M.Sc in Human Computing & Artificial Intelligence

Semester	Sl. No	Paper Code	Subjects	Credits		
			Theory Papers			
				T	P	Total
First	1	AEM101	Advanced Engineering Math	4	0	4
	2	ALD102	Algorithm & Logic Design	4	0	4
	3	ACA103	Parallel Computing	3	0	4
	4	OSC104	Soft Computing	3	0	4
	5	LAT105	Language & Automata Theory (Principle of Compiler Design)	4	0	4
			Practical Papers			
	6	CPR106	C Programming	0	2	2
	7		Neural Network Lab	0	2	2
Second	1	AST201	Advanced Statistics	4	0	4
	2	ADS202	Advanced Data Structure	4	0	4
	3	NWF203	Robot Motion Planning	4	0	4
	4	CGA204	Computer Graphics & Animation	3	0	3
	5	OPJ205	Object Oriented Programming in JAVA	3	0	3
			Practical Papers			
	6	OPR206	OOP through JAVA	0	2	2
	7	ALP207	Robotics Lab	0	2	2
Third	1	ADS401	Image Processing	4	0	4
	2	DTM402	Machine Learning	4	0	4

	3	CGA403	Operation Research	4	0	4
	4	AIB404	Modeling & Simulation	3	0	3
	5	ISO405	Cloud Computing	3	0	3
			Practical Papers			
	6	ADP406	Advanced Data Structure Programming	0	2	2
	7	PML407	Practical on Machine Learning	0	2	2
Fourth	1	PRO601	Project		22	22

101 ADVANCED ENGINEERING MATH

UNIT – I

LAPLACE TRANSFORM

Definition, Properties, Laplace Transform of Derivatives and Integrals, Evaluation of integrals by Laplace Transform, Inverse Laplace Transform and its Properties, Convolution theorem(Statement only), Laplace Transform of Periodic Functions(Statement only) and Unit Step Function, Applications of Laplace Transform to solve Ordinary Differential Equations, Simultaneous Differential Equations, Integral Equations & Integro-Differential Equations.

UNIT – II

FOURIER SERIES & FOURIER TRANSFORM

Periodic Functions and their Fourier Expansions, Even and Odd functions, Change of interval, Half Range Expansions.

Fourier Transform: Definition and Properties (excluding FFT), Fourier Integral Theorem, Relation with Laplace Transform, Applications of Fourier Transform to Solve Integral Equation.

UNIT – III

Z-TRANSFORM

Definition , Convergence of Z-transform and Properties, Inverse Z-transform by Partial Fraction Method, Residue Method (Inversion Integral Method) and Power Series Expansion, Convolution of two sequences. Solution of Difference Equation with Constant Coefficients by Z-transform method.

FUNCTIONS OF COMPLEX VARIABLE

Analytic Function, Cauchy- Riemann Conditions, Harmonic Functions (excluding orthogonal system), Milne-Thomson Method, Cauchy Integral Theorem & Integral Formula (Statement only), Taylor's & Laurent's series (Statement only), Zeros and Singularities of Analytic Function, Residue Theorem (Statement only), Contour Integration (Evaluation of real definite integral around unit circle and semi-circle).

UNIT- IV

MATRICES

Linear and Orthogonal Transformations, Linear dependence of vectors, Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley-Hamilton Theorem [without proof], Reduction to Diagonal form, Reduction of Quadratic form to Canonical form by Orthogonal Transformation, Sylvester's theorem[without proof], Solution of Second Order Linear Differential Equations with Constant Coefficients by Matrix method. Largest Eigen value and Eigen vector by Iteration method.

THEORY OF PROBABILITY

Axioms of Probability, Conditional Probability, Baye's Rule, Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Mathematical Expectation, Variance, Standard Deviation, Moments, Moment generating function, Binomial, Poisson and Normal Distributions.

