Syllabus

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY
(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)
Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

For

B.TECH

Computer Science & Engineering (Artificial Intelligence & Machine Learning)

2nd,3rd and 4th Year

Syllabus

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B.TECH

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2nd Year

Effective From – Session 2023-24

Syllabus

SEMESTER-III													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-006/ ECT-033	BSC/ ESC	Advanced Applied Mathematics / Digital Electronics	3	1	0	30	20	50	100		150	4
2	AHT-007/AHT-008	HSC	Technical Communication/ Universal Human Value	2	1	0	30	20	50	100		150	3
3	CST-002	DC	Discrete Structure	3	1	0	30	20	50	100		150	4
4	CST-003	DC	Data Structures and Algorithms	3	1	0	30	20	50	100		150	4
5	CST-004	DC	Object Oriented Programming	3	1	0	30	20	50	100		150	4
6	CSP-003	DLC	Data Structures and Algorithms Lab	0	0	2		25	25		25	50	1
7	CSP-004	DLC	Object Oriented Programming Lab	0	0	2		25	25		25	50	1
8	CSP-005	DLC	Python Programming Lab	0	0	2		25	25		25	50	1
9	CSP-006	DLC	Internship-I/Mini Project-I*	0	0	2			50			50	1
10	CST-005/CST-006	MC	Python Programming/ Cyber Security	2	0	0	15	10	25	50			
11	GP-003	NC	General Proficiency						50				
			Total									950	23
12			Minor Course (Optional)**	3	1	0	30	20	50	100			4
	*The Mini Project-I or Internship-I(3-4weeks) will be conducted during summer break after the II semester and will be assessed during the III semester												
	MOOCs course												

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS**-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks, PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	**1 Hr Tutorial**	**2 or 3 Hr Practical**
1 Credit	**1 Credit**	**1 Credit**

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SEMESTER-IV													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-006/ ECT-033	BSC/ ESC	Advanced Applied Mathematics / Digital Electronics	3	1	0	30	20	50	100		150	4
2	AHT-007/AHT-008	HSC	Technical Communication/ Universal Human Value	2	1	0	30	20	50	100		150s	3
3	CST-007	DC	Computer Organization and Architecture	3	1	0	30	20	50	100		150	4
4	CST-008	DC	JAVA Programming	3	1	0	30	20	50	100		150	4
5	CST-009	DC	Formal Languages & Automata Theory	3	1	0	30	20	50	100		150	4
6	CSP-007	DLC	Computer Organization and Architecture Lab	0	0	2		25	25		25	50	1
7	CSP-008	DLC	JAVA Programming Lab	0	0	2		25	25		25	50	1
8	CSP-009	DLC	UNIX/LINUX Programming Lab	0	0	2		25	25		25	50	1
9	CST-005/ CST-006	MC	Python Programming/ Cyber Security	2	0	0	15	10	25	50			
10	GP-004	NC	General Proficiency						50				
			Total									900	22
11			Minor Course (Optional)	3	1	0	30	20	50	100			4
		DLC	Internship-II/Mini Project-II*	To be completed at the end of the fourth semester (during the Summer).									
	MOOCs course												

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including studentss class performance and attendance, **PS**-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks, PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	**1 Hr Tutorial**	**2 or 3 Hr Practical**
1 Credit	**1 Credit**	**1 Credit**

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Advanced Applied Mathematics (AHT-006)

L:T:P:: 3:1:0 **Credits-4**

COURSE OBJECTIVES: The objectives of the course are to:

1. The idea of Laplace transform of functions and their applications.
2. The idea of Fourier transform of functions and their applications.
3. Evaluate roots of algebraic and transcendental equations.
4. Interpolation, numerical differentiation& integration and the solution of differential equations.
5. Acquaintance with statistical analysis and techniques.

COURSE OUTCOMES:

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

1. Remember the concept of Laplace transform and apply in solving real life problems.
2. Apply the concept of Fourier transform to evaluate engineering problems.
3. Understand to evaluate roots of algebraic and transcendental equations.
4. Solve the problem related interpolation, differentiation, integration and the solution of differential equations.
5. Understand the concept of correlation, regression, moments, skewness and kurtosis and curve fitting.

Module 1: Laplace Transform: **(8 hours)**

Definition of Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve linear differential equations.

Module 2: Fourier Transforms: **(8 hours)**

Fourier integral, Fourier sine and cosine integral, Complex form of Fourier integral, Fourier transform,Inverse Fouriertransforms, Convolution theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations.

Module 3: Solution of Algebraic & Transcendental equations and Interpolation: **(8 hours)**

Number and their accuracy, Solution of algebraic and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-Falsi method. Rate of convergence of these methods (without proof), Interpolation: Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formula, Interpolation with unequal intervals: Newton's divided difference and Lagrange's formula.

Module 4: Numerical differentiation & Integration and Solution of ODE: **(8 hours)**

Numerical Differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rule,Runge-Kutta method of fourth order for solving first order linear differential equations, Milne's predicator-corrector method.

Module 5: Statistical Techniques: (8 hours)

Introduction: Measures of central tendency, Moments, Skewness, Kurtosis, Curve fitting: Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves. Correlation and rank correlation, Regression analysis: Regression lines of y on x and x on y, Regression coefficients, Properties of regressions coefficients and non-linear regression.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons,10th ed.
2. B.V. Ramana: Higher Engineering Mathematics,McGrawHill.
3. Peter V.O'Neil: Advanced Engineering Mathematics, Cengage Learning,7th ed.
4. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th ed.
5. T.Veerarajan: Engineering Mathematics (for semester III), McGrawHill, 3rd ed.
6. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics,Narosa PublishingHouse,Std. ed.
7. P. Kandasamy, K. Thilagavathy, K. Gunavathi: Numerical Methods, S. Chand.
8. S.S. Sastry: Introductory methods of numerical analysis, Prentice Hall India, 5thed.
9. N.P. Bali and Manish Goyal: Computer Based Numerical and Statistical Techniques,Laxmi Publications, 5th ed.
10. J.N. Kapur: Mathematical Statistics, S. Chand &Company.
11. D.N.Elhance,V. Elhance&B.M. Aggarwal: Fundamentals of Statistics,Kitab Mahal.

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DIGITAL ELECTRONICS (ECT-033)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of the course are to:

1. Understand the basics of digital electronics.
2. Understand the basics of Logic family.
3. Apply the knowledge of digital electronics to construct various digital circuits.
4. Analyze the characteristics and explain the outputs of digital circuits.
5. Evaluate and asses the application of the digital circuits.
6. Understand the design flow of VLSI Circuits

COURSEOUTCOMES: After completion of the course student will be able to:

1. Understand the Boolean algebra and minimization of digital functions.
2. Design and implement various combinational circuits.
3. Design and implement various sequential circuits.
4. Understand the digital logic families, semiconductor memories.
5. Design the digital circuits using VHDL

UNIT 1: **MINIMIZATION OF LOGIC FUNCTIONS**: Review of logic gate and Boolean algebra, DeMorgan's Theorem, SOP & POS forms, canonical forms, don't care conditions, K-maps up to 6 variables, Quine-McClusky's algorithm, X-OR & X-NOR simplification of K-maps, binary codes, code conversion.

UNIT 2: **COMBINATIONAL CIRCUITS**: Combinational circuit design, half and full adders, subtractors, serial and parallel adders, code converters, comparators, decoders, encoders, multiplexers, de-multiplexer, parity checker, driver &multiplexed display, BCD adder, Barrel shifter and ALU.

UNIT 3: **SEQUENTIAL CIRCUITS**: Building blocks like S-R, JK and master-slave JK FF, edge triggered FF, ripple and synchronous counters, shift registers, finite state machines, design of synchronous FSM, algorithmic state machines charts, designing synchronous circuits like pulse train generator, pseudo random binary sequence generator, clock generation

UNIT 4: **LOGIC FAMILIES & SEMICONDUCTOR MEMORIES**: TTL NAND gate, specifications, noise margin, propagation delay, fan-in, fan-out, tri-state TTL, ECL, CMOS families and their interfacing, memory elements, concept of programmable logic devices like FPGA, logic implementation using programmable devices.

UNIT 5: **VLSI DESIGN FLOW**: Design entry: schematic, FSM & HDL, different modelling styles in VHDL, data types and objects, dataflow, behavioral and structural modelling, synthesis and simulation VHDL constructs and codes for combinational and sequential circuits.

BOOKS:

1. Mano, Digital electronics,TMH,2007.

2. Malvino, Digital Principle and applications, TMH,2014.
3. Jain, Modern digital electronics, PHI, 2012.
4. Tocci, Digital Electronics, PHI,2001.
5. W.H.Gothmann, “Digital Electronics-An introduction to theory and practice”,PHI,2nd edition,2006

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Technical Communication (AHT-007)

L:T:P:: 2:1:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are:

1. Produce technical documents that use tools commonly employed by engineering and computer science professionals.
2. Communicate effectively in a professional context, using appropriate rhetorical approaches for technical documents, adhering to required templates, and complying with constraints on document format.
3. Clarify the nuances of phonetics, intonation and pronunciation skills.
4. Get familiarized with English vocabulary and language proficiency.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will **utilize** the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to **enhance** confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Unit -1 Fundamentals of Technical Communication:

Technical Communication: Introduction, Features; Distinction between General and Technical Communication; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication, Importance of communication

Unit - II Forms of Technical Communication:

Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Unit - III Technical Presentation: Strategies & Techniques

Presentation: Forms; interpersonal Communication; Class Room presentation; style;method, Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation;

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Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections

Unit - IV Technical Communication Skills

Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances, exposition, narration and description

Unit - V Kinesics & Voice Dynamics:

Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation, pronunciation, articulation, vowel and consonants sounds

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

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UNIVERSAL HUMAN VALUES (AHT-008)

L:T:P:: 2:1:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Expected to become more aware of themselves, and their surroundings (family, society, nature)
2. Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Have better critical ability.
4. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction.

COURSE TOPICS: The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Introduction - Value Education
Universal human values; self exploration, natural acceptance an experimental validation; Human aspirations, right understanding, relationship and physical facility, current scenario; Understanding and living in harmony at various levels.

Module 2: Harmony in the Human Being
Understanding human being, needs of self(I) and body; body as an instrument of 'I'; characteristics and activities of 'I' and harmony in 'I'; harmony of I with the Body: Sanyam and Health, Physical needs an prosperity; Programs to ensure Sanyam and Health.

Module 3: Harmony in the Family and Society
Values in human-human relationship; nine universal values in relationships; justice, truth, respect, trust; Difference between intention and competence; Respect and differentiation, Harmony in society: resolution, prosperity, fearlessness and coexistence; Universal harmonious order in society.

Module 4: Harmony in the Nature and Existence
Harmony in the nature. Four orders of nature; existence as co-existence, harmony at all levels of existence.

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Module 5: Harmony in the Professional Ethics

Natural acceptance of human values**,** Definitiveness of Ethical Human Conduct**;** Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case studies; transition from the present state to Universal Human Order: at individual level and societal level.

TEXT BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karam chand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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DISCRETE STRUCTURE (CST-002)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of the course are to:

1. To introduce several Discrete Mathematical Structures to serve as tools in the development of theoretical computer science.
2. Transform a given problem into a combination of several simpler statements, reach at a solution and prove it logically.
3. Enhance the ability to reasoning and presenting the mathematically accurate argument.
4. Apply the abstract concepts of graph theory in the modelling and solving of non-trivial.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Develop new models to represent and interpret the data.
2. Apply knowledge of mathematics, probability & statistics, graph theory and logics.
3. Interpret statements presented in disjunctive normal form and determine their validity by applying the rules and methods of propositional calculus.
4. Reformulate statements from common language to formal logic using the rules of propositional and predicate calculus.
5. Apply graph theory in solving computing problems.

Unit 1- Set Theory: Introduction to set theory, set operations, Algebra of Sets, Combination of sets, Duality, Finite and infinite sets, Classes of sets, Power sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Binary relation, Equivalence relations and partitions, Mathematics Induction.

Function and its types: Composition of function and relations, Cardinality and inverse relations, Functions, logic and proofs injective, surjective and bijective functions.

Unit 2- Propositional Calculus: Basic operations; AND(^), OR(v), NOT(~), True value of a compound statement, propositions, tautologies, and contradictions. Partial ordering relations and lattices.

Lattice theory: Partial ordering, posets, lattices as posets, properties of lattices as algebraic systems, sublattices, and some special lattices.

Unit 3-Combinations: The Basic of Counting**,** Pigeonhole Principles, Permutations and Combinations, Principle of Inclusion and Exclusion.

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Particular solutions, and Total solution of a recurrence relation using generating functions.

Unit 4- Algebraic Structures: Definition, elementary properties of Algebraic structures, examples of a Monoid, sunmonoid,

semigroup, groups and rings, Homomorphism, Isomorphism and automorphism, Subgroups and Normal subgroups, Cyclic groups, Integral domain and fields, Rings, Division Ring.

Unit 5- Graphs and Trees: Introduction to graphs, Directed and undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, cut points and bridges, Multigraph and Weighted graphs, Paths and circuits, Shortest path in a weighted graph, Eulerian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Rooted trees, Spanning trees and cut-sets, Binary trees and its traversals.

TEXTBOOKS:

1. Discrete and combinatorial mathematics-An applied introduction-5th edition- Ralph P. Grimaldi, Pearson Education.
2. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott. A. Kandel, T.P. Baker, Prentice Hall.

REFERENCE BOOKS:

1. Discrete mathematical with graph theory, edgar G. Goodaire, 3rd Edition, Pearson Education.
2. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition. TMH.
3. Mathematical foundations of computer science-Dr S. Chandra sekharaiah-Prism books Prv. Lt.
4. Discrete mathematical structures Theory and applications-malik & Sen.
5. Logic and Discrete Mathematics, Grass Mann & Trembley, Person Education.
6. Discrete mathematical structures with applications to Comp. Science- J. P. Tremblay and R. Manohar, Tata-McGraw-Hill publications.
7. Elements of DISCRETE MATHEMATICS – A computer-oriented Approach – C L Liu, D P Mohapatra. Third Edition, Tata McGraw Hill

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DATA STRUCTURES AND ALGORITHMS (CST-003)

L:T:P:: 3:1:0 **Credits-04**

Course Objectives: The objectives of this course are to:

1. Introduce the fundamentals of Data Structures, Abstract concepts and how these concepts are useful in problem-solving.
2. Analyze step by step and develop algorithms to solve real-world problems.
3. Implement various data structures, viz. Stacks, Queues, Linked Lists, Trees and Graphs.
4. Understand various searching & sorting techniques

Course Outcomes: On successful completion of the course, the student will be able to:

1. Compare functions using asymptotic analysis and describe the relative merits of worst-case, average-case, and best-case analysis.
2. Become familiar with a variety of sorting algorithms and their performance characteristics (e.g., running time, stability, space usage) and be able to choose the best one under a variety of requirements.
3. Understand and identify the performance characteristics of fundamental algorithms and data structures and be able to trace their operations for problems such as sorting, searching, selection, operations on numbers, and graphs.
4. Solve real-world problems using arrays, stacks, queues, and linked lists.
5. Become familiar with the major graph algorithms and their analyses. Employ graphs to model engineering problems when appropriate.

Unit 1-Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade-off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Unit 2-Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

Unit 3-Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from the linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and complexity analysis.

Unit 4-Trees and Graphs: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity

analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Graphs: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Unit 5-Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods,

Hashing: Symbol table, Hashing Functions, Collision-Resolution Techniques

TEXTBOOKS:

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Ritika Mehra, Data Structures Using C, Pearson Education.
3. Data Structures using C & C++ -By Ten Baum Publisher – Prentice-Hall International**.**

REFERENCE BOOKS:

1. Schaum's Outlines Data structure Seymour Lipschutz Tata McGraw Hill 2nd Edition.
2. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 ed.
3. Fundamentals of Data Structures in C++-By Sartaj Sahani.
4. Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher-Thomson Learning.

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OBJECT ORIENTED PROGRAMMING (CST-004)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to:

1. Provide flexible and powerful abstraction.
2. Allow programmers to think the problem in terms of the structure rather than in terms of structure of the computer.
3. Decompose the problem into a set of objects.
4. Objects interact with each other to solve the problem.
5. Create new type of objects to model elements from the problem space

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
2. Apply some common object-oriented design patterns.
3. Specify simple abstract data types and design implementations using abstraction functions to document them.
4. Design a convenient way for the handling problems using templates and use simple try-catch blocks for Exception Handling.
5. Manage I/O streams and File I/O oriented interactions.

Unit 1- Object Oriented Programming Concepts: Classes and Objects, Methods and Messages, Abstraction and Encapsulation, Inheritance, Abstract Classes, Polymorphism. Introduction to C++: Classes and Objects, Structures and Classes, Unions and Classes, Friend Functions, Friend Classes, Inline Functions, Static Class Members, Scope Resolution Operator, Nested Classes, Local Classes, Passing Objects to Functions, Returning objects, object assignment. Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, Type Checking, this Pointer, Pointers to Derived Types, Pointers to Class Members, References, Dynamic Allocation Operators.

Unit 2- Function Overloading and Constructors: Function Overloading, Constructors, parameterized constructors, Copy Constructors, Overloading Constructors, Finding the Address of an Overloaded Function, Default Function Arguments, Function Overloading and Ambiguity. Operator overloading: Creating member Operator Function, Operator Overloading Using Friend Function, Overloading New and Delete, Overloading Special Operators, Overloading Comma Operator.

Unit 3- Inheritance and Polymorphism: Inheritance: Base-Class Access Control, Inheritance and Protected Members, Inheriting Muitiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes. Polymorphism: Virtual Functions, Virtual Attribute and Inheritance, Virtual Functions and Hierarchy, Pure Virtual Functions, Early vs. Late Binding, Run-Time Type ID and Casting Operators: RTTI, Casting Operators, Dynamic Cast.

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Unit 4- Templates and Exception Handling: Templates: Generic Functions, Applying Generic Functions, Generic Classes, The type name and export Keywords, Power of Templates, Exception Handling: Fundamentals, Handling Derived Class Exceptions, Exception Handling Options, Understanding terminate() and unexpected(), uncaught_exception () Function, exception and bad_exception Classes, Applying Exception Handling.

Unit 5- I/O System Basics: Streams and Formatted 1/O. File I/O: File Classes, File Operations. Namespaces: Namespaces, std Namespace. Standard Template Library: Overview, Container Classes, General Theory of Operation, Lists, string Class, Final Thoughts on STL.

TEXTBOOKS:

1. Object Oriented Programming with C++ by E. Balagurusamy, McGraw-Hill Education (India).
2. ANSI and Turbo C++ by Ashoke N. Kamthane, Pearson Education

REFERENCE BOOKS:

1. Big C++ - Wiley India.
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India).
3. C++ and Object Oriented Programming – Jana, PHI Learning.
4. Object Oriented Programming with C++ - Rajiv Sahay, Oxford.
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

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DATA STRUCTURES AND ALGORITHMS LAB (CSP-003)

L:T:P:: 0:0:2 **Credits-01**

Course Objectives: The objectives of this course are to:

1. Analyse step by step development of algorithms to solve real-world problems.
2. Implement various data structures, viz. Stacks, Queues, Linked Lists, Trees and Graphs.
3. Understand various data searching & sorting techniques.

Course Outcomes: On successful completion of the course, the student will be able to:

1. Develop programs using dynamic memory allocation and linked list ADT.
2. Apply Stack and Queue to solve problems.
3. Implement the concept of hashing in real-time dictionaries.
4. Identify and implement suitable data structures for the given problem.
5. Solve real-world problems by finding the minimum spanning tree and the shortest path algorithm.

LIST OF EXPERIMENTS:

1. Write programs to implement the following using an array.
   a) Stack ADT
   b) Queue ADT
2. Write programs to implement the following using a singly linked list.
   a) Stack ADT
   b) Queue ADT
3. Write a program to implement the deque (double-ended queue) ADT using a doubly linked list.
4. Write a program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
5. Write a program to implement circular queue ADT using an array.
6. Write a program to implement all the functions of a dictionary (ADT) using hashing.
7. Write a program to perform the following operations on B-Trees and AVL-trees:
   a) Insertion.
   b) Deletion.
8. Write programs for implementing BFS and DFS for a given graph.
9. Write programs to implement the following to generate a minimum cost-spanning tree:
   a) Prim's algorithm.
   b) Kruskal's algorithm.

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10. Write a program to solve the single source shortest path problem.

(Note: Use Dijkstra's algorithm).

11. Write a program that uses non-recursive functions to traverse a binary tree in:

    a) Pre-order.

    b) In-order.

    c) Post-order.

12. Write programs for sorting a given list of elements in ascending order using the following sorting methods:

    a) Quick sort.

    b) Merge sort.

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OBJECT ORIENTED PROGRAMMING LAB (CSP-004)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of this course are to:

1. Build software development skills using C++programming for real-world applications.
2. Understand and apply the concepts of classes, packages, interfaces, List, exception handling and file processing.
3. Develop applications using event handling.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Design object-oriented programs with static members and friend functions using C++.
2. Implement C++ programs with operator overloading and type conversions.
3. Develop class templates for various data structures like stack, queue and linked list.
4. Create classes with necessary exception handling
5. Construct simple test applications using polymorphism.

LIST OF EXPERIMENTS

1. Design C++ classes with static members, methods with default arguments, and friend functions. (For example, design matrix and vector classes with static allocation, and a friend function to do matrix-vector multiplication).
2. Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor, and overloading of the assignment operator.
3. Implement complex number class with necessary operator overloading and type conversions such as integer to complex, double to complex, complex to double etc.
4. Overload the new and delete operators to provide a custom dynamic allocation of memory.
5. Develop C++ class hierarchy for various types of inheritances.
6. Design a simple test application to demonstrate dynamic polymorphism and RTTI.
7. Develop a template of the linked-list class and its methods.
8. Develop templates of standard sorting algorithms such as bubble sort, insertion sort and quick sort.
9. Design stack and queue classes with necessary exception handling.
10. Write a C++ program that randomly generates complex numbers (use previously designed Complex class) and write them two per line in a file along with an operator (+, -, *, or /). The numbers are written to file in the format (a + ib). Write another program to read one line at a time from this file, perform the

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PYTHON PROGRAMMING LAB (CSP-005)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of this course are to:

1. Learn and understand Python programming basics and control statements.
2. Illustrate the applications of string handling and regular expressions in building Python programs using functions.
3. Discover the use of supported data structures like lists, dictionaries, and tuples in Python.
4. Understand a range of Object-Oriented Programming and in-depth data and information processing techniques.
5. Apply the concepts of file I/O in python.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Demonstrate the basic concepts of python programming with the help of data types, operators and expressions, and console input/output.
2. Apply the concept of Control Structures in Python to solve any given problem.
3. Demonstrate operations on built-in container data types (list, tuple, set, dictionary) and strings.
4. Ability to explore python, especially the object-oriented concepts and the built-in objects of Python.
5. Implement the concepts of file handling using packages.

LIST OF PROGRAMS:

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script

b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)

b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

a) Write a Program for checking whether the given number is a even number or not.

b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10

c) Write a program using a for loop that loops over a sequence.

d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow - Continued

a) Find the sum of all the primes below two million. Adding the previous two terms, each new term in the Fibonacci sequence

is generated. By starting with 1 and 2, the first 10 terms will be:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

b) By considering the terms in the Fibonacci sequence whose values do not exceed four million,find the sum of the even-valued terms.

c) Linear search and Binary search

d) Selection sort, Insertion sort

Exercise - 5 - DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure

b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 6 DS - Continued

a) Write a program combine_lists that combines these lists into a dictionary.

b) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

Exercise - 7 Files

a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 8 Functions

a) Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radiusIf (distance between two balls centers) <= (sum of their radii), then (they are colliding)

b) Find the mean, median, and mode for the given set of numbers in a list.

Exercise - 9 Functions - Continued

a) Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and bare nearly equal when a single mutation on b can generate a.

b) Write a function dups to find all duplicates in the list.

c) Write a function unique to find all the unique elements of a list.

Exercise - 10 - Functions –Problem-Solving

a) Write a function cumulative_product to compute the cumulative product of a list of numbers.

b) Write a function reverse to reverse a list. Without using the reverse function.

c) Write a function to compute gcd, lcm of two numbers. Each function shouldn’t exceed one line.

Exercise - 11–Python Packages

a) Install packages requests, flask and explore them. using (pip)

b) Plot graphs using python and Matplotlib.

c) Data Analysis using numpy and Pandas Libraries

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INTERNSHIP-I/MINI PROJECT-I (CSP-006)

L:T:P:: 0:0:2 **Credits-01**

ABOUT INTERNSHIP/ MINI PROJECT

It is an organized method or activity of enhancing and improving engineering students' skill sets and knowledge, which boosts their performance and consequently helps them meet their career objectives. Industrial Training is essential in developing the practical and professional skills required for an Engineer and an aid to prospective employment.

OBJECTIVES OF INTERNSHIP/ MINI PROJECT: The objectives of this course is to:

1. Expose the students to the actual working environment and enhance their knowledge and skill from what they have learned in college.
2. Enhance the good qualities of integrity, responsibility, and self-confidence. Students must follow all ethical values and good working practices.
3. Help the students with the safety practices and regulations inside the industry and to instils the spirit of teamwork and good relationship between students and employees.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Understand organizational issues and their impact on the organization and employees.
2. Identify industrial problems and suggest possible solutions.
3. Relate, apply and adapt relevant knowledge, concepts and theories within an industrial organization, practice and ethics.
4. Apply technical knowledge in an industry to solve real world problems.
5. Demonstrate effective group communication, presentation, self-management, and report writing skills**.**

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PYTHON PROGRAMMING (CST-005)

L:T:P:: 2:0:0 **Credits-0**

Course Objectives: The objectives of this course are to:

1. Introduce the basic principles and concepts of python programming, and how python programming concepts are useful in problem-solving.
2. Write clear and effective python code.
3. To perform file operations to read and write data in files.
4. To create applications using Python Programming.

Course Outcomes: On successful completion of the course, the student will be able to:

1. Develop essential programming skills in computer programming concepts like data types.
2. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
3. Illustrate the process of structuring the data using lists, tuples, and dictionaries.
4. Demonstrate using built-in functions and operations to navigate the file system.
5. Interpret the concepts of modules and user-defined functions in Python.

UNIT – I: Introduction and Syntax of Python Program: Features of Python, Interactive, Object-oriented, Interpreted, platform-independent, Python building blocks -Identifiers, Keywords, Indention, Variables, Comments, Python environment setup – Installation and working of IDE, Running Simple Python scripts to display a welcome message, Python variables.

Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Declaration and use of datatypes, Built-in Functions.

UNIT – II: Python Operators and Control Flow statements: Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence.

Control Flow: Conditional Statements (if, if...else, nested if), Looping in python (while loop, for loop, nested loops), loop manipulation using continue, pass, break, else.

UNIT – III: **Data Structures in Python: String:** Concept, escape characters, String special operations, String formatting operator, Single quotes, Double quotes, Triple quotes, Raw String, Unicode strings, Built-in String methods.

Lists: Defining lists, accessing values in lists, deleting values in lists, updating lists, Basic List Operations, and Built-in List functions.

Tuples: Accessing values in Tuples, deleting values in Tuples, and updating Tuples, Basic Tuple operations, and Built-in Tuple functions.

Sets: Accessing values in Set, deleting values in Set, and updating Sets, Basic Set operations, Built-in Set functions.

Dictionaries: Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary, Basic Dictionary operations, Built-in Dictionaries functions.

UNIT – IV: Python Functions, modules, and Packages: Use of Python built-in functions (e.g., type/data conversion

functions, math functions etc.),

user-defined functions: Function definition, Function call, function arguments and parameter passing, Return statement, **Scope of Variables:** Global variable and Local Variable.

Modules: Writing modules, importing modules, importing objects from modules, Python built-in modules (e.g., Numeric, mathematical module, Functional Programming Module), Packages.

UNIT – V: File Handling: Opening files in different modes, accessing file contents using standard library functions, Reading, and writing files, closing a file, Renaming, and deleting files, File related standard functions.

TEXTBOOKS:

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015.
3. Ch Satyanarayana, "Python Programming", 1st Edition, universities press (India) private limited 2018.

REFERENCE BOOKS:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, "Core Python Applications Programming", 3rd edition, Pearson Education India, 2015. ISBN-13: 978-9332555365
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python",1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978- 8126562176
5. Reema Thareja, "Python Programming using problem-solving approach", Oxford university press, 2017.

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CYBER SECURITY (CST-006)

L:T:P:: 2:0:0 **Credits-0**

Course Objectives: The objectives of this course are to:

1. Familiarize with network security, network security threats, security services, and countermeasures.
2. Be aware of computer security and Internet security.
3. Study the defensive techniques against these attacks.
4. To familiarize with cyber forensics, cybercrimes, and Cyberspace laws.
5. Understand ethical laws of computers for different countries, Offences under cyberspace and the Internet in India.

Course Outcomes: On successful completion of the course, the student will be able to:

1. Understand cyber-attacks and types of cybercrimes, and familiarity with cyber forensics
2. Realize the importance of cyber security and various forms of cyber-attacks and countermeasures.
3. Get familiar with obscenity and pornography in cyberspace and understand the violation of the Right to privacy on the Internet.
4. Appraise cyber laws and how to protect themselves and, ultimately, the entire Internet community from such attacks.
5. Elucidate the various chapters of the IT Act 2008 power of the Central and State Governments to make rules under IT Act 2008.

UNIT – I: Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, the motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., CIA Triad

UNIT – II: Cyber Forensics: Introduction to cyber forensic, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT – III: Cybercrime (Mobile and Wireless Devices): Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

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UNIT – IV: Cyber Security (Organizational Implications): Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing, and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in cyberspace, the ethical dimension of cybercrimes, the psychology, mindset and skills of hackers and other cybercriminals.

UNIT – V: Cyberspace and the Law &Miscellaneous provisions of IT Act.: Introduction to Cyber Security Regulations, International Law. The INDIAN Cyberspace, National Cyber Security Policy. Internet Governance – Challenges and Constraints, Computer Criminals, Assets and Threats. Other offences under the Information Technology Act in India, The role of Electronic Evidence and miscellaneous provisions of the IT Act.2008.

TEXTBOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.
3. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition, O' Reilly Media, 2006.
4. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, New Delhi, 2006.
5. Cyberspace and Cybersecurity, George Kostopoulos, Auerbach Publications, 2012.
6. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, Second Edition, Albert Marcella, Jr., Doug Menendez, Auerbach Publications, 2007.
7. Cyber Laws and IT Protection, Harish Chander, PHI, 2013.

Syllabus

COMPUTER ORGANIZATION AND ARCHITECTURE (CST-007)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to:

1. Thoroughly understand the basic structure and operation of a digital computer.
2. Study the different communication methods with I/O devices and standard I/O interfaces.
3. Learn the various instruction modes, Addressing modes and RISC and CISC Architecture
4. Study the various memory architecture.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions.
2. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
3. Design the connection between I/O address from the CPU and the I/O interface.
4. Understand the concept of Pipelining and multiprocessor.
5. Draw a flowchart for concurrent access to memory and cache coherency in parallel processors.

Unit 1- Functional Blocks of a Computer: CPU, Memory, Input-Output Subsystems, Control Unit. Instruction Set Architecture of a CPU – Registers, Instruction Execution Cycle, RTL Representation and Interpretation of Instructions, Addressing Modes, Instruction Set. Case Study – Instruction Sets of Some Common CPUs, RISC and CISC Architecture.

Unit 2- Basic Processing Unit: Signed Number Representation, Fixed Point Arithmetic, Addition and Subtraction of Signed Numbers, Multiplication of Positive Numbers, Signed Operand Multiplication Algorithm, Booth Multiplication Algorithm, division algorithm, floating point numbers and its arithmetic operation. Fundamental Concepts: Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Micro Programmed Control.

Unit 3- Peripheral Devices and their Characteristics: Input-Output Subsystems, I/O Device Interface, I/O Transfers– Program Controlled, Interrupt Driven and DMA, Software Interrupts and Exceptions, Programs and Processes – Role of Interrupts in Process State Transitions, I/O Device Interfaces – SCII, USB.

Unit 4- Pipelining& Multiprocessor: Basic Concepts of Pipelining, Throughput and Speedup, Instruction Pipeline, Pipeline Hazards, Introduction to Parallel Processors, Symmetric Shared Memory and Distributed Shared Memory Multiprocessors, Performance Issues of Symmetric and Distributed Shared Memory, Synchronization.

Unit 5- Memory Organization: Basic Concepts, Concept of Hierarchical Memory Organization, Main Memory: RAM, ROM, Speed, Size and cost, Cache Memory and its Mapping, Replacement Algorithms, Write Policies, Virtual Memory,

Memory Management Requirements, Associative Memory, Secondary storage devices.

TEXTBOOKS:

1. William Stallings, Computer Organization and architecture, 11th edition (2022), Pearson Education.
2. David A. Patterson and John L. Hennessy "Computer Organization and Design: The Hardware/Software Interface" , 5th Edition, Elsevier.
3. M. Morris Mano, "Computer System Architecture", Third Edition, Pearson Education.

REFERENCE BOOKS:

1. Microprocessor Architecture, Programming, and Applications with the 8085 -Ramesh S. Gaonkar Pub: Penram International.
2. CarlHamacher" Computer Organization and EmbeddedSystems", 6th Edition, McGraw Hill HigherEducation.
3. Miles Murdoccaa and Vincent Heuring"Computer Architecture and Organization: An integrated Approach" 2nd edition,Wiley Publication.

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JAVA PROGRAMMING (CST-008)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to:

1. Understand Object Oriented Programming concepts and basic characteristics of Java.
2. Know the principles of packages, inheritance and interfaces.
3. Define exceptions and use I/O streams.
4. Develop a java application with threads and generics classes
5. Design and build simple Graphical User Interfaces.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Write Java programs with properly designed constants, variables, objects, methods and reusability functionality
2. Learn how and where to implement interface and exception-handling concepts.
3. Write multi-threaded programming concepts for concurrency control based applications.
4. Construct GUI based JAVA enterprise applications
5. Develop web applications using JDBC, RMI and Servlet methodologies.

Unit 1- Java Basics and Inheritance: The Genesis of Java, Overview of Java, Data Types, Variables, and Arrays, Operators, Control Statements, Introducing Classes, Methods and Classes,Type Casting, String Handling, Abstract Class, Method overriding.

Inheritance: Basics, Using Super, Creating a Multilevel Hierarchy, Problem with Multiple Inheritance.

Unit 2- Packages, Interfaces and Exception Handling: Packages- Packages, Access Protection, Importing Packages,

Interfaces- Definition and Implementations,

Exception Handling- Types, Try and Catch, Throw and Finally statements.

Unit 3- Multi Threading and File Handling: Multithreaded Programming, Thread Life Cycle Creating Threads, Creating Multiple Threads, Thread Priorities, Synchronization, Inter Thread Communication, Suspending, Resuming and Stopping Threads.

File Handling: I/O Basics, Reading Console Input, Writing Console output, I/ O Classes and Interfaces.

Unit 4- Applets, Event Handling and AWT: Applet Basics, Applet Architecture, Applet Display Methods, Passing parameters to Applets,

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Event Handling: Delegation Event Model, Event Classes, Event Listener Interfaces,

AWT: Working with Windows, Graphics, Colors and Fonts, Using AWT Controls, Layout Managers and Menus.

Unit 5- JDBC, RMI And Servlets: JDBC-JDBC Architecture, The Structured Query Language, JDBC Configuration, Executing SQL, RMI Architecture, A simple client/server application using RMI, **Servlets-** Life cycle of a Servlet, Servlet packages ,Handling HTTP Requests and Responses.

TEXTBOOKS:

1. Herbert Schildt, ―Java The complete reference, 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals, 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
2. Steven Holzner, ―Java 2 Black book, Dreamtech press, 2011.
3. Timothy Budd, ―Understanding Object-oriented programming with Java, Updated Edition, Pearson Education, 2000.

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FORMAL LANGUAGES & AUTOMATA THEORY (CST-009)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to:

1. Introduce the student to the concepts of theory of computation in computer science.
2. Acquire insights into the relationship among formal languages, formal grammars, and automata.
3. Learn to design automats and Turing machine.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Apply the knowledge of automata theory, grammars & regular expressions for solving the problem.
2. Analyze the give automata, regular expression & grammar to know the language it represents.
3. Design Automata & Grammar for pattern recognition and syntax checking.
4. Distinguish between decidability and un-decidability of problems.
5. Identify limitations of some computational models and possible methods of proving them.

Unit 1- Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem

Unit 2- Regular Expressions: Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

Unit 3- Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Unit 4- Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. Turing machines: The basic model for Turing machines (TM), Turing- recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Unit 5- Types of Turing machine: Turing machines and halting Problem

Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE,

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Undecidable Problems about Turing Machines, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Modified Post Correspondence problem, Other Undecidable Problems, Counter machines.

TEXTBOOKS:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

REFERENCE BOOKS:

1. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. A Textbook on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
4. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
5. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.

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COMPUTER ORGANIZATION AND ARCHITECTURE LAB (CSP-007)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of this course are to:

1. Understanding the behaviour of Logic Gates, Adders, Decoders, Multiplexers and Flip-Flops.
2. Understanding the behaviour of ALU, RAM, STACK and PROCESSOR from working modules and the modules designed by the student as part of the experiment.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Recognize basic logic gates with IC chips.
2. Design combinational circuits using IC Chips.
3. Connect the theory of computer organization with hardware.
4. Implement the concept of adders
5. Apply fundamentals of digital design and extend the learning to design sequential circuits.

LIST OF EXPERIMENTS

1. Implementing HALF ADDER, FULL ADDER using basic logic gates.
2. Implementing Binary -to -Gray, Gray -to -Binary code conversions.
3. Implementing 3-8 line DECODER and Implementing 4x1 and 8x1 MULTIPLEXERS.
4. Verify the excitation tables of various FLIP-FLOPS.
5. Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.
6. Design of an 8-bit ARITHMETIC LOGIC UNIT.
7. Design the data path of a computer from its register transfer language description.
8. Design the control unit of a computer using either hardwiring or microprogramming based on its register transfer language description.
9. Write an algorithm and program to perform matrix multiplication of two n * n matrices on the 2-D mesh SIMD model, Hypercube SIMD Model or multiprocessor system.
10. Study of Scalability for Single board Multi-board, multi-core, multiprocessor using Simulator.

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JAVA PROGRAMMING LAB (CSP-008)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of this course are to:

1. Write the program using abstract classes.
2. Write programs for solving real world problems using java collection framework
3. Write multithreaded program.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Develop programs using object-oriented concepts, exception handling and multi-threading.
2. Demonstrate java features such as Inheritance, Interfaces, Polymorphism for different scenarios
3. Demonstrate java features such as Abstract class and method overriding
4. Design and implement data driven applications and assign responsibilities.
5. Develop web application using JDBC and Servlets

LIST OF EXPERIMENTS

1. Develop a java program to find the sum of odd and even numbers in an array.
2. Develop a java program to print the prime numbers between n1 to n2 using class, objects and methods.
3. Develop a program for calculating the age of a person and display the age in the form of years, months and days.
4. Demonstrate a program for method overloading. Consider the different types of transaction modes used for transferring money. (Credit card, Debit card, Net banking etc).
5. Create a Abstract class and calculate the area of different shapes by overriding methods.
6. Develop a Library application using multiple inheritances. Consider Book, Magazines and Journals as base classes and Library as derived class. In the Book class, perform the operations like Search Book, Issue Book, Return Book, Renew Book, and Fine Calculation. In the Magazines and Journals classes, perform issue and return operations.
7. