIT-I V (Genetic Algorithm) (15 Hrs)

Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming.

Applications of Soft Computing: A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis – Optimization of Travelling Salesman Problem using Genetic Algorithm Approach –Genetic Algorithm based Internet Search Technique – Soft Computing based Hybrid Fuzzy Controllers – Soft Computing based Rocket Engine – Control.

Reference Book:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007.
2. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2003.
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education.

D. Audio Processing: (45 Hrs)

UNIT-I Introduction (5 Hrs)

Audio signal & its properties, Types of audio signals, Audio processing system- brief outlines, Applications, History of audio processing.

UNIT-II Audio Processing & Analysis (10 Hrs)

Representation of digital audio signal, Analysis of audio signal components, Audio channels & its uses, Sampling, Analysis of amplitude, phase & frequency of audio, Case studies.

UNIT-III Audio Watermarking (10 Hrs)

Basic principles of audio watermarking, Advantages & disadvantages, Watermarking Techniques, Applications, Quality measurement, Payload, Case studies.

UNIT-IV Audio Authentication (10 Hrs)

Challenges, Basic concepts, Procedures, measuring of authentication levels, Applications, IPR of audio, Case studies.

UNIT-V Audio Compression (10 Hrs)

Basic principles, Challenges, Standard algorithms of audio compression, Benchmarks for audio compression, Case studies.

References Books:

1. Zdo Zoizen "Digital Audio Signal Processing" Wiley-Blackwell, 2nd Edition, 2008.

2. Ken C. Pohlmann, "Principles of Digital Audio", McGraw-Hill Inc., US, 3rd Edition, 1995.

3. Nedeliko Cvejic & Tapio Seppanen, "Watermarking Techniques and Technologies and Bench marks", Idea Group, 2007.

4. Stephen J. Solari, "Digital Video and Audio Compression", McGraw-Hill, 1997.

Paper-105: Computing Lab (60 Hours)

UNIT –I: Introductions to Matlab (15 Hrs)

Getting used to the environment, Algorithms, Pseudo-code, Tracing a program/algorithm step-by-step, Debugging with breakpoints and print statements, Divide and conquer, Variables, Data Types, Conditional program flow (if), Iteration / Looping (while), Solve a problem for one case, then iterate, Functions, Abstraction, and Encapsulation, Planning a large program, working with stubs.

UNIT –II: Introductions to Python (20 Hrs)

Introduction To Python, Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks, Python Data Types, Declaring and using Numeric data types: int, float, complex, Using string data type and string operations, Defining list and list slicing, Use of Tuple data type, Python Program Flow Control, Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops block, Python Functions, Modules And Packages, Organizing python codes using functions, Organizing python projects into modules, Importing own module as well as external modules Understanding Packages, Powerful Lamda function in python, Programming using functions, modules and external packages, Python String, List And Dictionary Manipulations, Building blocks of python programs, Understanding string in build methods, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in build functions, Python File Operation, Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations,

UNIT-III: LaTeX and Beamer (10 Hrs)

Writing scientific report - structure, and components of research report - revision and refining' - writing project proposal - paper writing for international journals, submitting to

editors - conference presentation – preparation of effective slides, pictures, graphs - citation styles.

UNIT –IV: Parallel Computing (15)

CUDA, Open MP, and Other Softwares.

Reference Books:

1. Learning Python, by David Ascher and Mark Lutz
2. Think Python, by Allen B. Downey
3. MATLAB Programming for Engineers, by Stephen J. Chapman
4. The LaTeX companion, by Michel Goossens

Semester-II

Paper-201: Software Project management (45 Hours)

Unit I – Introduction & Project Planning (11 Hrs)

Basics of project management,PMBoK areas, Introduction to project management in Business scenario, Project- Scope –time and cost-Project vs. operations, Project Resources, Project Classifications, Project Attributes-Project Life Cycle- Project Management Process, Global Project Management-Benefits, Project Management – Current Practices. Project Selection and preparing proposals. Project Planning - Defining scope and objectives, Work Break down structure, Lag, earliest start/finish dates, latest start/finish dates, Project organization structure, RACI matrix, Defining Activities, Developing the Network Plan Project, Program, and Portfolio management, PMO activities.

