DEPARTMENT OF INFORMATION AND COMMUNICATION TECHNOLOGY

B.TECH (INFORMATION TECHNOLOGY) SYLLABUS (2022 ADMITTED)

III SEMESTER

MAT 2126 ENGINEERING MATHEMATICS – III [2 1 0 3]

Boolean Algebra: Partial ordering relations, Poset, Lattices, Basic Properties of Lattices. Distributive and complemented lattices, Boolean lattices and Boolean Algebra. Elementary configuration: Permutations and Combinations, Generating function, Principle of inclusion and exclusion Partitions, compositions. ordering of permutations: Lexicographical and Fikes. Graph theory: Basic definitions, Degree, regular graphs, Eulerian and Hamiltonian graphs, Trees and Properties, Center, radius and diameter of a graph, Rooted and binary trees, Matrices associated with graphs, Algorithms for finding shortest path, Algorithm. Group theory : Semi groups, Monoids, Groups- subgroups, Normal Subgroups, Cosets, Lagrange's Theorem, Cyclic groups. Propositional and Predicate Calculus: Well formed formula, connectives, quantifications, Inference theory of propositional and predicate calculus.

ICT 2121 DATA STRUCTURES [3 1 0 4]

Abstract

Introduction, Stacks, Queues and their applications, Sparse Matrix, Pointers and dynamic memory allocation, Linked Lists: Singly linked lists, Dynamically Linked Stacks and Queues, Polynomial representation and polynomial operations using singly linked list, Singly Circular Linked List, Doubly Linked Lists, Trees: Binary trees, Binary Search Trees, threaded binary trees, Graphs: Depth First Search, Breadth First Search.

Course Outcomes

At the end of this course, the students will be able to

1. Associate real world representation of information using structures and recursions.
2. Solve real world problems using concepts like queues and stacks.
3. Solve real world problems using linked list concepts.
4. Analyse Non-Linear Data Structures such as Trees.
5. Explain Graph representations and Graph traversals.

References

1. Behrouz A. Forouzan, Richard F. Gilberg, A Structured Programming Approach Using C,3rd Edition, Cengage Learning India Pvt. Ltd, India, 2007.
2. Ellis Horowitz, Sartaj Sahani, Susan Anderson and Freed, Fundamentals of Data Structures in C, 2nd Edition, Silicon Press, 2007.
3. Richard F. Gilberg, Behrouz A. Forouzan, Data structures, A Pseudocode Approach with C, 2nd Edition, Cengage Learning India Pvt. Ltd, India, 2009.

4. 4.Tenenbaum Aaron M., Langsam Yedidyah, Augenstein Moshe J., Data structures using C, Pearson Prentice Hall of India Ltd., 2007.
5. Debasis Samanta, Classic Data Structures, 2nd Edition,

ICT 2122 OBJECT ORIENTED PROGRAMMING [3 1 0 4]

Abstract

Introduction to OOP, Java Programming Fundamentals, Data types & Operators, Control structures, strings, Introducing Classes, Objects and Methods, Inheritance: Inheritance basics, Constructors, Interfaces: Fundamentals, creating and implementing an interface, Packages: Fundamentals, packages and member access, Exception handling: Exception hierarchy and fundamentals, try block, multiple catch clauses, throw and throws, finally, user defined exceptions, Multithreaded Programming: Multithreading fundamentals, creating threads, thread priorities, synchronization, thread communication, Generics: Generic fundamentals, Generic class, bounded types, wildcards, Generic methods, Generic restrictions, GUI Programming with Javafx: Introducing Javafx: Basic concepts, Application Skeleton, Using buttons and events, Exploring Javafx Controls, CERT Java Coding Standard: Rules and Recommendations..

Course Outcomes

At the end of this course, the student will be able to

1. Acquire knowledge of Object-oriented programming along with CERT JAVA coding standard
2. Achieve reusability using Inheritance and Packages
3. Achieve high level reusability using Generics
4. Appreciate the use of exception handling and achieve concurrency through multithreading.
5. Explain event handling and Design simple GUI based applications using JavaFX

References

1. Herbert Schildt and Dale Skrien, Java Fundamentals – A Comprehensive Introduction, 1st Edition, McGrawHill, 2015
2. Herbert Schildt, Java The Complete Reference, 10th Edition, Tata McGrawHill, 2017
3. Fred Long, Dhruv Mahindra, Ebook: CERT Oracle Secure Coding Standard for Java, Addison Wesley, 2013
4. Fred Long, Dhruv Mohindra, Ebook: Java Coding Guidelines: 75 Recommendations for Reliable and Secure Programs, Addison Wesley, 2014.

5. Bruce Eckel, Thinking in Java, (5e), Prentice Hall, 2013
6. Herbert Schield , Java A beginner's Guide, (6e), 2014
7. Dietel and Dietel, Java How to Program, (9e), Prentice Hall India, 2012
8. Steven Holzner, Java 2 Programming Black Book, DreamTech, India, 2005

ICT 2123 DIGITAL SYSTEMS AND COMPUTER ORGANIZATION [4 0 0 4]

Abstract

Introduction, Simplification of Boolean functions: K-map method, NAND and NOR implementation, Combinational logic, Design of Adders/Subtractors, Code converters, Multipliers, Magnitude Comparator, Decoders, Encoders, Multiplexers, De Multiplexers, Sequential logic: Counters and Shift Registers, Computer organization: Introduction, Execution unit, Control unit, Memory unit, Input and Output unit.

Course Outcomes

At the end of this course, students will be able to:

1. Apply the Boolean algebra and K-maps to simplify the logic functions
2. Design minimal combinational and sequential logic circuits using logic gates and building blocks
3. Apply the integrated circuits of the standard building blocks to solve a combinational and sequential problem
4. Analyze the operations of combinational and sequential logic circuits.
5. Distinguish operations of control unit, execution unit and I/O in computer organization.

References

1. M. Morris Mano, Digital Design, 3rd edition, Pearson education, 2002
2. Ronald J. Tocci, Neal S. Widmer and Greggory L Moss, Digital Systems: Principles and Applications (12e), Pearson Education India, 2017.
3. Donald D. Givonne, Digital Principles and Design,Tata McGraw-Hill edition 2003
4. Mohamed Rafiquazzaman and Rajan Chandra, Modern computer Architecture (3e), Galgotia publications Pvt. Ltd, 2015.
5. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th edition, Elsevier, 2014

ICT 2124 PRINCIPLES OF DATA COMMUNICATION [3 0 0 3]

Abstract

Introduction to Data Communication, Signals, Basic properties of data communication system, Nyquist rate, Shannon Capacity, Signal encoding, Modulation schemes. Transmission media, Wired and wireless transmission, error detection and correction, Cyclic redundancy check, Hamming code, Stop and wait flow control, Sliding window flow control, Automatic repeat request, High level data Link control, Multiplexing, Media Access Sub layer and LAN, Random access protocols, Bridges.

Course Outcomes

At the end of this course, students will be able to

1. Demonstrate the working of various components in data communication system.
2. Apply suitable techniques to detect and correct errors in data transmission.
3. Analyze different flow control techniques in data link layer and select suitable technique.
4. Compare the performance of media access protocols in wired and wireless channel.

References

1. William Stallings, Data & Computer Communications (10e), Pearson Education Inc., Noida, 2017

2. Behrouz Forouzan, Introduction to data communication & networking (5e), Tata McGraw Hill, New Delhi-2017.

3. Alberto Leon Garcia and Indra Widjaja, Communication Networks (2e), Tata McGraw Hill, 2011.

4. Theodore S. Rappaport, Wireless Communications: Principles and Practice (2e), Pearson Education Inc, 2010.

ICT 2141 DATA STRUCTURES LAB [0 0 3 1]

Abstract

Application using arrays, String operations, Pointers, Recursive programs, Structure concepts, Stacks, Queues, Application of stacks, Arithmetic expression conversion and evaluation, Sparse matrix representation Singly linked lists and applications, Circular linked lists, doubly linked lists,

polynomial addition and multiplications using circular linked lists, Binary Tree: creation, deletion and traversal techniques, Binary search tree operations.

Course Outcomes

By the end of this course, the students are able to:

1. Apply recursion concepts to problems with arrays, functions, structures and pointers.
2. Implement applications using stacks and queues.
3. Solve problems using linked lists and trees.

References

1. Behrouz A. Forouzan, Richard F. Gilberg, A Structured Programming Approach Using C, 3rd Edition, Cengage Learning India Pvt. Ltd, India, 2007.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson and Freed, Fundamentals of Data Structures in C, 2nd Edition, Silicon Press, 2007.
3. Richard F. Gilberg, Behrouz A. Forouzan, Data structures, A Pseudocode Approach with C, 2nd Edition, Cengage Learning India Pvt. Ltd, India, 2009.

ICT 2142 OBJECT ORIENTED PROGRAMMING LAB [0 0 3 1]

Abstract

Simple Java programs using control structures and Arrays, Programs using Classes, objects, methods, Programs on Constructors and static members, Programs using Inheritance, Packages, Interfaces and Generics, Programs using Exceptions and Multithreading, GUI based programs using Javafx.

Course Outcomes

At the end of this course, students will be able to

1. Explain the Object-oriented paradigm of software development.
2. Achieve reusability using Inheritance, Packages and Generics.
3. Appreciate the use of exception handling, achieve concurrency through multithreading and implement small Java applications using JavaFX.

References

1. Herbert Schildt and Dale Skrien, Java Fundamentals – A Comprehensive Introduction,1st Edition, McGrawHill, 2015
2. Herbert Schildt, The Complete Reference JAVA 2, 10th Edition, Tata McGrawHill, 2017
3. Dietel and Dietel, Java How to Program, 9th Edition, Prentice Hall India, 2012

ICT 2143: DIGITAL SYSTEMS LAB [0 0 3 1]

Abstract

Verification of Boolean algebra and De Morgan theorems, Simplification of Boolean expressions using K-maps, Combinational logic circuit implementation – Binary parallel adder, BCD adder, Multiplier, Code converter, Comparator, 3 to 8 decoder, Magnitude comparator, Multiplexers, Sequential logic circuits- Flip flops, Conversion of flip-flops, Analyzing timing diagram using output waveforms, Asynchronous and Synchronous counters, Shift registers, Shift register counters, Sequence generators, Sequence detectors.

Outcomes

At the end of this course, students will be able to

1. Verification of the Boolean expression after simplification using basic/universal gates on trainer kit/ Simulation tool.
2. Design and build a combinational circuit using trainer kit/ Simulation tool.
3. Design and build a sequential circuit using trainer kit/ Simulation tool.
4. Apply the digital system concepts to solve a given problem and build the circuit using MSI circuits on simulation tool

References

1. M. Morris Mano, Digital Design, Prentice Hall India, 3rd edition, Pearson education, 2002
2. Tocci R.J., Widmer N.S., Greegory L.M., Digital Systems: principles and Applications (12e), Pearson Education India, 2017.
3. Wakerly J.F., Digital Design Principles and Practices (4e), Pearson Education, 2014

IV SEMESTER

MAT 2226 ENGINEERING MATHEMATICS – IV [2 1 0 3]

Basic Set theory, Axioms of probability, Sample space, conditional probability, total probability theorem, Baye's theorem. One dimensional and Two-dimensional random variables, mean and variance, properties, Chebyshev's inequality, correlation coefficient, Distributions, Binomial, Poisson, Normal and Chisquare. Functions of random variables: One dimensional and Two-dimensional, F & T distributions, Moment generating functions, Sampling theory, Central limit theorem, Point estimation, MLE, Interval estimation. Test of Hypothesis: significance level, certain best tests; Chi square test.

References:

1. P.L. Meyer: Introduction to probability and Statistical Applications,2nd edition, 1980, Oxford and IBH publishing, Delhi.
2. Miller, Freund and Johnson, Probability and Statistics for Engineers, 8th Edn, PHI, 2011.
3. Hogg and craig, Introduction to mathematical statistics, 6th Edn,2012, Pearson education, New Delhi.
4. Ross Sheldon M, Introduction to Probability and Statistics for Engineers and Scientists, Elseveir, 2010.

ICT 2221 DATABASE SYSTEMS [3 1 0 4]

Abstract

Database-System Applications, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Database Architecture, NoSQL, Data Sharding, Database Schemas, Keys, Relational Query Languages, Relational Operations, SQL Data Definition, SQL Data Types and Schemas, Integrity Constraints, Set Operations, Aggregate Functions, Overview of SQL Query Language, Basic Structure of SQL Queries, Join Expressions, Overview of the Design Process, The Entity-Relationship Model, Extended E-R Features, Reduction to Relational Schemas, Features of Good Relational Design, Atomic Domains and Normalization, File concepts, Indices Concept, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Transaction Concept, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm Lock-based protocols, deadlock handling, Timestamp based protocols, Validation based protocols.