Reference Books

1. Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication

2. Advanced Engineering Mathematics by Chandrika Prasad, Khanna Publishing House.

3. Engineering Mathematics-I by Reena Garg, Khanna Publishing House.

4. Advanced Engineering Mathematics by Erwin Kreysizig, 8th Edition, Wiley India

5. Applied Mathematics for Engineers & Physicist by L.R. Pipes and Harville

6. Theory & Problems of Probability and Statistics by M.R. Spiegal , Schaum Series, McGraw Hills

102 ALGORITHM & LOGIC DESIGN

UNIT-I

Arrays: single dimensional arrays, two dimensional arrays, multidimensional arrays, variable length arrays. Array operations. Strings, single dimensional array of string, two dimensional

array of string, operations in “string.h”. Structures: array of structures, passing structure to function, structure within structures. Unions, bit-fields, enumerations, sizeof, typedef.

Introduction File handling,:-File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, Closing a file, Writing a character, Reading a character, Using fopen(), getc(), putc(), and fclose(), Using feof(). Using fread() and fwrite(), Direct access file, fseek() and random access I/O, fprintf() and fscanf(), getting file name as Command line arguments.

UNIT II

Pointers: pointers operators, pointer arithmetic, Pointers and function, Array of pointers, Pointer and Strings, Pointer to structure, Pointers within structure, Introduction of Static and Dynamic memory allocation, The process of Dynamic memory allocation, DMA functions Malloc() function, Sizeof() operator, Function free(), Function realloc()

UNIT III

Graphics: Graphics and Text mode, Video Adapter, Initialize Graphics Mode and resolution, header file graphics.h. Functions used In Graphics – Drawing a Point on Screen, Drawing – lines, rectangle, circles, arcs, polygon. Functions to fill colors. Display Text in Graphics mode, outtext(), outtextxy(), justifying text. Advanced Graphics : various functions used for moving of graphical objects vizmoverel(), moveto(), putimage(), putpixel().

UNIT IV

Introduction to problem solving and programming : Basic model of computation, Notion of Algorithms, Principle of Mathematical Induction, Basics of functional programming, notion of types, Iterative versus recursive style, Correctness and efficiency issues in programming, time and space measures

Introduction to problem solving and programming: Basics of imperative style programming, Assertions and loop invariants, Top down design and examples of step-wise refinement, Programming using structures, introduction to encapsulation and object oriented programming.

Reference Books

1. The C Programming Language : Dennis Ritchie & Brain Kernighan [Pearson] 2. Practical “C” Programming: Steve Oualline, O’Reilly Publications

2. Programming with C :K.R.Venugopal & S. R.Prasad [TMH]

3. How to solve it by Computer by R. J. Dromey, Prentice-Hall India EEE Series. Reference Books

4. The Complete Reference C (4th Edition) : Herbert Schildt [TMH]

5. Problem Solving and Programming in C, R.S. Salaria [Khanna Publications]

6. Design & Analysis of Algorithms, Gajendra Sharma [Khanna Publications]

103 PARALLEL COMPUTING

UNIT-I

- Overview of parallel computing
- Performance measures
- Parallel architectures
- Problems amenable to parallel programming solution
- Programming languages for parallel programming
- Program portability issues

UNIT-II

- Operating system issues
- Tools for parallel programming
- Parallel Algorithms
- Parallelizing serial programs
- Knowledge Acquisition Goals

UNIT-III

- After successfully completing CS 5170 a student should have a conceptual understanding of:
- Flynn's Taxonomy
- Languages for parallel computing, including: MPI and OpenMP
- The Message passing paradigm
- Parallel Processing speedup issues, including Amdahl's and Gustafason's Laws

UNIT-IV

- Decomposition methodologies for parallel program development
- Load balancing issues for parallel programs
- Parallel Architectures and effect of architecture on design/implementation of a parallel

algorithm

- Quantifying Speedup; empirical tools and theoretical models
- PRAM computational model
- Current issues in parallel processing

Reference Books

1) An Introduction to Parallel Computing Paperback by Ananth Grama (Author)
2) Parallel Computation by Virender Kumar (Khanna Publications)

104 SOFT COMPUTING

UNIT-I

Fuzzy Logic: Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations.
Propositional logic and Predicate logic, fuzzy If – Then rules, fuzzy mapping rules and fuzzy implication functions, Applications.