Unit II - Project estimation and Scheduling (11 Hrs)

Concepts of Cost estimation / forecasting, Costing elements in a project, Cost forecasting, Project Budgeting, Cost Management processes Project Scheduling , Usage of Gantt Charts in Project Scheduling, Usage of Network charts in project Scheduling, Concepts of Critical path and Float, Pert/CPM , resourceleveling

Unit III – Risk Management &Project Management (12 Hrs)

Risk Management, Concept of Risk, Managing Risks, Risk Management Process, Risk Management Approaches, Change control Management, People Management in Projects-Leadership, Leadership Styles, Teamwork Conflicts, Conflict Management Project Control, Evaluation and Reporting, Project feedback and control, Project monitoring, Quality control, Metrics, Measurement and Analysis, Performance Measurement Analysis, Project Appraisal, Reviews, Project Status Reporting, Dashboard Reporting, Controlling and Closing Post-project reviews, and Maintenance.

Unit IV – Software Testing (11 Hrs)

Software bug tolerance and recovery, Security attacks and Security bugs, Concurrency bugs, Microsoft configuration.Microsoft Project (Practical)

Reference Books:

1. R. K.Wysocki,*Effective Software Project Management*, Wiley India: 2009.
2. B. Hughes&M.Cotterell,*Software Project Management*, Tata Mcgraw-hill,2006.
3. Rosen, *Effective IT Project Management*, 2004.
4. W. Royce, *Software Project Management: A Unified Framework*,Addison-Wesley Professional, 2008.

Paper-202: Machine Learning (60 Hrs)

UNIT -I Itroduction to Pattern Recognition (15 Hrs)

What is Pattern recognition; Applications and Examples, Paradigms of Pattern Recognition, Representation of Patterns and classes, Feature Extraction; Different methodologies of feature selection, classification vs clustering, study of different classifiers.

UNIT -II Introduction to Artificial Neural Network (15 Hrs)

Biological Neuron and Artificial Neuron Model, McCulloch-Pits Neuron Model, Perceptron Classification, Linearly Seperability, XOR Problem, Overview of Neural Network, Architecture, Learning Rules, Supervised Learning, Unsupervised Learning, Perceptron Learning, Reinforcement Learning, Delta Learning Rule.

UNIT -III Multilayer Neural Network (15 Hrs)

Generalized Delta Learning, Back propagations training algorithm and derivation of weight, Variant in Back propagations, Radial Basis Function (RBF), Application of BP and RBF N/**W** Counter Propagation, Kohonen Self Organizing feature Maps, Hopfield network

UNIT -IV Introduction to Biometrics (15 Hrs)

Introduction of biometric traits and its aim, Image processing/pattern recognition/statistics, Error types. Biometric system, authentication, physiological and behavioral properties, properties of biometric system, Application areas. Fingerprint recognition, Enhancement, Thinning, minutiae, CN number, matching, Ear and Iris recognition, normalization, matching and decision

Reference Books:

1. Introduction to the Theory of Neural Competition By- John hertz, Krogh and Richard Addision Wesely

2. Artificial Neural Systems By Jack M. Zurada West Publishing Company, 1992.

3. Neural Networks A CLASS ROOM APPROACH By Satish Kumar, Tata McGraw –Hill Publishing.

4. Pattern Classification, second edition, by "Richard O.Duda, Peter E. Hent & David G. Strok.

5. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.