Course Outcomes:

At the end of this course, students will be able to

1. Interpret the basic concepts of database and relational model

2. Apply structured query language for data retrieval
3. Use and design databases using E-R models
4. Analyze and apply the normalization technique to decompose given relational schema into effective schemas
5. Explain the method of indexing, hashing and organization of files and apply the different transaction properties for serializability and recovery and concurrency control algorithm.

References

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 6th edition, McGraw-Hill, New York, 2011.
2. Pramod J Sadalage, Martin Fowler, NoSQL Distilled, Addison-Wesley, 2013
3. Ramez Elmasri and Shamkant Navathe, Durvasula V L N Somayajulu, Shyam K Gupta, Fundamentals of Database Systems, 6th edition, Pearson Education, United States of America, 2011.
5. Thomas Connolly, Carolyn Begg, Database Systems – A Practical Approach to Design, Implementation and Management, 4th edition, Pearson Education, England, 2005.
6. Peter Rob, Carlos Coronel, Database Systems–Design, Implementation and Management, 10th edition, Course Technology, Boston, 2013.

ICT 2222 DESIGN AND ANALYSIS OF ALGORITHMS [3 1 0 4]

Abstract

Fundamentals of Algorithms, Important Problem Types, Analysis of algorithm efficiency. Analysis Framework: Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. Brute force Techniques, Divide and Conquer, Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting. Transform and Conquer: Presorting, BST, Heapsort. Space and Time tradeoffs: Input Enhancement in String Matching. Dynamic Programming: Warshall's and Floyd's Algorithms, The Knapsack Problem. Greedy Techniques: Prim's, Kruskal's and Dijkstra's Algorithm, Huffman Trees. Coping with limitations of algorithmic power, P, NP, and NP-complete Problems, Backtracking: n–Queens problem, Hamiltonian Circuit Problem, Subset–Sum Problem. Branch and Bound: Assignment Problem, Knapsack Problem, TSP.

Course Outcomes

At the end of this course, students will be able to

1. Apply the techniques for designing algorithms to solve problems.

2. Analyze the various aspects which contribute to algorithm efficiency.
3. Describe the complexity of algorithm using asymptotic notations.
4. Classify the complexity of algorithm into different efficiency classes.
5. Comprehend different strategies of algorithm design technique.

References

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson Education, India, 2011.
2. Ellis Horowitz and Sartaj Sahni, Computer Algorithms/C++, 2nd Edition, University Press, India, 2007.
3. Thomas H. Cormen, Charles E. Leiserson, Ronal L, Rivest, Clifford Stein, Introduction to Algorithms, 2nd Edition, PHI, India, 2006

ICT 2223 EMBEDDED SYSTEMS [4 0 0 4]

Abstract

An overview of Computer Architecture, overview of ARM-Cortex- M Architecture, CISC versus RISC, The RISC and ARM design philosophy, ARM addressing modes, Data transfer instructions, Arithmetic and logical instructions, Shift and rotate instructions, Branch and conditional branch instructions, Function call and return, Stack, Recursive functions, Conditional execution, Assembly language programming, Input/output I/O) programming, Timer/counter programming, I/O interfacing : LED, LCD, Keyboard, Stepper motor, ADC, DAC, PWM, UART, Nested Vectored Interrupt Controller (NVIC), External hardware interrupts, IO interrupts.

Course Outcomes

At the end of this course, students will be able to

1. Demonstrate the salient features of embedded systems.
2. Explain addressing modes and assembly language instructions
3. Illustrate the architecture of ARM Cortex- M microcontroller.
4. Develop the application software for ARM Cortex-M microcontroller-based Systems.
5. Design real world systems using ARM Cortex-M microcontroller

References

1. Jonathan W.V., Embedded systems: Real-time interfacing to ARM Cortex-M microcontrollers, 8th Edition, ISBN: 978-1463590154 Createspace Independent Publishing Platform, July 2021.

2. Wilmshurst T., Fast and Effective Embedded System Design applying the ARM mbed, Elsevier, 2017.

3. Jonathan W.V., Embedded systems: Introduction to Arm(r) Cortex-M Microcontrollers, 6th Edition, ISBN: 978-1477508992, Createspace Independent publishing platform, Jan 2019.

4. UM10360, LPC 176x/5x User Manual, NXP Semiconductors, Rev. 3.1, 2014.

5. Joseph V., A definitive Guide to ARM Cortex-M3 and Cortex-M4 processors, 3rd Edition, Elsevier, 2014.

6. Muhammad A.M, Sarmad N., Sepehr N., Shujen C., ARM Assembly Language Programming & Architecture, 2nd Edition, Wiley, 2016.

ICT 2224 COMPUTER NETWORKS [4 0 0 4]

Abstract

Introduction to Computer Networks: Definition, Network Layer, Network Layer services, Interfacing :Bridges, IP addressing, Subnetting and Supernetting, IPv6 addressing, Delivery Forwarding, and Routing of IP Packets, Internet Protocol - Datagram, Fragmentation, Options, Checksum, Introduction to Routing Protocols, Interior and Exterior routing, Dynamic IP Routing Protocols - RIP, RIP Version 2, OSPF, Routing between peers :BGP, ARP and RARP, Internet Control Message Protocol, User Datagram Protocol, Transmission Control Protocol and Introduction to application layer, DNS, DHCP, FTP, SNMP.

Course Outcomes:

At the end of this course, students will be able to

1. Illustrate the proper usage of various protocols that has been used in the different layers of TCP/IP protocol suite
2. Interpolate the basic protocols of computer networks in network design and implementation.
3. Describe the End-to-End communication and routing mechanisms.
4. Apply various application layer protocols to solve challenges in real world scenario.

References:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th Edition, Tata McGraw Hill 2017.
2. Andrew S. Tanenbaum, Computer Network, 5th Edition Prentice Hall of India Pvt Ltd 2013.
3. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition Tata McGraw Hill 2013.
4. Leon Garcia and Widjala, Communication Networks, 2nd Edition, Tata McGraw Hill 2004.

ICT 2241 DATABASE SYSTEMS LAB [0 0 3 1]

Abstract
Data Definition Language, Basic database query operations, Nested subqueries, Join Operations, Views, Stored procedures, Functions, Trigger, Cursors, Data Access using JDBC-ODBC, Design and development of application based on database concepts.

Course Outcomes
At the end of this course, the students will be able to

- Write queries for design and manipulation of database tables
- Identify the effective use of stored procedures, functions and packages.
- Design and develop applications

References

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 6th edition, McGrawHill, 2011.
2. Ivan Bayross, SQL, PL/SQL, 3rd edition, BPB Publications
3. G, Reese, Database Programming with JDBC And Java, 2nd edition, O'REILLY, 2000.

ICT 2242 EMBEDDED SYSTEMS LAB [0 0 3 1]

Abstract

Familiarization of data transfer from code segment to data segment and from data segment to data segment, Arithmetic operations, Logical instructions, Branch instructions, Code conversion from hexadecimal to decimal and decimal to hexadecimal, Packing and unpacking of ASCII digits, Sorting using selection sort and bubble sort techniques, Searching using linear and binary search techniques, Recursion, I/O interfacing of LEDs, LCD, keyboard, 7 segment display, ADC, PWM., I2C and RTC In addition to the above list of experiments, students are required to develop a mini project using mbed LPC1768board.

Course Outcomes

Upon successful completion of this course student will be able to

1. Illustratethe basics of an embedded system
2. Design an embedded system using ARM controller
3. Model and test an embedded system for a real world scenario

References

1. Jonathan W.V., Embedded systems: Real-time interfacing to ARM Cortex-M microcontrollers, 8th Edition, ISBN: 978-1463590154 Createspace Independent Publishing Platform, July 2021.
2. Wilmshurst T., Fast and Effective Embedded System Design applying the ARM mbed, Elsevier, 2017.
3. Jonathan W.V., Embedded systems: Introduction to Arm(r) Cortex-M Microcontrollers, 6th Edition, ISBN: 978-1477508992, Createspace Independent publishing platform, Jan 2019.
4. UM10360, LPC 176x/5x User Manual, NXP Semiconductors, Rev. 3.1, 2014.
5. Joseph V., A definitive Guide to ARM Cortex-M3 and Cortex-M4 processors, 3rdEdition, Elsevier, 2014.
6. Muhammad A.M, Sarmad N., Sepehr N., Shujen C., ARM Assembly Language Programming & Architecture, 2nd Edition, Wiley, 2016.

ICT 2243 NETWORK PROGRAMMING AND SIMULATION LAB [0 0 3 1]

Abstract

Socket programming- Files, Database, Multi Client Server Environment and Application Development. Packet Tracer: Introduction to CISCO Packet Tracer, Basic Configuration, simulation of Ethernet LAN protocol, token bus and token ring protocols, implementation of distance vector algorithm, link state routing algorithm and finding shortest path, DHCP and NAT.

Course Outcomes

At the end of this course, students will be able to

1. Design and Implement client server socket programming.
2. Illustrate the working of files, database and multiprocessor communication using socket programming.
3. Create a network design using the different modules of packet tracer.
4. Simulate the network concepts using packet tracer that provides solution to the real-world problem.

References

1. Stevens R., Stephen A. R., Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2013.

2. Jesin A, Packet Tracer Network Simulator, 1st Edition, Packt Publishing, 2014.
3. Dr. M. O. Faruque Sarker, Sam Washington, Learning Python Network Programming, 1st Edition, Packt Publishing 2015.

V SEMESTER

HUM 3022 ESSENTIALS OF MANAGEMENT [3 0 0 3]

Definition of management and systems approach, Nature & scope. The functions of managers. Corporate social responsibility. Planning: Types of plans, Steps in planning, Process of MBO, how to set objectives, Strategies, Policies & planning premises. Strategic planning process and tools. Nature & purpose of organizing, Span of management, Factors determining the span, Basic departmentation, Line & staff concepts, Functional authority, Art of delegation, Decentralization of authority. HR planning, Recruitment, Development and training. Theories of motivation, Special motivational techniques. Leadership-leadership behaviour & styles, Managerial grid. Basic control process, Critical control points & standards, Budgets, Non-budgetary control devices. Profit & loss control, Control through ROI, Direct, Preventive control. Managerial practices in Japan & USA, Application of Theory Z. The nature & purpose of international business & multinational corporations, Unified global theory of management. Entrepreneurial traits, Creativity, Innovation management, Market analysis, Business plan concepts, Development of financial projections.

Course Outcomes:

At the end of this course, the students are able to

1. Understand the roles of managers, principles of management, and managerial skills required to run a business successfully with social and ethical responsibilities
2. Develop an organizational structure and plan for manpower in a given business organization
3. Apply leadership and motivational theories in the organizational contexts
4. Acquire budgetory skills through process and techniques of controlling
5. Prepare a business plan by identifying business opportunities, conducting market analysis and preparing feasibility reports

References:

1. Harold Koontz & Heinz Weihrich (2012), "Essentials of Management", McGraw Hill, New Delhi.
2. Peter Drucker (1993), "Management: Tasks, Responsibilities and Practices", Harper and Row, New York.
3. Peter Drucker (2004),"The Practice of Management", Harper and Row, New York.

ICT 3121 INFORMATION SECURITY [3 0 0 3]

Abstract

Introduction to Information and Network Security, Symmetric-Key Ciphers: Classical and Modern encryption techniques, Block ciphers, Advanced Encryption Standard, Uses block ciphers, Asymmetric-Key Cryptographic Ciphers, Principles of public key cryptosystems, Number theory concepts, Uses of primes, Message Integrity and Message Authentication, Cryptographic hash functions, Application of cryptographic hash functions, Digital Signature, Key Management, Entity Authentication, Transport Level Security, System Security concepts, Firewalls, Network Intrusion detection and prevention systems, SET, Multimedia Security , Advanced Encryption Concepts.

Course Outcomes

At the end of this course, the students are able to

1. Recall the foundational theory behind information security.
2. Illustrate several basic principles and mathematical techniques used when designing a secure system.
3. Apply assorted cryptographic algorithms for providing the core security services.
4. Analyze the application of the security mechanisms learnt in various domains.
5. Model suitable cryptosystems for solving real-life security problems in practical systems.

References

1. William Stallings, Cryptography and Network Security: Principles and Practice , 7th edition, Pearson Publications, 2016.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger , Jonathan Margulies, Security in Computing, 5th edition, Prentice Hall, 2015.
3. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security ,5th edition, Cengage Learning, 2015.
4. Mark Stamp, Information Security: Principles and Practice,2nd edition, John Wiley & Sons, 2011.
5. Behrouz A. Forouzan, Debdeep Mukhopadhyay, Cryptography and Network Security ,2nd Edition (Revised), Tata McGraw-Hill Education India, 2010.
6. Borko Furht, Darko Kirovski, Multimedia Encryption and Authentication Techniques and Applications ,1st edition, Taylor and Francis,2019.
7. Xun Yi, Russell Paulet, and Elisa Bertino, Homomorphic Encryption and Applications ,1st edition, Springer Publishing Company, Incorporated, 2014.

8. Brij B. Gupta, Mamta, Secure Searchable Encryption and Data Management,1st edition, Taylor and Francis,2021.

ICT 3122 PRINCIPLES OF OPERATING SYSTEMS [4 0 0 4]

Abstract

Introduction to Operating systems, Operating System Services, Operating system Structure, System calls, Process management: Process concept, Threads, Inter-process communication, CPU Scheduling, Process synchronization, Handling deadlocks: Deadlock Characterization, Deadlock Detection, Prevention, Avoidance and Recovery, Memory management: Main memory, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Virtual memory: Demand Paging, Page Replacement, Thrashing, Allocating Kernel Memory, Storage Management: File management, Disk scheduling, Case study on Unix based Operating system: Design Principles, Kernel Modules, Basic concepts of Real time operating systems: Classification of Real Time Systems, Microkernels, Scheduling.

Course Outcomes

At the end of this course, the students will be able to

1. Illustrate the design principles and functionalities of different operating systems.
2. Demonstrate the working of various algorithms for CPU scheduling, synchronization and deadlocks.
3. Assess the memory management and storage management techniques and their suitability in different operating systems.
4. Apply the concepts of Real Time Operating Systems in application development.

References

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th edition, Wiley, 2012.
2. William Stallings, Operating Systems: Internals and Design Principles,9th edition, Pearson, 2017.
3. Phillip A Laplante, Seppo J Ovaska, Real time systems design and analysis, 4th edition, Wiley, 2013.
4. Rajib Mall, Real time systems: Theory and Practice, 2nd edition, Pearson, 2009.

ICT 3123 SOFTWARE ENGINEERING [3 0 0 3]

Abstract

Introduction to Software Engineering, Software Processes, Agile Software Development, Requirement Engineering, Requirements Modelling (Scenario-based), Requirements Modelling (Class-based), Requirements Modelling (Behavior, Patterns, and Web/Mobile Apps), Architectural Design, Design and Implementation, Review Techniques, Software Testing Strategies, Testing Conventional Applications: W&B, Testing Web Apps and Mobile Apps, Software Configuration Management, Product Metrics, Risk Management, Maintenance and Re-engineering.

Course Outcomes

At the end of this course, students will be able to

1. Identify appropriate process models with the techniques to complete a small-scale analysis.
2. Analyze the requirements of a project by translating it into appropriate models
3. Analyze the architectural patterns with the design process.
4. Apply suitable review and software testing techniques.
5. Demonstrate the use of software configuration management and risk management concepts.

References

1. Pressman R. S., Software Engineering A practitioner's approach, 8th Edition, McGraw Hill, 2019.
2. Somerville Ian, Software engineering, 10th Edition, Pearson Education, 2019.
3. Booch G., Rumbaugh J., Jacobson I., The Unified Modelling Language User Guide, 2nd Edition, Pearson, 2017.
4. Rajib Mall, Fundamentals of Software Engineering, 5th Edition, PHI Learning, 2018

Flexible Core – 1 (A1/B1/C1/D1)

A1: ICT 3124 DATA STRUCTURES FOR DATABASES [3 0 0 3]

Abstract:

Overview of the Functionality of a Database Management System, Data Structures for Buffer Management, Data Structures for Disk Space Management: Record Organizations, Page Organizations, File Organization, Data Structures for Query Processing**.**

Course Outcomes

At the end of this course, students will be able to

1. Understand the concepts of database system.
2. Interpret the Data Structures for Buffer Management.
3. Understand the concepts of Disk Space Management.
4. Describe Data Structures for Query Processing concepts.

References:

1. E. F. Codd.Relational model of data for large, shared data banks, Commun. ACM 13, 6 (June 1970), 377–387.
2. Hammer, Joachim, and Markus Schneider, Data structures for databases, In Handbook of Data Structures and Applications, pp. 967-981. Chapman and Hall/CRC, 2018.
3. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Database systems: The complete book (2e), Prentice Hall, Pearson publishers.

B1: ICT 3125 SOFTWARE PROJECT MANAGEMENT [3 0 0 3]

Abstract

Embarking on a career in project management, Becoming an effective project manager, Organizational structure and culture, Fundamentals of project initiation, Defining project goals, scope, and success criteria, Working effectively with stakeholders, Beginning the planning phase, Building a project plan, Managing budgeting and procurement, Managing risks effectively, Organizing communication and documentation, Introduction to project execution, Quality management and continuous improvement, Data-informed decision-making, Leadership and influencing skills, Effective project communication, Closing a project.

Course Outcomes

At the end of this course, students will be able to

1. Apply the concepts of project evaluation and project planning on software.
2. Apply the concepts of effort estimation and risk management.
3. Exhibit the project management and control activities.
4. Analyze the staffing and organization behavior aspects in project management.

References

1. Bob Hughes, Mike Cotterell and Rajib Mall, Software Project Management, 6th Edition, Tata McGraw Hill, 2017.
2. Robert K. Wysocki, Effective Software Project Management, 8th Edition, Wiley Publication, 2019.
3. Walker Royce, Software Project Management: A Unified Framework, Pearson, 2002.
4. Gopalaswamy Ramesh, Managing Global Software Projects, McGraw Hill Education (India), 2017.

C1 : ICT 3131 WEB TECHNOLOGIES [3 0 0 3]

Abstract

Introduction to WorldWideWeb, Protocols and programs, application and development tools, Web design, Introduction to HTML, tags and simple HTML forms, XML, Meta tags, frames, Style Sheets: CSS formatting, Introduction to JavaScript, Client side scripting, advanced Scripting, JavaScript objects, DOM and web browser environments, DHTML, Combining HTML and CSS, Ajax, XML, PHP, Database

Course Outcomes

At the end of this course, students will be able to

1. Demonstrate the fundamentals of web hosting and domain name services
2. Illustrate various non-browser specific web design principles.
3. Develop HTML/HTML and CSS pages with valid structure as well as content.
4. Develop JavaScript code to access the structure of web document and object properties.
5. Develop dynamic web pages with usage of server-side scripting PHP and MongoDB.

References:

1. DT Editorial Services, HTML 5 Black Book, 2nd Edition, DreamTech Press, 2016
2. Kogent Learning Solutions Inc, Web technologies: Black Book, 1st Edition, DreamTech Press, 2009
3. Ralph Moosley and M. T. Sayaliya, Developing Web Applications, 2nd Edition, Wiley-India, 2011

D1: ICT 3126 THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE [3 0 0 3]

Abstract

Introduction, Mathematical Notations, Finite Automata: DFA, NFA, Regular Expression, Regular languages, Properties of regular languages, Context free languages, Chomsky normal form, Push down automata, context free grammars, Pumping lemma and its applications, Turing machines, TM computation, natural generalizations, Church-Turing hypothesis, Undecidability.

Course Outcomes

At the end of this course, students will be able to

1. Construct deterministic and non-deterministic finite state machines for the given scenario.
2. Analyse deterministic and non-deterministic context-free grammars and pushdown automata.
3. Apply the concepts of automata to solve complex engineering problem.
4. Solve various problems by applying Turing Machines.

References

1. J Hopcroft, JD Ullman, R Motwani, Introduction to Automata Theory, Languages and Computation, 3rd Edition., Pearson, 2008.
2. Peter Linz, An Introduction to formal languages and automata, 6th Edition, Jones & Bartlett Learning, 2017
3. M Sipser, Theory of Computation, 1st Edition, Brooks-Cole, 2008.

OPEN ELECTIVE-I IPE 4302 CREATIVITY, PROBLEM SOLVING AND INNOVATION [3 0 0 3]

ICT 3141 INFORMATION SECURITY LAB [0 0 3 1]

Abstract

Pentesting with Metasploit-Buffer Overflow, Server Client Side Exploitation; USB forensics-Basics, USB write Blocking, USB impersonation; Network Pentesting - Pentesting Routers, Attacking SSH with Metasploit, Nmap, Medusa, Hydra, Ncrack, SNMP attacks, Bypassing Firewalls; WiFi Security-Cracking WLAN Encryption (WEP,WPA),Metasploit, Social Engineering; PCAP to XML and SQLITE ;Web Application Pentesting; Windows Forensics-Analyse File System, Capture Volatile data, Perform Memory Analysis, Analyse Malware; Traffic Analysis-Wireshark, Pyshark; Reverse Engineering- Heap Overflow, Stack Overflow; Social Engineering Attacks.

Course Outcomes

At the end of this course, the students will be able to

1. Examine security threats and vulnerabilities.
2. Demonstrate the various tools which can combat different security threats.
3. Model the tools appropriately to provide maximum security against any breach.

References

1. Corey P. Schultz, Bob Percianccante, Kali Linux Cook Book ,2nd edition , Packt Publishing, 2017.
2. Phillip L. Wylie, Kim Crawley, The Pentester BluePrint ,1stedition,Wiley,2020.
3. James Corley, Kent Backman, Michael Simpson., Hands on Ethical hacking and network Defense ,2nd edition, Delmar Cengage Learning; 2010.
4. Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy,1stedition , Syngress Media, U.S.,2010.

ICT 3142 PRINCIPLES OF OPERATING SYSTEMS LAB [0 0 3 1]

Abstract:

UNIX based operating system commands, executing shell scripts, inter process communication using system calls, implementing CPU scheduling algorithms, memory and deadlock management.

Course Outcomes:

At the end of this course, students will be able to

1. Demonstrate the working of UNIX based operating systems
2. Demonstrate process management in operating systems
3. Implement CPU scheduling as well as synchronization algorithms
4. Implement algorithms used to understand the functionality of modern operating systems

References

1. Blurn R.& Bresnahan C., Linux Command Line Shell Scripting Bible, 3rd edition, Wiley, 2015.
2. Silberschatz A., Galvin P.B.& Gagne G., Operating System Concepts, 9th edition, Wiley, 2012.

VI SEMESTER

HUM – 3021 ENGINEERIG ECONOMICS AND FINANCIAL MANAGEMENT [3 0 0 3]

Nature and significance, Micro & macro differences, Law of demand and supply, Elasticity & equilibrium of demand & supply. Time value of money, Interest factors for discrete compounding, Nominal & effective interest rates, Present and future worth of single, Uniform gradient cash flow. Bases for comparison of alternatives, Present worth amount, Capitalized equivalent amount, Annual equivalent amount, Future worth amount, Capital recovery with return, Rate of return method, Incremental approach for economic analysis of alternatives, Replacement analysis. Break even analysis for single product and multi product firms, Break even analysis for evaluation of investment alternatives. Physical & functional depreciation, Straight line depreciation, declining balance method of depreciation, Sum-of-the-years digits method of depreciation, sinking fund and service output methods, Introduction to balance sheet and profit & loss statement. Ratio analysis - Financial ratios such as liquidity ratios, Leverage ratios, Turn over ratios, and profitability ratios.

Course Outcomes:

At the end of this course, the students are able to

1. Compute the worth of money at various points of time.
2. Apply various Depreciation methods in determining the value of an asset.

3. Describe and apply the basic techniques of Financial statement analysis.
4. Evaluate the Replacement of an existing asset based on standard replacement analysis techniques.
5. Evaluate the best alternative in Engineering Economics problems considering risk and safety

References:

1. Prasanna Chandra (2005), "Fundamentals of Financial Management", Tata Mc-Graw Hill Companies, New Delhi.
2. James L Riggs, David D Bedworth and Sabah U Randhawa, (2004), "Engineering Economics", Tata McGraw – Hill Publishing Company Ltd, New Delhi
3. T. Ramachandran (2001), "Accounting and Financial Management", SciTech Publications Pvt. Ltd. India.
4. Eugene F. B. & Joel F. H. (2009), "Fundamentals of Financial Management", 12th ed., Cengage Learning Publisher.
5. M. Y. Khan & P. K. Jain (2008), "Financial Management", 5th edition Tata McGraw Hill Publication, New Delhi.
6. Thuesen G.J (2005), "Engineering Economics" Prentice Hall of India, New Delhi.
7. Blank Leland T. Tarquin Anthony J. (2002), "Engineering Economy", McGraw Hill, Delhi.
8. Chan S. Park, (2013), "Fundamentals of Engineering Economics", 3rd edition, Pearson Publication.

Flexible Core – 2 (A2/B2/C2/D2)

A2: ICT 3222 DISTRIBUTED DATABASE MANAGEMENT SYSTEM [3 0 0 3]

Abstract

Introduction to Distributed Databases, Distributed Database Systems Architecture, Multidatabase System Architecture, Distributed Database Design, Distributed Query Processing, Optimization of Distributed Queries, Distributed Concurrency Control, Optimistic Concurrency Control Algorithms, Distributed Data management, Web data management, Streaming data

Course Outcomes

At the end of this course, students will be able to

1. Understand the concepts of Distributed Database Systems Architecture.
2. Interpret the concepts of Distributed Database Design.
3. Describe Distributed Query Processing concepts.
4. Interpret the concepts of Distributed Concurrency Control.
5. Describe Distributed Data management concepts.

References

1. M. Tamer Özsu, Patrick Valduriez, Principles of Distributed Database Systems, 2nd edition, Pearson Education, 2012
2. Stefano Ceri (Author), Giuseppe Pelagatti (Distributed Databases: Principles and Systems, 1st edition, McGraw Hill Education, 2017.
3. Ozsu M T, Principles of Distributed Database Systems, 3rd edition, Springer Exclusive (Cbs), 2012

B2: ICT 3223 SOFTWARE VERIFICATION AND VALIDATION [3 0 0 3]

Abstract

Introduction, Fundamentals of testing, Real time software failures, Software Defects, Reviews as a testing activity, Test Case Design Strategies, Black Box Approach to Test Case Design, White Box Approach to Test case Design, Levels of Testing, Test policies and plans, Test organization, Controlling and monitoring the testing process, Test Automation, Testing Tools.

Course Outcomes

At the end of this course, students will be able to

1. Design the test plan and policies for the testing of software system.
2. Develop the defect repository with correct classification of defects.
3. Apply static and dynamic analysis approaches to the different deliverables of software systems.
4. Design effective test cases for the execution-based testing and perform the different levels of testing in different stages of software development process.
5. Use testing tools to automate the different activities in testing process.

References

1. Paul AmmannandJeff Offutt, Introduction to Software Testing, 2nd Edition, Cambridge University Press United States, December 2016.
2. Sommerville I, Software Engineering, 10th Edition, Pearson Education Limited Boston, 2016.
3. Ilene Burnstein, Practical Software Testing: A Process-Oriented Approach, 1st Edition, Springer New York, December 2010.
4. Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing – Principles and Practices, 6th Impression, Pearson Education, 2008.
5. Ron Patton, Software Testing, 2nd Edition, Sams Publishing, Pearson Education, 2006.
6. Renu Rajani and Pradeep Oak, Software Testing-Effective Methods, Tools and Techniques, 2nd Edition, Tata McGraw Hill Education, 2017.

C2: ICT 3230 FULL STACK WEB DEVELOPMENT TOOLS [3 0 0 3]

Abstract

Front-End Web UI frameworks and Tools: Bootstrap 4, CSS and JavaScript component, Node.js, NPM and task runners, Front-End Web Development with React: JavaScript ES6, Reactstrap for Bootstrap 4-based responsive UI design, react router, Flux architecture, redux, REST API, Front-End JavaScript Framework with Angular: Typescript, Angular material, Flex-layout for responsive design, components, Data binding, Angular router, Angular animation support and Angular testing, Server-side development with NodeJS, Express and MongoDB.

Course Outcomes

At the end of this course, students will be able to

1. Demonstrate client-side web UI frameworks
2. Utilize angular materials and angular flex layout for UI design
3. Design web UI using react and REST API
4. Build applications with NodeJS, Express and mongoDB

References

1. Shama Hoque, Full-Stack React Projects: Modern web development using React 16, Node, Express, and MongoDB, Ingram Publishers, 2018
2. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, 1st Edition, 2018
3. Frank Zammetti, Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, 1st Edition, 2020.

D2: ICT 3224 COMPILER CONSTRUCTION [3 0 0 3]

Abstract

Introduction to compiling, Compiler Structure, Programming language basics, Syntax, Parsing, Lexical analysis, symbol tables, Input buffering, Tokens, Lexical analyser generator Lex, Syntax analysis, LR Parsing, Parson generators, Semantic Analysis, Syntax Tree, Parameter passing, Intermediate code generations, Types of intermediate forms, Code Optimization, analysis, Control Flow, Data Flow, Global Optimization, Loop Optimization, Peep Hole Optimization, Architecture dependent code improvement.

Course Outcomes

At the end of this course, students will be able to

1. Explain the concepts of compiler design.
2. Construct the lexical analyser and parser.
3. Construct the syntax tree, symbol table
4. Demonstrate the run-time environment for given program.
5. Demonstrate intermediate code generation and code optimization.

References

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, 2nd Edition, Addison-Wesley, 2013
2. Kenneth C. Louden Compiler Construction: Principles and Practice, 1st Edition, Course Technology Inc, 2006
3. Michael L. Scott, Programming Language Pragmatics, 4th Edition, Elsevier, 2015
4. Andrew W. Appel, Modern Compiler Implementation in C/Java, 2nd Edition, Cambridge University Press, 2002

ICT 3221 DATA MINING [4 0 0 4]

Abstract

Introduction to Data mining, Data objects and attribute types, Statistical descriptions of data, Data visualization, measuring similarities and dissimilarities, Data pre-processing, Data warehouse modeling, Association rule mining techniques, Apriorialgorithm, improving efficiency of apriori, Pincer Search algorithm, FP Tree Growth algorithm, Classification techniques, Decision Tree Induction, Bayes Classification Methods, Techniques to Improve Classification Accuracy, Clustering techniques, Outlier detection, Data mining applications

Course Outcomes:

At the end of this course, students will be able to

1. Understand the fundamental concepts of data mining
2. Make use of data pre-processing techniques and data warehouse for data mining
3. Apply appropriate data mining techniques for a given data set
4. Understand data mining applications

References

1. Han J. and Kamber M., Data Mining: Concepts and Techniques, 3rd edition, Morgan Kaufmann Publishers, 2012.
2. Pujari A. K., Data Mining Techniques, 4th edition, Orient Blackswan, 2016.
3. Charu C Aggarwal, Data Mining, Springer Publisher, 2015
4. Charu C Aggarwal,Recommender Systems, Springer Publisher, 2016
5. Pang-N. T., Steinbach M., Anuj K., Vipin K., Introduction to Data Mining, Pearson Education, 2nd edition, Pearson 2018.

6. Bing L., Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, 2nd edition, Springer, 2011.

ICT **: PROGRAM ELECTIVE-I [3 0 0 3]**

ICT **: PROGRAM ELECTIVE-II [3 0 0 3]**

**** ****: OPEN ELECTIVE-2 [3 0 0 3]**

ICT 3241 ADVANCED TECHNOLOGY LAB [0 0 3 1]

Abstract

Introduction to the emerging technology used in the software industries, Understand the tools and techniques used to application development, Application user interface design, Backend database design. Implementation of mini project using emerging technology like Flutter, Android Studio, React Native.

Course Outcome

At the end of this course, the students will be able to

1. Design and develop an application based on the selected technology.
2. Choose the appropriate database to store the data.
3. Apply the concepts to create a web/mobile application.

References

1. David Griffiths, Head First Android Development: A Brain-Friendly Guide Shroff/O'Reilly; Second edition,2017

2. John Horton, Android Programming for Beginners - Second Edition: Build in-depth, full-featured Android 9 Pie apps starting from zero programming experience, 2nd Edition, Ingram short title; 2nd edition, 2018

ICT 3242 DATA MINING LAB [0 0 3 1]

Abstract

Pre-processing the raw-datasets using data mining software, applying data mining techniques such as association rule mining, clustering, classification on the pre-processed data using software tools,

performing extraction, transformation and loading to create a data warehouse, Implementation of Apriori algorithm, K-means, Decision tree, Design and development of Mini Project.

Course Outcomes

At the end of this course, students will be able to

1. Identify suitable pre-processing techniques for various dataset.
2. Demonstrate the construction of data warehouse
3. Apply suitable data mining technique on pre-processed data
4. Develop data mining applications for a large data set

References

1. Han J. and Kamber M., Data Mining: Concepts and Techniques, 3rd edition, Morgan Kaufmann Publishers, 2012.
2. Pujari A. K., Data Mining Techniques,4th edition, Orient Blackswan, 2016.
3. Silberschatz A., Korth H. F., Sudarshan S., Database System Concepts, 6th edition, McGraw Hill Education, 2013.

VII SEMESTER

ICT **: PROGRAM ELECTIVE-III [3 0 0 3]**

ICT **: PROGRAM ELECTIVE-IV [3 0 0 3]**

ICT **: PROGRAM ELECTIVE-V [3 0 0 3]**

ICT **: PROGRAM ELECTIVE-VI [3 0 0 3]**

ICT **: PROGRAM ELECTIVE-VII [3 0 0 3]**

ICT **: OPEN ELECTIVE-3 [3 0 0 3]**

Mini Project (Minor specialization) *

***Applicable to students who opted for minor specialization**

VIII SEMESTER

ICT 4291 INDUSTRIAL TRAINING [0 0 0 1]

ICT 4292 PROJECT WORK/PRACTICE SCHOOL [0 0 - 12]

PROJECT WORK (V - VIII SEM)**

THEORY – 1 (V SEMESTER)**

THEORY – 2 (VI SEMESTER)**

THEORY – 3 (VII SEMESTER)**

****** Applicable to eligible students who opted for and successfully completed the B. Tech – honours requirements**

MINOR SPECIALIZATIONS

I. COMPUTATIONAL INTELLIGENCE

ICT 4401 ARTIFICIAL INTELLIGENCE [3 0 0 3]

Abstract

Introduction; Searching State Space; Multiagent Search; Propositional Logic; First-Order Logic: Basics of FoL, Expert systems with FoL, Systematic inference procedures; Knowledge Representation: Ontological engineering, Reasoning systems for categories; Quantifying Uncertainty: Acting under uncertainity, Inference with full joint distributions; Probabilistic Reasoning: Knowledge representation in uncertain domain, Bayesian networks; Making Simple Decisions: Combining beliefs and desires under uncertainty, Decision-theoretic expert functions

Course Outcomes

At the end of this course, students will be able to

1. Make use of concepts of rational agents and represent real world problems.

2. Design mechanisms to reach the goal state using searching techniques
3. Infer the necessary axioms from the existing knowledge in propositional and first-order logic
4. Illustrate the knowledge in an uncertain domain and make probabilistic inferences
5. Explain utility theory usage for making simple decisions

References

1. Charu C Agarwal, Artificial Intelligence, Springer, 2021
2. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach (3e), Pearson 2015.
3. Wolfgang Ertel, Introduction to Artificial Intelligence (2e), Springer, 2018

ICT 4402 MACHINE LEARNING [3 0 0 3]

Abstract

Introduction to Machine Learning, Mathematical Preliminaries, Supervised Learning-LMS, logistic regression, GDA, Naive Bayes, SVM, model selection, Learning theory-bias/variance tradeoff, union and Chernoff bounds, VC dimensions, Unsupervised learning-clustering, k-means, Gaussian mixture, factor analysis, PCA, ICA, Reinforcement learning-MDPs, Bellman equations, value and policy iteration, LQR, LQG, Q-learning, policy search, POMDPs, Explainability.

Course Outcomes

At the end of this course, students will be able to:

1. Explain machine learning algorithms and their use in data-driven knowledge discovery
2. Identify the suitability of discriminative or generative supervised model for a given problem
3. Choose an appropriate unsupervised model for a given learning problem
4. Identify and formulate an appropriate reinforcement model for a given learning scenario
5. Apply diagnostics for debugging learning algorithms

References

1. Kevin P Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
2. Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar., Foundations of Machine Learning, MIT Press, 2012.
3. Daphne Koller and Nir Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press, 2009.
4. Christopher M.Bishop., Pattern Recognition and Machine Learning (2e), Springer, 2013.
5. Richard S.Sutton and Andrew G.Barto, Reinforcement Learning, 2nd Edition, MIT Press, 2018

6. Solon Barocas, Moritz Hardt and Arvind Narayanan, Fairness and Machine Learning, failml.org, 2021

ICT 4403 FOUNDATIONS OF GENERATIVE AI [3 0 0 3]

Abstract

Introduction; Generative Modeling, Deep Learning, Variational Encoders, Generative Adversarial Networks, Autoregressive Models, Normalizing Flow Models, Energy-Based Models, Diffusion Models, Transformers, Large Language Models, World Models, Multimodal Models, Ethical Issues in Generative AI

Course Outcomes:

1. Understand the principles and methods of generative AI.
2. Learn how to use popular frameworks and tools such as TensorFlow, Keras, PyTorch, and Hugging Face.
3. Implement and customize generative models for various tasks and domains.
4. Evaluate and compare the performance and quality of generative models.
5. Explore the opportunities and risks of generative AI for individuals, businesses, and society.

References

1. Jakub Langr, and Vladimir Bok, GANs in Action: Deep Learning with Generative Adversarial Networks, Manning, 2019.

2. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose and Play, 2nd Edition, O'Reilly, 2023.

3. Joseph Babcock, and Raghav Bali, Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models, Packt, 2021.

4. Altaf Rehmani, Generative AI for Everyone, Bluerose Publishers Pvt. Ltd, 2024

5. Oliver Caelen and Marie-Alice Blete, Developing Apps with GPT-4 and ChatGPT, O'Reilly, 2023

ICT 4404 NEURAL COMPUTATION AND APPLICATIONS [3 0 0 3]

Abstract

Introduction; Perceptron: Perceptron convergence theorem, Batch perceptron algorithm; Model Building: Linear regression model, Relationship between regularized Least-squares estimation and MAP estimation; LMS Algorithm: Wiener filter, Least-mean-square algorithm, Statistical LMS

learning theory; Multilayer Perceptron: Batch and on-line learning, BPA, XOR problem; Radial-Basis Function Networks: Cover's theorem, Interpolation problem, RBFN, Hybrid learning procedure for RBFN; Restricted Boltzmann Machines: Hopfield networks, Boltzmann machine, Restricted Boltzmann machines; Recurrent Neural Networks: Architecture of RNNs, Echo-state networks, LSTM, GRUs

Course Outcomes

At the end of this course, students will be able to

1. Design a shallow neural network for a given learning problem.
2. Apply backpropagation algorithm for a given neural network architecture
3. Identify and design a suitable neural architecture for a given learning problem
4. Use restricted Boltzmann machines that can learn a probability distribution over its set of inputs.
5. Apply recurrent neural networks to sequential data

References

1. Simon Haykin, Neural Networks and Learning Machines, Pearson, 2016
2. Charu C.Aggarwal, Neural Networks and Deep Learning, Springer, 2018
3. John A.Hertz, Anders S.Krogh, and Richard G.Palmer, Introduction to The Theory of Neural Computation, Taylor and Francis, 2020

II. COMPUTER GRAPHICS AND VISUALIZATION

ICT 4405 COMPUTER GRAPHICS [3 0 0 3]

Abstract

Introduction: History of computer graphics and applications, Introduction to OpenGL, Graphics Output Primitives**:** line, circle and ellipse generating algorithm, polygon fill algorithm. Geometric transformations: Homogeneous coordinates, affine transformations (translation, rotation, scaling, shear, reflection), 2D & 3D Viewing: Line clipping, polygon clipping and projection, Lighting and Shading: Phong and Gouraud shading, Hidden surface removal: Z-Buffer, BSP trees, Ray Tracing, Curve surfaces: Bezier curves and surfaces, B-splines.

Course outcomes

At the end of this course, students will be able to

1. Illustrate the basic concepts of computer graphics.
2. Interpret the mathematical foundation of geometric output primitives in computer graphics.
3. Apply various geometric transformation, viewing and projection techniques in computer graphics.
4. Explore shading, illumination, and visible surface detection techniques for the display of 3D scenes on a 2D screen.

References:

1. Donald D. Hearn, Warren Carithers, M. Pauline Baker. Computer Graphics with OpenGL (Fourth Edition), Pearson Education, 2014.
2. Zhigang Xiang, Computer Graphics: Theory and Practice with OpenGL (Third Edition), Pearson Education, 2016.
3. Edward Angel, Interactive Computer Graphics- A top down approach using OpenGL (Sixth Edition), Pearson Education, 2012
4. Foley J. D., VanDam A., Feiner S. K., Hughes J. F., Computer Graphics, Principles and Practice (Third Edition), Addision-Wesley, 2014.
5. Peter Shirley, Steve Marschner and et al., Fundamentals of Computer Graphics (Fourth Edition), A K Peters/CRC Press, 2015.
6. F. S. Hill Jr. and S. M. Kelley, Computer Graphics using OpenGL (Third Edition), Pearson, 2007.

ICT 4406 DIGITAL IMAGE PROCESSING [3 0 0 3]

Abstract:

Introduction, components of image processing system, Spatial domain transformations, histogram processing, smoothing, sharpening spatial filters, Filtering in the frequency domain- Introduction to Fourier transform, image smoothing, image sharpening using frequency domain filters. Image restoration- Noise models, restoration using spatial filtering, periodic noise reduction by frequency domain filtering, Morphological image processing- Preliminaries, dilation and erosion, opening and closing, hit-or-miss transformation, basic algorithms, extension to gray-scale images, Image segmentation- Point, line, and edge detection, Thresholding, Region Segmentation Using Clustering and Superpixels, Graph Cuts, morphological watersheds, motion in segmentation.

Course outcomes

At the end of this course, students will be able to

1. Interpret the image acquisition procedure and image storage mechanisms.
2. Analyse various spatial and frequency domain techniques of image processing.
3. Determine appropriate image restoration method to denoise and enhance the degraded image using qualitative and quantitative assessments.
4. Apply different morphological, and segmentation algorithms for real-world problems.

References

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (fourth edition), Pearson, 2017.
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis and Machine Vision (fourth edition), CENGAGE Learning, 2014.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB (second edition),Mc Graw Hill India, 2010.
4. Gloria Bueno García, Oscar Deniz Suarez, José Luis Espinosa Aranda, Jesus Salido Tercero, Ismael Serrano Gracia, Noelia Vállez Enano, Learning Image Processing with OpenCV (first edition), Packt Publishing, 2015.

ICT 4407 AUGMENTED AND VIRTUAL REALITY [3 0 0 3]

Abstract

Introduction of virtual and augmented reality, Definition and scope, Brief history 3 I's of VR a short history of early virtual reality, early commercial VR technology, VR becomes an industry, Components of a VR system, Displays in augmented reality multimodal displays, Audio displays Haptic, Tactile, and Tangible displays, Displays, Visual perception, Requirements and characteristics, Multiple models of I/O gesture interfaces 3D position trackers, Navigation and manipulation interfaces, Gesture interfaces. Output devices, Haptic display,Graphicsdisplays, Sound displays. Computer vision for AR, Natural feature tracking by detection, Incremental tracking, Simultaneous localization and mapping, Outdoor tracking, Computing architectures for VR, The rendering pipeline, Workstation-based architectures, Distributed VR architectures, Geometric modeling, Kinematics modeling, Physical modeling, Behavior modeling.

Course outcomes

At the end of this course, students will be able to

1. Exhibit the fundamental concepts and terminologies in the field of AR and VR systems.
2. Distinguish among various displays used for AR.
3. Demonstrate competence with several modern VR technologies such as tracking, computer vision.
4. Design and model of virtual environments and simulators.

References:

1. Dieter Schmalstieg, Tobias Hollerer, Augmented Reality: Principles & Practice (1e), Addison-Wesley, 2016.
2. Steven M. LaValle. Virtual Reality. Cambridge University Press, 2017.

3. Burdea, G. C. and P. Coffet. Virtual Reality Technology (2e), Wiley-IEEE Press, 2006.
4. Tony parisi, Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile (1e), O'Reilly Media, 2015.
5. Steve Aukstakalnis, Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability) (1e), Addison-Wesley Professional, 2016.
6. Jonathan Linowes, Unity Virtual Reality Projects Paperback, Packt Publishing eBooks Account, September 2015.

ICT 4408 COMPUTER VISION [3 0 0 3]

Abstract

Introduction to computer vision and its applications, Image formation, Liner Filtering, image transformations and Colour models, Edge Detection methods (Laplacian detectors and Canny edge detector), Points and patches, Harris corner detector, Histogram of Gradients, Difference of Gaussian detector, SIFT, Colour and Texture, Feature based alignment, least squares and RANSAC, Camera models, Camera calibration, Stereo vision, Stereo correspondence, Epipolar geometry, Optical flow, Lucas Kanade method, KLT tracking method, Mean shift method, Dense motion estimation, Support Vector Machines, Face detection and recognition, Bag of words, Deep learning.

Course outcomes

At the end of this course, students will be able to

1. Apply the concept of filtering, convolution, and image transformation techniques to a real-world problem.
2. Investigate different feature detectors and descriptors to identify the different features in real-world images.
3. Apply camera calibration for enhancing the image quality and to extract intrinsic and extrinsic parameters of the camera.
4. Determine appropriate techniques for tracking objects for a given problem.

References

1. Szeliski R., Computer Vision: Algorithms and Applications, Springer 2011.
2. David A. F. and Ponce J., Computer Vision: A Modern Approach (second edition), Pearson 2015.
3. Solem J. E., Programming Computer Vision with Python, O'Reilly, 2012.

III. DATA ANALYTICS

ICT 4409 INFORMATION RETRIEVAL [3 0 0 3]

Abstract

Boolean Retrieval Model, Index Construction: Blocked sort based indexing, Single Pass in memory indexing, Distributed indexing, Dynamic Indexing, Index Compression: Dictionary compression, postings compression, Vector Space Model, Parameter and zone indexes, Evaluation in IR, Result snippets, Relevance Feedback and Query Expansion, Latent Semantic Indexing, Web Search Basics, Near duplicates and shingling, Web Crawling and Indexes, Distributing indexes, Link Analysis, Page Rank.

Course Outcomes

At the end of this course, students will be able to

1. Demonstrate the understanding of the various Information Retrieval models
2. Apply the appropriate index construction and compression techniques
3. Formulate queries andevaluate the performance of retrieval systems
4. Assess the IR techniques for webindexing and Link Analysis

References

1. Christopher D. Manning, PrabhakarRaghavan and HinrichSchütze, Introduction to Information Retrieval, Cambridge University Press, 2008.

2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, MIT Press, 2016.

3. David A. Grossman and OphirFrieder, Information Retrieval: Algorithms and Heuristics, Springer, 2004.

ICT 4410 BIG DATA ANALYTICS [3 0 0 3]

Abstract

Introduction, Big Data Concepts and Terminology, Big data and Hadoop, Understanding Hadoop feature, HDFS and MapReduce, Hadoop subprojects, Hadoop MapReduce examples. Spark and Big Data: Theoretical concepts and Core components of Spark, The Spark architecture, Spark SQL, Spark Streaming. NoSQL databases: Need for NoSQL, In-memory databases, Categories of

NoSQL, Other NoSQL types and summary, working on NoSQL systems using MongoDB. Applications: Implementation of machine learning algorithms using MapReduce and Spark.

Course Outcomes

At the end of the course of studies, students will be able to

1. Demonstrate the Understanding of Hadoop Architecture
2. Design Big data solutions using MapReduce framework.
3. Design Big data solutions using Spark
4. Model large, semi-structured data using NoSQL .

References:

1. Thomas Erl, Wajid Khattak, and Paul Buhler., Big Data Fundamentals, Concepts, Drivers & Techniques, 1st Edition, The Prentice Hall Service Technology Series, 2016.
2. Vignesh Prajapati., Big Data Analytics with R and Hadoop, Packt Publishing Ltd., 2013.
3. Nataraj Dasgupta., Practical Big Data Analytics, 1st Edition, Packt Publishing Ltd, 2018.
4. Anand Rajaraman and Jeffrey David Ullman., Mining of Massive Datasets, 2nd Edition, Cambridge University Press, 2011.
5. Matei Zaharia, Patrick Wendell, Andy Konwinski, Holden Karau., Learning Spark, 2nd Edition, O'Reilly Media, Inc., 2015.

ICT 4411 SOCIAL NETWORK ANALYSIS [3 0 0 3]

Abstract:

Introduction to social networks, Graph Concepts, Strong and Weak Ties, Community detection, Graph Partitioning, Networks in their surrounding contexts, Homophily, Spatial model of Segregation, Positive and negative relations, Information cascades, Baye's rule, Simple cascade model,Network effects, Diffusion, Cascades and clusters, Small world phenomena, Decentralized Search, Link Prediction

Course Outcomes

At the end of this course, students will be able to

1. Define various models of social network with different metrics
2. Correlate the characteristics of network
3. Identify the network effects taking place in a given context
4. State the role of nature of ties and social context in influencing a network
5. Analyse the link prediction

References:

1. David Easley and Jon Kleinberg,Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
2. Christina Prell, Social Network Analysis, SAGE Publications, 2012.

3. Song Yang, Franziska B Keller, Lu Zheng,Social Network Analysis, SAGE Publications, 2017.

4. Devangana Khokhar,Gephi Cookbook, Packt Publishing, 2015.

5. Jennifer Golbeck, Analyzing the Social Web, Morgan Kaufmann, 2013

ICT 4412 APPLIED DATA ANALYTICS [3 0 0 3]

Abstract

Introduction- Data Analysis fundamentals- Importance of Data Analytics in automobiles - Data Hygiene – Levels of Data Analytics - Data privacy – GDPR-Data ethics-Storage and security, Mathematical Foundation for Data Analytics-Conditional Probability and Independence–Bayes' theorem-convergence and sampling - discrete and continuous random variables-– covariance and correlation – central limit theorem – Probabilistic Modelling of Problems, Understanding the basic Data Analytics Software and Tools , Data Analytics Pipeline and Predictive Modelling- How to choose a data analytics tool–installation and usage of the tools-missing and inconsistent data, Feature Engineering– Exploratory Data Analysis for Data - Visualizing and understanding patterns in data – Creating Dashboards – Design principles - Overview of ML algorithms, Real-time Monitoring and control- Importance -Real-time analytics/alert systems in systems - Building adaptive systems using data feedback - Adjusting vehicle parameters based on real-time analytics - Data Quality Monitoring, Case studies of application of data analysis for use cases- Types of Data Collected by Vehicles- Big Data Handling - Choosing appropriate model for different type of use cases- Assessing and maintaining battery health, sensor levels through analytics- Root cause Analysis for product issues

References

1. Andrew Bruce, Peter Bruce, Peter Gedeck "Practical Statistics for Data Scientists"

2.Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007

3. S. Angalaeswari, T.Deepa, L. Ashok Kumar, "Artificial Intelligence Applications in Battery Management Systems and Routing Problems in Electric Vehicles"

4. Jeff M. Phillips, "Mathematical Foundations for Data Analysis", First Edition, Springer Cham

5. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer, 2009.

6. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, Fundamentals of Data Structures in C++ (2e), Galgotia Publications, 2008.

IV. CYBER SECURITY

ICT 4413 CYBER FORENSICS AND CYBER LAWS [3 0 0 3]

Abstract

Introduction, Biometric fundamentals, technologies and benefits, Key processes, Application of biometrics, Incident reports, responses and preparation, Forensic technologies and systems, Forensic tools and digital evidences, Computer crimes and types, Cyber Criminal Mode and Manner of Committing Cyber Crime, Cyber laws, Information Technology Act 2000, Intellectual property, IP theft, Cyber ethics, International cyber laws, Policies and compliances, Compliances auditing.

Course Outcomes

At the end of this course, students will be able to

1. Understand various cybercrimes, digital forensics techniques and its usage.
2. Apply digital forensics techniques to generate incident response report.
3. Analyze the incident response report contents.
4. Evaluate cyber-crimes with the knowledge of cyber laws.

References:

1. Nilakshi Jain, Dhananjay R. Kalbande, Digital Forensic: The Fascinating World of Digital Evidences, 1st edition, Wiley publishers, 2016.
2. Jin Xiong, Essential bioinformatics, 1st edition, Cambridge University Press, 2006.
3. Linda Volonino, Reynaldo Anzaldua and Jana Godwin, Computer Forensics: Principals and Practices, 1st edition, Pearson PrenticeHall, 2007.
4. Eoghan Casey, Digital Evidence and Computer Crime Academic Press, 2nd edition, Academic Press, 2004.
5. Jeff Kosseff, Cyber Security Law, 2ndedition, Wiley Publishers, 2019.

ICT 4414 ETHICAL HACKING [3 0 0 3]

Abstract

Introduction, Types, Terminologies and Laws, Footprinting, Social Engineering, Malware and Virus, Vulnerability Assessment, DDOS attacks, SQL injection, Sniffing and System Hijacking, Session Hijacking, Scanning and Enumeration, Web Servers attacks, Pentesting Report, Tools for each of attacks and Countermeasures.

Course Outcomes

At the end of the program the students will be able to:

1. Recall the key concepts and fundamentals of ethical hacking.
2. Identify the various security loopholes in every aspect of computing.
3. Outline and make use of various tools and techniques to launch attacks on computing systems.
4. Apply the countermeasures that can be taken to prevent attacks on computing systems.

References

1. Ric Messier, Certified Ethical Hacker Version 10- Study Guide ,10th edition, Sybex Wiely, 2019.
2. Corey P. Schultz, Bob Percianccante, Kali Linux Cook Book ,2nd edition , Packt Publishing, 2017.
3. Phillip L. Wylie, Kim Crawley, The Pentester BluePrint ,1st edition, Wiley,2020.
4. Christopher Hadnagy, Social Engineering: The Art of Human Hacking ,1stedition, Wiley, 2020.
5. James Corley, Kent Backman, Michael Simpson., Hands on Ethical hacking and network Defense 2nd edition, Delmar Cengage Learning; 2010.
6. John Erickson, Hacking: The art of exploitation ,2nd edition, No Starch Press,2008.
7. Patrick Engebretson, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy,1stedition, Syngress Media,U.S.,2010.

ICT 4415 BLOCKCHAIN TECHNOLOGY [3 0 0 3]

Abstract

Introduction to technology stack: Blockchain, protocol, understanding how blockchain works. Introduction to blockchain primitives, consensus model. Introduction to smart contracts and its development environment. Architecture of decentralized application using Ethereum and Hyperledger platforms. Introduction to Hyperledger.

Course outcomes

At the end of this course, students will be able to

1. Illustrate the fundamentals of the blockchain.
2. Design and implement a smart contract.
3. Review blockchain architecture.
4. Analyze Hyperledger Fabric and Composer in general.

References

1. Elad Elrom, The Blockchain Developer, Apress; 1st ed. Edition, 2019
2. Lorne Lantz, Daniel Cawrey, Mastering Blockchain, O'Reilly Media, Inc.2020.
3. Paul Vigma, Michael J. Casey, The Truth Machine: The Blockchain and the Future of Everything (1e), St Martin's Press, 2018.
4. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps (1e), Apress, 2017.
5. Xun Brian Wu, Chuanfeng Zhang, Andrew Zhang, Hyperledger Cookbook, Packt Publishing Limited, 2019
6. David Hooper, Kevin Solorio, Hands–On Smart Contract Development with Solidity and Ethereum: From Fundamentals to Deployment, O'Reill, 2019.

ICT 4416 ARTIFICIAL INTELLIGENCE IN CYBER SECURITY [3 0 0 3]

Abstract

Introduction. Role of ML and AI in Security: Rules-Based, Signature-Based, and Firewall Solutions Focusing on the Threat of Malicious Bots, Network Anomaly Detection with AI **:** Intrusion Detection Systems, Host Intrusion Detection Systems, Network Intrusion Detection Systems, Anomaly-driven IDS ,Web Applications Security using AI and ML, Privacy Issues, Case Studies, AI, ML and Managed Security Service Providers

Course Outcomes

At the end of this course, students will be able to

1. Classify various types of network attacks
2. Interpret privacy policies and their specifications in various domains
3. Develop ML-Based defenses for Security Events and Log Analysis
4. Analyse AI and ML solutions in identification of malicious Bots and Botnets

References

1. Laurent Gil and Allan Liska Security with AI and Machine Learning, 1st Edition, O'Reilly Media, 2019.
2. Alessandro Parisi, Hands–On Artificial Intelligence for Cybersecurity, 1st Edition, Packt Publishing, 2019.
3. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1st Edition , Wiley, 2011.
4. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, 1st Edition, CRC Press, 2018.
5. Ishaani Priyadarshini, Rohit Sharma Artificial Intelligence and Cybersecurity Advances and Innovations, 1st Edition, CRC Press, 2022.
6. Soma Halder, Sinan Ozdemir Hands-On Machine Learning for Cybersecurity: Safeguard your system by making your machines intelligent using the Python ecosystem,1st Edition, Packt Publishing, 2018.

V SOFTWARE SYSTEM DESIGN

ICT 4417 ADVANCED SOFTWARE ENGINEERING [3 0 0 3]

Abstract:

Specialized process models: Component based and Aspect Oriented Development; Agile process; Formal model: Cleanroom strategy, formal concepts; Safety Engineering, Security engineering, Resilience Engineering, Software reuse, Component-based software engineering, Service-oriented software engineering, Systems engineering, Real-time software engineering, Emerging trends in software engineering and AI in software engineering.

Course Outcomes

At the end of this course, students will be able to

1. Utilize the specialized process models.
2. Apply web engineering best practices to develop web app.
3. Appraise advanced software engineering concepts and their applicability in practice.
4. Apply the most relevant processes, technologies, and tools for the software development.

References

1. Pressman R. S., Software Engineering-A practitioner's approach, 9th Edition, McGraw-Hill Publications, 2020.
2. Sommerville I. Software Engineering, 10th Edition, Pearson Education, 2017.
3. Ghezzi, Jazayeri M., and Mandrioli D., Fundamentals of Software Engineering, 2nd Edition, Pearson Education, 2016.
4. Wolfgang R., Understanding Petri Nets Modelling Techniques, Analysis, Methods, Case Studies, Springer-Verlag, 2013.
5. Barenkamp, M., Rebstadt, J. and Thomas, O., 2020., Applications of AI in classical software engineering., AI Perspectives, 2(1), pp.1-15.

ICT 4418 SOFTWARE ARCHITECTURE [3 0 0 3]

Abstract

The Architecture Business Cycle, Software Processes, Reference Models, and Reference Architectures, Architectural Structures and Views, Understanding Quality Attributes, Functionality and Architecture, Architecture and Quality Attributes, Achieving Qualities, Tactics,Relationship of Tactics to Architectural Patterns, Designing the Architecture, Documenting Software Architectures, Reconstructing Software Architectures, Information Extraction, Database Construction, View Fusion, Transaction and Data Design, Architectural patterns.

Course Outcomes

At the end of this course, students will be able to

1. Understand the major architectural styles, design patterns
2. Analyze the quality attributes of a system at architectural level

3. Utilize well-understood paradigms for designing new systems
4. Design an architectural model using relevant approach and descriptions to solve real time problems

References

1. Len B., Clements P, and Kazman R., Software Architecture in Practice, 3rd Edition, SEI Series in Software Engineering, 2013.
2. Buschmann F., Meunier R., Rohnert H., Sommerlad P., and Stal M., Pattern-Oriented Software Architecture, A System of Patterns (4e), John Wiley and Sons, 2008.
3. Cervantes H., Kazman R., Designing Software Architectures: A Practical Approach (1e), Addison-Wesley Professional, 2016.
4. Eric Dashofy, Nenad Medvidović, and Richard N. Taylor "Software Architecture:Foundations, Theory, and Practice", John Wiley, 2010.

ICT 4419 SOFTWARE QUALITTY MANAGEMENT [3 0 0 3]

Abstract

Introduction, software quality, factors, classification, components of the software quality assurance, error prevention and quality improvement, quality software development plans, reviews, verification and testing, software configuration management, software change control, management components of software project, product metrics, software quality standards assessments and certification.

Course Outcomes

At the end of this course, students will be able to

1. Explain different factors that influence the software quality.
2. Identify and apply management aspects of software quality plan and control.
3. Apply software quality aspects in the software development process.
4. Apply configuration management tasks and standards in real time projects.

References

1. Alan Gillies, Software Quality: Theory and Management, 3rd Edition, Lulu.com, 2011.
2. Daniel Galin, Software Quality Concepts and Practice, 1st Edition, Wiley, 2018.
3. Claude Y. Laporte, Alain April, Software Quality Assurance, 1st Edition, Wiley, 2017.
4. Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan, Software Quality Assurance, 1st Edition, O'Reilly Morgan Kaufmann, 2015.

ICT 4420 SOFTWARE CONSTRUCTION [3 0 0 3]

Abstract

Introduction to software construction; Creating High Quality Code-Design in construction, Working classes, High Quality Routines, Defensive Programming, The Pseudo code Programming Process; Variables, Data Types; Statements- Organizing Straight Line Code, Using conditionals, Controlling loops, Unusual Control Structures, Table Driven Methods, General Control Issues; Code Improvements- Software Quality Landscape, Collaborative Construction, Developer Testing, Code Tuning Strategies and Techniques; Software Craftsmanship, Self-Documenting Code, Personal Character, Themes.

Course Outcomes

At the end of this course, students will be able to

1. Acquire a better understanding of the process involved in software construction.
2. Design and write a high-quality code
3. Analyze various programming tools.
4. Provide a proper layout to the code along with appropriate documentation

References

1. McConnell S., Code Complete: A practical Handbook for Software Construction (2e), Microsoft Press, 2004.
2. Meyer B., Object Oriented Software Construction (2e), Prentice Hall, 1997.
3. Martin R. C., Clean Code: A handbook of Agile Software Craftsmanship, Prentice Hall, Pearson Education, 2012.
4. Martin R. C., Clean Architecture: A Craftsman's Guide to Software Structure and Design (1e), Prentice Hall, 2017.

OTHER PROGRAM ELECTIVES

ICT 4441 CLOUD COMPUTING [3 0 0 3]

Abstract

Introduction: Cloud computing delivery models and services, Challenges, Cloud Infrastructure: Amazon, Google, Microsoft Azure, Open Source Platforms, Services in Cloud: Service Oriented Architecture, REST, Cloud resource virtualization: Types of virtualization, Understanding hypervisors, Virtual Machines, Dockers Containers, Virtualization at Compute, Storage and Network level, Resource Management and Scheduling: Policies and Mechanisms, Scheduling, Business Continuity and Cloud management: Fault Tolerance, Replication Methods, Cloud Security: Virtual machine security, Access control and identity management, Cloud Tools: Eucalyptus, OpenNebula/OpenStack, CloudSim,

Course Outcomes

At the end of this course, students will be able to

1. Use the fundamental concepts of cloud computing infrastructure.
2. Apply the concepts of service-oriented architecture in cloud application.

3. Apply various resource management techniques as per the requirements of cloud applications.
4. Analyse various virtualization techniques and infrastructure requirements in cloud computing
5. Analyse various security risks and management in the cloud computing

References

1. Dan C Marinescu, Cloud Computing Theory and Practice, 2nd Edition, 2017
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, 2nd Edition, McGraw Hill 2017
3. Sehgal, Naresh Kumar, and Pramod Chandra P. Bhatt, Cloud Computing: Concepts and Practices, 1st Edition, Springer, 2018
4. Barrie Sosinsky, Cloud Computing Bible, 1st Edition, Wiley Publishing Inc., 2011.
5. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, 1st Edition, McGraw Hill 2017
6. Mark C Chu-Carroll, Code in the Cloud, 1st Edition, Pragmatic Bookshelf, 2011.

ICT 4442 DEEP LEARNING [3 0 0 3]

Abstract:

Introduction; Mathematical Preliminaries; Machine Learning Basics: Learning algorithms, Capacity, Under and Overfitting, Hyperparameter and validation set, Estimators, Bias and variance, Bayesian statistics, Supervised learning algorithms, Unsupervised learning algorithms; Deep Feedforward Networks: Gradient-based learning, Architecture Design, BPA; Regularization for Deep Learning: Parameter norm penalties, Dataset augmentation, Dropout; Optimization for Training Deep Models: Parameter initialization strategies, Approximate second-order methods; Convolutional Networks: Convolution operation, Pooling; Recurrent and Recursive Networks: RNNs, BiRNNs, Encoder-decoder sequence-to-sequence architecture, LSTM

Course Outcomes

At the end of this course, student should be able to:

1. Choose the right deep learning model and architecture for a given learning problem

2. Construct a deep learning pipeline for a given problem
3. Design a customize deep learning network
4. Make use of regularization to improve the performance of deep learning architecture
5. Apply diagnostic tools to a deep learning pipeline

References

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press 2016
2. Simon Haykin, Neural Networks and Learning Machines, Pearson, 2018
3. Charu C Agarwal, Neural Networks and Deep Learning, Springer 2018
4. Francois Chollet, Deep Learning with Python, Manning, 2017
5. Seth Weidman, Deep Learning from Scratch, Shroff/O'Reilly, 2019

ICT 4443 EVOLUTIONARY COMPUTING AND SWARM INTELLIGENCE [3 0 0 3]

Abstract: Introduction, Optimization, Modelling and simulation problems, Search problems, Evolutionary computing, Natural versus artificial evolution, Global optimization and heuristic search algorithms, genetic algorithm, Fitness, selection and population management, Advanced operators and techniques in genetic algorithm, multi-objective optimization, combinatorial optimization, knowledge based techniques, parameters and parameter tuning, (1+1) EA, , $(\mu + \lambda)$ EA, run time analysis of (1+1) EA, swarm intelligence, particle swarm optimization, metaheuristics, ant colony optimization.

Course Outcomes

1. Apply evolutionary computing to find solutions to complex problems
2. Analysis of various parameter choices in Evolutionary Computation
3. Demonstrate techniques and operators of genetic algorithms
4. Analysis of techniques and principles of swarm intelligence.
5. Apply metaheuristics to optimize complex problems

Reference

1. A.E. Eiben, J.E. Smith, Introduction to Evolutionary Computing, Second Edition, Springer, 2015
2. S.N.Sivanandam · S.N.Deepa, "Introduction to Genetic Algorithms", 2008
3. Andries P. Engelbrecht, Computational Intelligence: An Introduction . Second Edition, John Wiley & Sons Ltd, 2007
4. Xinjie Yu · Mitsuo Gen, Introduction Evolutionary Algorithms, Springer , 2010

ICT 4444 EXPLAINABLE ARTIFICICAL INTELLIGENCE [3 0 0 3]

Abstract

Introduction; Pre-model Interpretability and Explainability: EDA, Feature engineering; Model Visualization Techniques and Traditional Interpretable Algorithms: Model validation and evaluation, Classification model visualization, Traditional interpretable algorithms, Model Interpretability: Interpretable vs. explainable algorithms, Ensemble-based explainable machines, Rule-based techniques, Scoring system; Post-Hoc Interpretability and Explanations; Explainable

Deep Learning: ; Intrinsic, Perturbation, Gradient/Backpropagation; Explainability in Different Applications Domains

Course Outcomes

At the end of this course, students will be able to:

1. Differentiate between black box models and the explainable models
2. Make use of tools for model visualization, and make interpretation
3. Make model interpretation for a given learning problem
4. Explain deep learning models
5. Apply explainability in the areas of temporal, NLP and CV

References

1 Uday Kamath, and John Liu, Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning, Springer, 2021

2 Wojciech Samek, Grégoire Montavon, Andrea Vedaldi, Lars Kai Hansen, and Klaus-Robert Müller, Explainable AI: Interpreting, Explaining and Visualizing Deep Learning, Springer, 2019

3 Serg Masis, Interpretable Machine Learning with Python, Packt Publishing Ltd, 2021

ICT 4445 GAME THEORY AND APPLICATIONS [3 0 0 3]

Abstract

Introduction; Mathematical Preliminaries: Probability theory, Linear algebra, Linear programming, Mathematical analysis, and complexity classes; Non-Cooperative Game Theory: Extensive form games, Strategic form games, Dominant strategy equilibria, PSNE, MSNE, and Bayesian games; Cooperative Game Theory: Correlated strategies, Two person bargaining problem, Coalition games, Solution concept; Mechanism Design: Social choice function, Incentive compatibility theorem, Auctions.

Course Outcomes

At the end of this course, students will be able to:

1. Identify strategic situations and represent them as games
2. Solve simple games using various techniques
3. Recommend and prescribe which strategies to implement
4. Develop mechanisms to elicit the required response
5. Analyze engineering situations using game theoretic techniques

References

1. Y Narahari, Game Theory and Mechanism Design, World Scientific, 2020

2. Vladimir Mazalov, Mathematical Game Theory and Applications, Wiley, 2014
3. Hans Peters, Game Theory: A Multi-Leveled Approach, 2nd Edition, Springer, 2015
4. Dario Bauso, Game Theoy with Engineering Applications, SIAM, Philadelphia, 2016

ICT 4446 HIGH PERFORMANCE COMPUTING [3 0 0 3]

Abstract

High performance computing ecosystem with architectures, classifications, forms, and limitations, High performance programming paradigms with pthreads/OpenMP for shared-memory architectures, MPI for distributed-memory architectures, CUDA/OpenCL for data parallel tasks, Data parallel computing by device query, thread organization and mapping, Memory and data locality optimization with the memory hierarchy, Parallel Programming Patterns with optimizations, Application Case Study from the Machine Learning (ML) perspective.

Course Outcomes

At the end of this course, students will be able to

1. Utilize the high-performance computing architectures and paradigms.
2. Analyze parallel programs developed using different parallel programming paradigms.
3. Evaluate performance of data-parallel computations using optimization techniques.
4. Apply parallel computations to solve real world problems.

References

1. Kirk D. B. and Hwu W., Programming Massively Parallel Processors: A Hands-on Approach, 3rd Edition, Morgan Kaufmann Publishers Inc., 2016.
2. Robert Robey and Yuliana Zamora, Parallel and High-Performance Computing, 1st Edition, Manning Publications, 2021.
3. Barlas G., Multicore and GPU Programming: An Integrated Approach, 2nd Edition, Morgan Kaufmann Publishers Inc., 2022.
4. Tolga Soyata, GPU Parallel Program Development Using CUDA, 1st Edition, CRC Press, 2018.
5. Gaster B., Howes L., Kaeli D. R., Mistry P., and Schaa D., Heterogeneous Computing with OpenCL, 2nd Edition, Morgan Kaufmann Publishers Inc., 2012.

ICT 4447 HUMAN COMPUTER INTERACTION [3 0 0 3]

Abstract

Contexts for HCI: Human, Computer, Interaction, Design Process: Interaction Design, Design Rules, Navigation Design, Principles of good design and designers: Usability, Guidelines, Golden Rules, User Support, Patterns, Accessibility, User Experience (UX) Design: UX Design Process, Visual Design Principles and processes, UI Design and Implementation, Usability Evaluation Techniques: Different measures for evaluation, Usability heuristics and the principles of usability testing, Cognitive models: Models and Architectures; Case Study: AR/VR and Multimedia, Tools: Unity, Figma.

Course Outcomes

At the end of this course, students will be able to

1. Apply the key components of an interactive system to use a conceptual vocabulary for analyzing human interaction with software.
2. Experiment the process and principles of user interface design for a universally accessible interactive system.
3. Analyze the concepts of user experience design for an interactive systems and case studies.
4. Evaluate an interactive system to check the satisfaction of user's requirement.

References

1. Alan Dix, Janet E. Finlay, Gregory D. Abowd, and Russell Beale, Human-Computer Interaction, 3rd Edition, Pearson Education India, 2017.
2. Elvis Canziba, Hands-On UX Design for Developers, 1st Edition, Packt, 2018.
3. Samit Bhattacharya, Human-Computer Interaction: User-Centric Computing for Design, 1st Edition, McGraw-Hill, 2019.
4. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6th Edition, Addison-Wesely, 2017.
5. Jeffrey Rubin and Dana Chisnell. Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests. 2nd Edition, Wiley, 2014.
6. Yvonne Rogers, Helen Sharp and Jenny Preece, Interaction Design: Beyond Human - Computer Interaction, 5th Edition, John Wiley & Sons Inc, 2019.

ICT 4448 INTERNET OF THINGS [3 0 0 3]

Abstract

Introduction to M2M communication and IoT, An emerging industrial structure for IoT, IoT system architecture, IoT reference model, IoT deployment and operational view, IoT physical devices and endpoints, Communication and networking protocols: MQTT and AMQP protocols, IoT enabling technologies: RFID, WSN,SCADA etc., Analytics for the IoT, Applying the geospatial analytics to IoT data, Real world design constraint, Technical design constraint, Future

internet design for various IoT use cases such as smart cities, smart environments, smart homes, smart health etc.

Course Outcomes

At the end of this course, students will be able to

1. Apply the concept of IoT for a particular sensor-based network
2. Demonstrate an internetwork between embedded devices through the Internet
3. Choose appropriate network architecture for a particular application.
4. Assess different Internet of Things technologies and their applications.

References

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, David Boyle., From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence,2nd Edition,Elsevier 2018.
2. Andrew Minteer, Analytics for the Internet of Things (IoT), 1st Edition, Packt publishing Ltd, 2017.
3. Arshdeep Bahga, Vijay Madisetti, Internet of Things-A Hands on Approach, 1st Edition, Orient Blackswan Private Limited 2015.
4. Oleg Roderick, Nicholas Marko, David Sanchez and Arun Aryasomajula, 1st Edition, Internet of Things and Data Analytics Handbook, Wiley-Blackwell, 2017.
5. Yatish Patil, Azure IoT Development Cookbook, 1st Edition, Packt publishing Ltd, 2017.
6. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 1st Edition, 2012.

ICT 4449 MOBILE COMPUTING [3 0 0 3]

Abstract:

Introduction to Mobile Wireless Communication, 5G Roadmap, Internet of Things and Context-Awareness, 5G Architecture, RAN Internals, Spectrum Utilization, OFDMA, NOMA, 5G Frame Structure, Beamforming, Massive MIMO, Network Deployment Types, Mobility management, Coordinated multi-point, Network Functions Virtualization, Software-Defined Networking, Network Slicing, Multi-access Edge Computing, Machine-type communications, Device-to-Device Communications.

Course Outcomes:

On completion of this course the student should be able to

- Illustrate the proper usage of various protocols and components of 5G for mobile communication.
- Analyze the factors influencing the 5G radio network and its effects on radio communication.
- Make use of emerging technologies and services in 5G to solve societal problems.

Apply the appropriate protocols to resolve the challenges in a given scenario.

References

1.Afif Osseiran, Jose F. Monserrat, and Patrick Marsch, 5G Mobile and Wireless Communications Technology, Cambridge University Press 2016.

2. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, John Wiley & Sons, Ltd, 2015.

3. Saro Velrajan, An Introduction to 5G Wireless Networks: Technology, Concepts and Use-cases, 2016.

4.Larry Peterson and OMguz Sunay, 5G Mobile Networks: A Systems Approach, Morgan & Claypool 2020.

5. Harri Holma, Takehiro Nakamura, and Antti Toskala, 5G Technology 3GPP New Radio, JohnWiley & Sons Ltd, 2020.

6. Patrick Marsch, Ömer Bulakçı, Olav Queseth, and Mauro Boldi, 5G System Design Architectural and Functional Considerations and Long Term Research, John Wiley & Sons Ltd, 2018.

ICT 4450 SOFTWARE RELIABILITY [3 0 0 3]

Abstract

Need and concepts of software reliability; Software reliability models-classification, limitations and issues; model disagreement and inaccuracy, predictive accuracy, recalibration; The operational profile, concepts and development procedures, test selection; Testing for reliability measurement; Software testing; operational profiles – difficulties, estimating reliability, time/structure based software reliability; Fundamentals of measurement product metrics – measurement of internet product attributes, size and structure , measurement of quality; Reliability growth model.

Course Outcomes

At the end of this course, students will be able to

1. Explain the fundamentals of measurement in software engineering.
2. Analyze the need of software metrics for quality control and assurance.
3. Apply Software Reliability Growth Models in Software Development.
4. Apply simple statistical analysis relevant to software measurement data.

References

1. Patric D. connor, Practical Reliability Engineering, 5th Edition, John Wesley & sons, 2012.
2. Norman E .Fenton, James Beiman, Software metrics-A rigorous and practical approach, 3rd Edition, Chapman & Hall/CRC Innovations in Software Engineering and Software Development Series, 2014.
3. John D. Musa, Software Reliability Engineering, 2nd Edition, Tata McGraw Hill, 2005.

4. Shigeru Yamada, Software Reliability Modeling: Fundamentals and Applications (Springer Briefs in Statistics), 2014 Edition, Springer, 2014
5. Michael Lyu, Handbook of Software Reliability Engineering, IEEE Computer Society Press, ISBN: 0-07-039400-8, 1996.

OPEN ELECTIVES

ICT 4311 COMPUTER GRAPHICS AND ANIMATION [3 0 0 3]

Abstract
Overview of Graphic Systems, Graphics hardware, devices software Graphics output Primitives: Line, circle, ellipses generating algorithms; Geometrical transformations, two dimensional and 3 dimensional views, animation, Graphics Programming using open GL.

Course Outcomes

At the end of this course, students will be able to

1. Illustrate the basic concepts of computer graphics.
2. Interpret the mathematical foundation of geometric output primitives in computer graphics.
3. Apply various geometric transformation, viewing and projection techniques in computer graphics.
4. Design, create and animate objects using fundamental principles of animation.
5. Demonstrate the rendering of 2D and 3D vector graphics using OpenGL.

References

1. Donald D. Hearn, Warren Carithers, M. Pauline Baker. Computer Graphics with OpenGL, 4th edition, Pearson Education, 2014.
2. Zhigang Xiang, Computer Graphics: Theory and Practice with OpenGL, 3rd edition, PearsonEducation,2016.
3. Edward Angel, Interactive Computer Graphics- Atop down approach using OpenGL, 6th edition, Pearson Education, 2012.
4. Foley J. D.,VanDamA., Feiner S. K., Hughes J. F.,Computer Graphics, Principles and Practice, 3rd edition, Addision-Wesley, 2014.
5. Peter Shirley, Steve Marschner and et al., Fundamentals of Computer Graphics, 4th edition, A K Peters/CRC Press, 2015.
6. F. S. Hill Jr., and S. M. Kelley, Computer Graphics using OpenGL, 3rd edition,Pearson, 2007.

ICT 4312 DESIGN AND DEVELOPMENT OF WEB APPLICATIONS [3 0 0 3]

Abstract

Front-End Web UI frameworks and Tools: Bootstrap 4, CSS and JavaScript component, Node.js, NPM and task runners, Front-End Web Development with React: JavaScript ES6, Reactstrap for Bootstrap 4-based responsive UI design, react router, Flux architecture, redux, REST API, Front-End JavaScript Framework with Angular: Typescript, Angular material, Flex-layout for responsive design, components, Data binding, Angular router, Angular animation support and Angular testing, Server-side development with NodeJS, Express and MongoDB

Course Outcomes

At the end of this course, students will be able to

1. Understand client-side web UI frameworks
2. Utilize angular materials and angular flex layout for UI design
3. Design web UI using react and REST API
4. Build applications with NodeJS, Express and mongoDB

References

1. Shama Hoque, Full-Stack React Projects: Modern web development using React 16, Node, Express, and MongoDB, Ingram Publishers, 2018
2. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, 1st ed. Edition, 2018
3. Frank Zammetti, Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, 1st ed. Edition, 2020

ICT 4313 FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS [3 0 0 3]

Abstract

Introduction to algorithms, Arrays: Elementary operations, Applications, Performance Analysis, Sparse matrix representation, Transpose of sparse matrix, Stacks operations, Arithmetic expression conversion and evaluation using stack, Queue Operations, Singly linked Lists, Circular lists, Doubly linked lists, Trees, Binary Tree traversals and different operations, Binary search Tree, Heaps, Graph Abstract type: Representations and elementary operations, Sorting and searching techniques, Analysis of algorithm.

Course Outcomes:

By the end of this course, the students should be able to:

1. Design efficient algorithms for various problems
2. Illustrate the basic concepts of linear and nonlinear data structures
3. Compare and contrast various searching and sorting techniques

4. Apply data structure concepts for efficient representation of data

References

1. Horowitz E., Sahni S., Mehta D., Fundamentals of Data Structures in C++, 2nd edition, Golgotia Publications, 2008.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4th edition, Pearson Education, 2014.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data structures in C, 2nd edition, Silicon Press, 2008

ICT 4314 MACHINE LEARNING TOOLS AND TECHNOLOGIES [3 0 0 3]

Abstract

Basics, Data types, Attribute types, Mathematical preliminaries, Visualization tools, Preprocessing and visualization techniques, Supervised learning algorithms:Linear, Logistic, Perceptron, Naïve Bayes, k-Nearest Neighbor, Decision trees, Random forest; Ensemble techniques, performance metrics, Unsupervised learning: K-Means, Dimensionality reduction techniques, implementation of supervised and unsupervised models

Course Outcomes

At the end of this course, students will be able to

1. Illustrate fundamental concepts of Machine learning.
2. Build machine learning models fordata-driven knowledge discovery.
3. Analyse machine learning models
4. Implement machine learning algorithms

References

1. Mohri M., Rostamizadeh A., and Talwalkar A.,Foundations ofMachineLearning, 2nd Edn, MIT Press, 2018.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Concepts, Tools and Techniques to build Intelligent Systems, 2nd Edn., O'Reilly Media, Inc., 2019.
3. Stephen Marsland's, Machine Learning: An Algorithmic Perspective, 2nd edition, (Chapman & Hall), CRC Press, Taylor and Francis,2015

ICT 4315 NETWORKING WITH TCP/IP[3 0 0 3]

Abstract

Introduction to Networking and brief History of Internet, OSI and TCP/IP Reference Models, Network Layer, IP Addresses, Internet Protocol (IP) Datagram, Fragmentation, Options, Address Translation, Internet Control Message Protocol, Intra and Inter domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP, User Datagram and Transmission Control Protocol, Application Layer Protocols, The Web and HTTP, DNS: Services Provided by the DNS

Course Outcomes

At the end of this course, students will be able to

1. Illustrate the proper usage of various protocols that has been used in the different layers of
2. Interpolate the basic protocols of computer networks in network design and implementation.
3. Describe the End-to-End communication and routing mechanisms.
4. Apply various application layer protocols to solve challenges in real world scenario.

References

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th Edition, Tata McGraw Hill 2017.
2. Andrew S. Tanenbaum, Computer Network, 5th Edition Prentice Hall of India Pvt Ltd 2013.
3. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition Tata McGraw Hill 2013.
4. Leon Garcia and Widjala, Communication Networks, 2nd Edition, Tata McGraw Hill 2004.
5. James F. Kurose, Computer Networking A Top-Down Approach Featuring the Internet, 6th Edition, Pearson Education Inc 2013.

ICT 4316 FUNDAMENTALS OF CYBER SECURITY [3 0 0 3]

Abstract

Abstract

Introduction to Information, Network and System Security, Encryption techniques, Message Integrity and Message Authentication, Digital Signature, Key Management, User Authentication. Web security model: Browser security model including same-origin policy, Client-server trust boundaries, Server and Client-side security: Cookies security policy, HTTP security extensions, Plugins, extensions, and web apps, Web user tracking, cyber security for In-vehicle communication & Intra-vehicle communication, Cyber security Risk management and Standards, Digital Forensics and Contemporary issues.

Course Outcomes

At the end of this course, the student should be able to

1. Understand the symmetric and asymmetric cryptographic algorithms.
2. Describe common types of vulnerabilities and attacks in web applications, and defenses against them.
3. Understand cyber security for in vehicle communication & Intra vehicle communication
4. Propose and design security algorithm for handling risks using standards
5. Understand Digital Forensics and Contemporary issues

References

1. Mayank Bhushan, Fundamentals of cybersecurity, BPB publications, 2017
2. Raef Meeuwisse, Cyber Security for Beginners, 2015
3. Rolf Oppliger, Security Technologies for the World Wide Web, 2nd edition, Artech House, 2002.
4. Seth Fogie, Jeremiah Grossman, Robert Hansen and Anton Rager, XSS Attacks: Cross Site Scripting Exploits and Defense, Syngress, 2007.
5. Shiho Kim, Rakesh Shrestha, "Automotive Cyber Security Introduction, Challenges, and Standardization", 2020, 1, Springer Singapore.
6. Dietmar P.F. Möller, Roland E. Haas, "Guide to Automotive Connectivity and Cybersecurity", 2019, Springer Cham.
7. Ahmad Mk Nasser, "Automotive Cybersecurity Engineering Handbook", 2023, 1, Pack. Publishing limited
8. Craig Gibbs "Automotive Cybersecurity: Issues and Vulnerabilities" 2016 Nova Science Publishers.
9. Gloria D'Anna "Cybersecurity for Commercial Vehicles" 2018 SAE International.
10. Jiajia Liu, Abderrahim Benslimane ·" Intelligent and Connected Vehicle Security", 2022 River Publishers.
11. Justin Clarke et.al.,SQL Injection Attacks and Defense, 2nd edition, Syngress, 2012.
12. DafyddStuttard, and Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws,2nd edition, Wiley, 201