UNIT-II

Neural Networks: Basic concepts of neural networks, Neural network architectures, Learning methods, Architecture of a back propagation network, Applications.

UNIT-III

Genetic Algorithms: Basic concepts of genetic algorithms, encoding, genetic modeling.

UNIT-IV

Hybrid Systems: Integration of neural networks, fuzzy logic and genetic algorithms.

Reference Books

1 S. Rajasekaran and G.A.Vijaylakshmi Pai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.

2 K.H.Lee.. First Course on Fuzzy Theory and Applications, Springer-Verlag.

3 J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

105 LANGUAGE & AUTOMATA THEORY (PRINCIPLE OF COMPILER DESIGN)

UNIT I

Finite State Machines : Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and liner sequential machines. Finite State Models : Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information loss less & inverse machines : testing table & testing graph.

UNIT II

Structure of Sequential Machines : Concept of partitions, closed partitions, lattice of closed partitions, decomposition : serial & parallel.

UNIT III

Finite Automation : Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with emoves, regular sets & regular expressions : equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata.

UNIT IV

Closure Properties of Regular Sets : Pumping lemma & its application, closure properties minimization of finite automata : minimization by distinguishable pair, Myhill-Nerode theorem.

Context Free Grammars : Introduction, definition, derivation trees, simplification, CNF & GNF.

Pushdown Automata : Definition, moves, Instantaneous Descriptions, language recognised by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL.

Closure Properties of CFLs : Pumping lemma & its applications, ogden′s lemma, closure properties, decision algorithms.

Introduction to Z. Regular language properties and their grammars. Context sensitive languages.

References books:

1. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
2. K.L.P Mishra & N. Chandrasekharan –"Theory of Computer Science", PHI
3. Ash & Ash –"Discrete Mathematics",TMH
4. Martin—Introduction
5. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
6. R.B. Patel & Prem Nath, "Theory of Computation", Khanna Publications.

106 C PROGRAMMING

UNIT I

Introduction to 'c' language character set. Variables and identifiers, built-in data types. Variable definition, arithmetic operators and expressions, constants and literals, simple assignment statement, basic input/output statement, simple 'c' programs

Conditional statements and loops decision making within a program, conditions, relational operators, logical connectives, if statement, if-else statement, loops: while loop, do while, for loop. Nested loops, infinite loops, switch statement, structured programming

UNIT II

Arrays one dimensional arrays: array manipulation; searching, insertion, deletion of an element from an array; finding the largest/smallest element in an array; two dimensional arrays, addition/multiplication of two matrices, transpose of a square matrix; null te01linated strings as array of characters, representation sparse matrices

UNIT III

Functions top-down approach of problem solving, modular programming and functions, standard library of c functions, prototype of a function: foo1lal parameter list, return type, function call, block structure, passing arguments to a function: call by reference, call by value, recursive functions, arrays as function arguments

UNIT IV

Structures and unions structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions

Pointers address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, arrays and pointers, pointer arrays

File processing concept of files, file opening in various modes and closing of a file, reading from a file, writing onto a file

Reference Books

The C Programming Language by Dennis Ritchieand Brian Kernighan.
Problem Solving and Programming in by R.S. Salaria (Khanna Publications)
Computer Concepts and Programming in C++ by R.S. Salaria (Khanna Publications)

107 NEURAL NETWORK LAB

UNIT I

SAMPLE PROBLEM STATEMENT: Create a custom feed-forward network .It consists of the following sections:

1. Network Layers Constructing Layers Connecting Layers Setting Transfer Functions

2. Weights and Biases

3. Training Functions & Parameters The difference between train and adapt Performance Functions Train Parameters

4. Conclusion

UNIT II

Constructing Layers.Define properties of input layerDefine the number of neurons in the input layer.

UNIT III

Setting Transfer Functions

UNIT IV

Training Functions & Parameters

The difference between train and adapt When using adapt, both incremental and batch training can be used. Which one is actually used depends on the format of your training set.

Reference Book

CCNA Lab Manual for Cisco Networking Fundamentals
12 September 2002
by Kelly Cannon

201 ADVANCED STATISTICS

UNIT I

- Inference for two means (independent and paired);
- Inference for variances;
- Multiple regression techniques

UNIT II

• One-way analysis of variance and its extensions;

• Analysis of covariance and its extensions

UNIT III

• Multivariate analysis of variance and covariance;

• Discriminate analysis

UNIT IV

• Inference for proportions and comparison of proportions; • Chi-square goodness of fit and tests of independence

Reference Books

1. Apostol, T. M. (1975) Mathematical Analysis : A Modern Approach to Advanced Calculus. (Addison -Wesley)

2. Bartle, R. G. (1976) Elements of Real Analysis (Wiley)

3. Rudin, W. (1985) Principles of Mathematical Analysis (McGraw - Hill)

4. Manish Sharma (2015) The Practice of Business Statistics (Khanna)

5. R. Agor (2016) Elements of Mathematical Analysis (Khanna)

202 ADVANCED DATA STRUCTURE

UNIT I

Basic Concepts of OOPs – Templates Function and class templates – Algorithms: performance analysis: time complexity and space complexity– ADT – List (Singly– Doubly and Circular) Implementation – Array – Pointer – Cursor Implementation

UNIT II

Stacks and Queues – ADT– Implementation and Applications – Trees – General– Binary – Binary Search – Expression Search – AVL – Introduction to Red Black trees and Splay tree – B Trees – Implementations – Tree Traversals

UNIT III

Set – Implementation – Basic Operations on Set – Priority Queue – Implementation – Graphs – Directed Graphs – Shortest Path Problem – Undirected Graph – Spanning Trees – Graph Traversals:hash table representation: hash functions: collision resolution:separate chaining: open addressing:linear probing: quadratic probing: double hashing: rehashing

UNIT IV

Issues – Managing Equal Sized Blocks – Garbage Collection Algorithms for Equal Sized Blocks – Storage Allocation for Objects with Mixed Sizes – Buddy Systems – Storage Compaction

Searching Techniques – Sorting – Internal Sorting – Bubble Sort – Insertion Sort – Quick Sort – Heap Sort – Bin Sort – Radix Sort – External Sorting – Merge Sort – Multiway Merge Sort – Polyphase Sorting – Design Techniques – Divide and Conquer – Dynamic Programming – Greedy Algorithm – Backtracking – Local Search Algorithms

References Books:

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C++ , Pearson Education, 2002.

2. Aho Hopcroft Ullman, ―Data Structures and Algorithms , Pearson Education, 2002.

3. Horowitz Sahni, Rajasekaran, ―Computer Algorithms , Galgotia, 2000.

4. Tanenbaum A.S, Langram Y, Augestien M.J., Data Structures using C & C++ , Prentice Hall of India, 2002.

5. Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

6. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons. 7. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

7. R.B. Patel, Expert Data Structures and Algorithms with C++, Khanna Publications

203 ROBOT MOTION PLANNING

UNIT I

• Introduce basic robotic motion planning problems.

• Provide students with a basic review of classical motion planning theory and an intro- duction to the most widely used classical motion planning algorithms.

•Introduce sufficient terminology and concepts so that interested students can indepen- dently read the robotic motion planning research literature.

UNIT II

• Introduce the basic concepts behind sensor-based motion planning algorithms.

• Expose students practical issues involved in implementing a planner via laboratories involving small mobile robots.

•Extend the review of sensor-based planning algorithms studied in ME/CS 132.

UNIT III

• Review some of the basic sensor-processing issues and algorithms needed to process the outputs of typical robotic sensors.

• Enable students to implement sensor-based planning algorithms on a mobile robot.

UNIT IV

• Introduce and review the basic problems in robotic localization and mapping.

• Review conventional estimation techniques (Kalman filter and Particle Filter) that un- derly localization and mapping algorithms.

• Review estimation-based localizaton and mapping techniques.

• Allow students to implement a significant robot motion planning project.

References Books:

1. Steven M. LaValle, Planning Algorithms, Cambridge University Press, 2006.

2. JeanClaude Latombe, Robot motion planning. Springer, 1990.

3. Choset, H., Lynch, K. M., Hutchinson, S., Kantor, G., Burgard, W., Kavraki, L. E., & Thrun, S. (2005). Principles of robot motion: theory, algorithms, and implementations. MIT press.

4. B. Siciliano, L. Sciavicco, L., Villani, G. Oriolo, Robotics: Modeling, Planning and Control, Springer, 2009.

204 COMPUTER GRAPHICS & ANIMATION

UNIT I

What is Multimedia Definition – Multimedia elements Text Graphics Audio Video Animation Interactivity Where to use – Business Schools Home Public places Virtual reality Delivering multimedia – CDROM, DVD, Flash Drives

Text or Typography -10 Hours o About Fonts & Faces o Using Text in Multimedia o Computers and text o The power of text with examples (Ads)

Images (10 Hours) o Making still images Bitmaps Vector drawing Vector vs. bitmap 2d-3d drawing o Color Understanding natural light and color Computerized color Color palettes o Image file formats

UNIT II

Sound o Sound Theory o Digital audio o Midi audio o Midi vs. digital audio o Sound in multimedia o Audio file formats o The power of sound(examples)

Animation o About motion graphics o Principles of animation o Animation by computer Animation techniques Animation file formats o Display of animated content

Video o Using video o Analog video o Digital video o Characteristics of video o Digital video containers Codec Video format converters Video formats o How to get video clips o Shooting and editing video Shooting platform Storyboarding Lighting Chroma keys Composition Titles and text Nonlinear editing(NLE)

UNIT III

Creating Multimedia content o Stages of multimedia project o Creativity & Observation skills o Organization of MM Assets o Communication process SMR in detail o Hardware windows vs. Macintosh memory and storage devices input devices output devices connectors (ports) o software word processors OCR software Painting / drawing tools 2d / 3d modeling and animation software Image editing tools Sound editing tools Animation, video and digital movie tools Other helpful tools (current trends) o What is authoring?

Multimedia Jobs / Skills (15 Hours) o Project Manager o Multimedia Designer o Interface designer o Writer o Video specialist o Audio specialist o Multimedia programmer o Multimedia producer for web o Animator (specialization)

UNIT IV

Planning and costing o Idea o Prototype development o Alpha testing o Beta testing o Delivery o Scheduling o Estimating

Multimedia & Internet o Designing and Producing From Layout to Production o Content and talent Research skills What exactly industry requires (skill-set) o The internet and Multimedia Rich Media Content examples o Designing for WWW using Text Graphics Audio Video Animation Interactivity / authoring o Delivering Multimedia content Online Offline

Reference Books

Primary: Multimedia BASICS by Suzanne (Suzanne Weixel) Weixel, Jennifer Fulton, Karl Barksdale and Cheryl Beck Morse (Mar 14, 2003)

Secondary: Digital Multimedia by Nigel Chapman and Jenny Chapman (Apr 14, 2009) Exploring Multimedia for Designers (Design Exploration) by Ray Villalobos (Sep 21, 2007) Multimedia Learning by Richard E. Mayer (Jan 12, 2009) An Introduction to Digital Multimedia by T.M. Savage and K.E. Vogel (Oct 14, 2008)

Multimedia and Animation, by V.K. Jain (Khanna)

205 OBJECT ORIENTED PROGRAMMING IN JAVA

UNIT I

Object oriented thinking

Need for oop paradigm, A way of viewing world – Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of oop concepts, coping with complexity, abstraction mechanisms.

UNIT II

Java Basics

History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring string class.

Inheritance
Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance-specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism-method overriding, abstract classes, the Object class.

UNIT III

Packages and Interfaces

Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring java.io.

Exception handling

Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. String handling,Exploring java.util

UNIT IV

Multithreading

Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, interthread communication, thread groups, daemon threads. Enumerations, autoboxing, annotations ,generics.

Event Handling

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

Applets

Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.
Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing-JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Reference Books:

1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, pearson eduction.
3. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley & sons.
4. An Introduction to OOP, third edition, T. Budd, pearson education.
5. Introduction to Java programming , Y. Daniel Liang, pearson education.
6. An introduction to Java programming and object oriented application development, R.A. Johnson-Thomson.
7. Mastering Object Oriented Programming using C++, R.S. Salaria by Khanna Publishers.

206 OOP THROUGH JAVA

UNIT I

Object oriented thinking

Need for oop paradigm, A way of viewing world – Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of oop concepts, coping with complexity, abstraction mechanisms.

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History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring string class.

UNIT II

Inheritance

Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance-specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism-method overriding, abstract classes, the Object class.

Packages and Interfaces

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Exception handling

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Multithreading

Differences between multi threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, interthread communication, thread groups, daemon threads. Enumerations, autoboxing, annotations ,generics.

UNIT IV

Event Handling

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1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Understanding OOP with Java, updated edition, T. Budd, pearson eduction.

207 ROBOTICS LAB

UNIT I

Undertake kinematics analysis of robot manipulators
Understand the importance of robot dynamics

UNIT II

Have an understanding of the functionality and limitations of robot actuators and sensors
Understand and be able to apply a variety of techniques to solve problems in areas such as robot control and navigation

UNIT III

Describe different mechanical configurations of robot manipulators
To be able to program a robot to perform a specified task (e.g obstacle avoidance or wall following) in a target environment.

UNIT IV

Understand how simulations of robots work, where they can be useful and where they can break down.
Appreciate the current state and potential for robotics in new application areas.

Reference Books:

Learning Robotics Using Python Paperback – Import, 27 May 2015

by Lentin Joseph (Author)

301 IMAGE PROCESSING

UNIT-I

INTRODUCTION Origin of Digital Image processing – fundamental steps – Components of Image processing system – Visual perception – Light and EM spectrum – Image sensing and acquisition – Image sampling and Quantization – relationship between pixels

UNIT-II

IMAGE ENHANCEMENT Spatial Domain: Gray level transformation – Histogram processing – Arithmetic / Logic operations- Spatial filtering – smoothing filters – sharpening filters Frequency Domain: Fourier transform – smoothing frequency domain filters – sharpening filters – Homographic filtering

UNIT-III

IMAGE RESTORATION Model of Image degradation/ restoration process – Noise models – mean filters – order statistics – adaptive filters – band reject – band pass – notch – optimum notch filters – Linear, position invariant degradations –establishing degradation functions – Inverse filtering – Weiner – least square – Geometric mean filters

UNIT-IV

IMAGE COMPRESSION Fundamentals – Image compression models – Information theory – error free compression: variable length – LZW – Bit plane – Lossless predictive coding; Lossy compression: Lossy predictive – transform – wavelet coding; Image compression standards

IMAGE SEGMENTATION, REPRESENTATION & DESCRIPTION Segmentation: Detection of discontinuities – Edge linking & Boundary detection – Thresholding – region based segmentation. Representation & Description: Chain codes – Polygonal approximations – signatures – Boundary segments – Skeletons; Boundary Descriptors – Regional descriptors

Reference Books

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing" , 2nd edition , Pearson Education, 2007.
2. Digital Image Processing, M.Anji Reddy, Y.Hari Shankar, BS Publications.
3. S.Annadurai, R.Shanmugalakshmi, "fundamentals of Digital Image Processing", Pearson Education, 2007
4. Rafael C. Gonzalez, Richard E. Woods, Eddins, "Digital Image Processing using MATLAB" , Pearson Education, 2005
5. Anil Jain K. "Fundamentals of Digital Image Processing", PHI.
6. William Pratt , "Digital Image Processing", Wiley Interscience, 2nd edition. M. TECH.

302 MACHINE LEARNING

UNIT I

INTRODUCTION - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

UNIT II

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

UNIT III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning - Instance-Based LearningIntroduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

UNIT IV

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution M. TECH. (NEURAL NETWORKS)-R13 Regulations Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search

Objective, Using Prior Knowledge to Augment Search Operators, Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

References Books:

1. Machine Learning – Rajiv Chopra, - Khanna Publishing House
2. Machine Learning using Python - Jeeva Jose- Khanna Publishing House
3. Machine Learning – Tom M. Mitchell, - MGH
4. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)
5. Cover, T. M. and J. A. Thomas: Elements of Information Theory. Wiley.
6. Charniak, E.: Statistical Language Learning. The MIT Press.
7. Jelinek, F.: Statistical Methods for Speech Recognition. The MIT Press.
8. Lutz and Ascher - "Learning Python", O'Reilly
9. Jeeva Jose - "Introduction to Computing and Problem Solving through Python", Khanna Publications

303 OPERATION RESEARCH

UNIT I

QUEUEING MODELS 9 Poisson Process – Markovian Queues – Single and Multi:server Models – Little's formula – Machine Interference Model – Steady State analysis – Self Service Queue.

UNIT II

ADVANCED QUEUEING MODELS 9 Non: Markovian Queues – Pollaczek Khintchine Formula – Queues in Series – Open Queueing Networks –Closed Queueing networks.

UNIT III

SIMULATION 9 Discrete Even Simulation – Monte – Carlo Simulation – Stochastic Simulation – Applications to Queueing systems.

UNIT IV

LINEAR PROGRAMMING 9 Formulation – Graphical solution – Simplex method – Two phase method : Transportation and Assignment Problems.

NON:LINEAR PROGRAMMING 9 Lagrange multipliers – Equality constraints – Inequality constraints – Kuhn : Tucker conditions – Quadratic Programming.

Reference Books:

1. Winston.W.L. ―Operations Research , Fourth Edition, Thomson – Brooks/Cole, 2003.

2. Taha, H.A. ―Operations Research: An Introduction , Ninth Edition, Pearson Education Edition, Asia, New Delhi, 2002.

3. Robertazzi. T.G. ―Computer Networks and Systems – Queuing Theory and Performance

4. Evaluation, Third Edition, Springer, 2002 Reprint.

5. Ross. S.M., ―Probability Models for Computer Science, Academic Press, 2002.

304 MODELING & SIMULATION

UNIT I

- Simulation Basics
- Handling Stepped and Event-based Time in Simulations
- Discrete versus Continuous Modelling
- Numerical Techniques
- Sources and Propagation of Error

UNIT II

- Dynamical, Finite State, and Complex Model Simulations
- Graph or Network Transitions Based Simulations
- Actor Based Simulations
- Mesh Based Simulations
- Hybrid Simulations

UNIT III

- Converting to Parallel and Distributed Simulations
- Partitioning the Data
- Partitioning the Algorithms
- Handling Inter-partition Dependencies

UNIT IV

- Probability and Statisics for Simulations and Analysis
- Introduction to Queues and Random Noise
- Random Variates Generation
- Sensitivity Analysis

- Simulations Results Analysis and Viewing Tools
- Display Forms: Tables, Graphs, and Multidimensional Visualization
- Terminals, X and MS Windows, and Web Interfaces
- Validation of Model Results

Reference Books:

The Nature of Code: Simulating Natural Systems with Processing by Daniel Shiffman - The Nature of Code , 2012

305 CLOUD COMPUTING

UNIT I

CLOUD COMPUTING Understanding the Cloud Computing – Cloud Architecture – Cloud Storage – Advantages, Disadvantages of Cloud Computing – Companies in the Cloud Today – Developing Cloud Services – Web:Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On:Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

UNIT II

CLOUD COMPUTING FOR EVERYONE Centralizing Email Communications – Collaborating on Schedules, To:Do Lists, Contact Lists and Group Projects and Events – Cloud Computing for the Community and Corporation, Using Cloud Services: Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications, Online Planning and Task Management – Collaborating on Event Management, Contact Management, Project Management, Word Processing and Databases – Storing and Sharing Files

UNIT III

VIRTUALIZATION & CLOUD COMPUTING * Virtualization & Cloud Computing Overview – Case Study: Enterprise Virtualization & Cloud Computing – Definitions – Hypervisor / Virtual Machine Monitor Architecture – CPU Virtualization Extensions – Network and Storage Virtualization Architecture

UNIT IV

VIRTUALIZED ENTERPRISE * Smashing the Virtualized Stack – Case Study: Owning the Virtualized Enterprise – CPU & Chipsets – VMM/Hypervisor/Host – VMs/Guest – Control & Management planes & APIs.

CLOUD SECURITY AND PRIVACY Infrastructure security – Data Security and Storage – Identity and access management – Security management in the cloud – privacy – Security as a cloud service.

References Books:

1. Michael Miller, Cloud Computing: Web:Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

2. Christofer Hoff, Rich Mogull, Craig Balding, Hacking Exposed: Virtualization & Cloud Computing: Secrets & Solutions [Paperback], McGraw:Hill Osborne (20 Jan 2012) *

3. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On:demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

4. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance, By O'Reilly Media, 2009

306 ADVANCED DATA STRUCTURE PROGRAMMING

UNIT I

LAB EXERCISES:

Each student has to work individually on assigned lab exercises. Lab sessions could be scheduled as one contiguous four-hour session per week or two two-hour sessions per week. There will be about 15 exercises in a semester. It is recommended that all implementations are carried out in Java. If C or C++ has to be used, then the threads library will be required for concurrency.

Exercises should be designed to cover the following topics:

1. Implementation of graph search algorithms.
2. Implementation and application of network flow and linear programming problems.
3. Implementation of algorithms using the hill climbing and dynamic programming design techniques.
4. Implementation of recursive backtracking algorithms.
5. Implementation of randomized algorithms.
6. Implementation of various locking and synchronization mechanisms for concurrent linked lists, concurrent queues, and concurrent stacks.
7. Developing applications involving concurrency.

UNIT II

OUTCOMES:

Upon completion of the course, the students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement algorithms using the hill climbing and dynamic programming and recursive backtracking techniques.
- Design and implement optimization algorithms for specific applications.
- Design and implement randomized algorithms.
- Design appropriate shared objects and concurrent objects for applications.
- Implement and apply concurrent linked lists, stacks, and queues.

Reference Books:

1. Jeff Edmonds, "How to Think about Algorithms", Cambridge University Press, 2008.
2. M. Herlihy and N. Shavit, "The Art of Multiprocessor Programming", Morgan Kaufmann, 2008.
3. Steven S. Skiena, "The Algorithm Design Manual", Springer, 2008.
4. Peter Brass, "Advanced Data Structures", Cambridge University Press, 2008.
5. S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani, "Algorithms" , McGrawHill, 2008.
6. R.S. Salaria, Data Structures using C++, Khanna Publishers.

307 PRACTICAL ON MACHINE LEARNING

Speech Recognition (HMMs, ICA)

Computer Vision

Time Series Prediction (weather, finance)

Genomics (micro-arrays, SVMs, splice-sites)

NLP and Parsing (HMMs, CRFs, Google)

Text and InfoRetrieval (docs, google, spam, TSVMs) Medical (QMR-DT, informatics, ICA) Behavior/Games

Reference Books:

- Stephen Marsland, Machine Learning: An Algorithmic
- Christopher M. Bishop, Pattern Recognition and Machine
- Tom Mitchell, Machine Learning
- Rajiv Chopra, Machine Learing
- Jeeva Jose, Machine Learning using Python

401 PROJECT