Paper- 203 Elective-III (45 Hours)

A. Computer Vision:

UNIT-I: Digital Image Formation and low-level processing (15 Hrs)
Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing. Depth estimation and Multi-camera views Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

UNIT-II: Feature Extraction (15 Hrs)
Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

UNIT-III: Motion Analysis (10 Hrs)
Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation. Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

UNIT-IV: Miscellaneous (5 Hrs)
Applications: CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing; Modern trends - super-resolution; GPU, Augmented Reality; cognitive models, fusion and SR&CS.

Reference Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

4. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
5. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

B. Data Mining: (45 Hrs)

Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. It is currently regarded as the key element of a more general process called Knowledge Discovery that deals with extracting useful knowledge from raw data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures. The course will cover all these issues and will illustrate the whole process by examples. Special emphasis will be give to the Machine Learning methods as they provide the real knowledge discovery tools. Important related technologies, as data warehousing and on-line analytical processing (OLAP) will be also discussed. The students will use recent Data Mining software.

Reference Books:

1. Data Mining Techniques: Marketing, Sales and Customer Support Michael J. A. Berry, Gordon S. Linoff, John Wiley & Sons
2. Data Mining: Concepts and Techniques, Third Edition (The Morgan Kaufmann Series in Data Management Systems) Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann , 2011.
3. Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations (The Morgan Kaufmann Series in Data Management Systems) Ian H. Witten, Eibe Frank, Morgan Kaufmann
4. Building Data Mining Applications (Enterprise Computing) Alex Berson, Stephen J. Smith, Osborne/McGraw-Hill

C. Bio-informatics: (45 Hrs)

UNIT –I : Introduction and Bioinformatics Resources: (05 Hrs)

Knowledge of various databases and bioinformatics tools available at these resources, the major content of the databases, Literature databases: Nucleic acid sequence databases: GenBank, EMBL, DDBJ Protein sequence databases: SWISS-PROT, TrEMBL, PIR, PDB Genome Databases at NCBI, EBI, TIGR, SANGER, Other

Databases of Patterns/Motifs/System Biology (Gene and protein network database and resources)

UNIT-II : Sequence analysis: (10 Hrs)

Various file formats for bio-molecular sequences: genbank, fasta, gcg, msf, nbrf-pir etc. Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM series. Sequence-based Database Searches: what are sequence-based database searches, BLAST and FASTA algorithms, various versions of basic BLAST and FASTA.

UNIT-III: Pairwise and Multiple sequence alignments: **(10 Hrs)**

basic concepts of sequence alignment, Needleman, & Wuncsh, Smith & Waterman algorithms for pairwise alignments, Progressive and hierarchical, algorithms for MSA. Use of pairwise alignments and Multiple sequence alignment for analysis, of Nucleic acid and protein sequences and interpretation of results.

UNIT-IV: Phylogeny (10 Hrs)

Phylogenetic analysis, Definition and description of phylogenetic trees and various types of trees, Method of construction of Phylogenetic trees [distance based method (UPGMA, NJ), Maximum Parsimony and Maximum Likelihood method]

UNIT-V: Current Advancements in Bioinformatics: (10 Hrs)

Introduction to System Biology, Structural Biology, Structural bioinformatics, Chemoinformatics, Immunoinformatics etc.

Reference Books:

1. Introduction to Bioinformatics by Aurther M lesk
2. Developing Bioinformatics Computer Skills By: Cynthia Gibas, Per Jambeck
3. Structural Bioinformatics Books.

D. Digital Image Processing: (45 Hours)

Unit I - Introduction and Digital Image Fundamentals (11 Hrs)

The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations. Image Enhancement in the Spatial DomainSome basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Unit II - Image Enhancement in the Frequency Domain (11 Hrs)

Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering. **Image Restoration** - A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Pereodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invarient Dedradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Unit III - Image Compression (11 Hrs)

Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards. Image Segmentation - Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

Unit IV - Representation and Description (12 Hrs)

Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms. Object Recognition - Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Reference Books:

1. J. R. Jensen, *Introductory Digital Image Processing*, 3rd ed. Prentice Hall, 2010.
2. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, Pearson International Edition, 2008.
3. Joshi, *Digital Image Processing: An algorithmic approach*, PHI 2007.
4. Chanda Majumdar, *Digital Image Processing and analysis*, PHI 2007.

(v) Natural Language Processing: (45 Hrs)

Introduction, Machine Learning and NLP, ArgMax Computation, WSD : WordNet, Wordnet; Application in Query Expansion, Wiktionary; semantic relatedness, Measures of WordNet Similarity, Similarity Measures, Resnick's work on WordNet Similarity, Parsing Algorithms, Evidence for Deeper Structure; Top Down Parsing Algorithms , Noun Structure; Top Down Parsing Algorithms, Non-noun Structure and Parsing Algorithms, Probabilistic parsing; sequence labeling, PCFG, Training issues, Arguments and Adjuncts, inside-outside probabilities, Speech : Phonetics HMM, Morphology, Graphical Models for Sequence Labelling in NLP, Graphical Models for Sequence Labelling in NLP , Phonetics, Consonants (place and manner of articulation) and Vowels, Forward Backward probability; Viterbi Algorithm, Phonology, Sentiment Analysis and Opinions on the Web, Machine Translation and MT Tools - GIZA++ and Moses., Text Entailment, POS Tagging., Phonology; ASR, Speech Synthesis, HMM and Viterbi, Precision, Recall, F-score, Map, Semantic Relations; UNL; Towards Dependency Parsing., Universal Networking Language, Semantic Role Extraction, Baum Welch Algorithm; HMM training.

Reference Books:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
5. Radford, Andrew et. al., Linguistics, An Introduction, Cambridge University Press, 1999.

Paper-204: Seminar

Student have to deliver seminar presentation on a specific topic that will be provided by the department

Paper-205: Advanced Computing Lab-II (60 Hrs)

UNIT –I: Advanced Matlab (20 Hrs)

Plotting: XY- plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots, Linear Algebraic Equations: Elementary Solution Methods, Matrix Methods for (LE), Cramer's Method, Undetermined Systems, Order Systems, Probability and Statistics, Interpolation, Statistics, Histogram and probability, The Normal Distribution, Random number Generation, Interpolation, Symbolic Processing With Matlab, Symbolic Expressions and Algebra, Algebraic and Transcendental Equations, Calculus, Symbolic Linear Algebra, Image Processing, Vector Graphics, Morphological Image Processing, Filtering, Remote Sensing, Sample Project.

UNIT –II: Advanced Python (20 Hrs)

Python Object Oriented Programming – Oops, Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support, Python Regular Expression, Powerful pattern matching and searching, Power of pattern searching using regex in python, Real time parsing of networking or system data using regex, Password, email, url validation using regular expression, Pattern finding programs using regular expression, Python Exception Handling Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling, Python Database Interaction, SQL Database connection using python,Creating and searching tables, Reading and storing config information on database, Programming using database connections , Python Multithreading, Understanding threads Forking threads, Synchronizing the threads, Programming using multithreading, Contacting

User Through Emails Using Python, Installing smtp python module, Sending email, Reading from file and sending emails to all users addressing them directly for marketing 13: Python CGI Introduction, Writing python program for CGI applications, Creating menus and accessing files, Server client program, Sample Project.

UNIT –III: Advanced parallel processing (20 Hrs)
Advanced CUDA, Open MP, and Other Software.

Reference Books:

1. Learning Python, by David Ascher and Mark Lutz
2. Think Python, by Allen B. Downey
3. MATLAB Programming for Engineers, by Stephen J. Chapman
4. The LaTeX companion, by Michel Goossens

2nd year (Semester-III and Semester-IV) Full Marks -100

Dissertation (Upto 1 yr)

Proposal- 25

Pre-submission- 25

Adjudication- 50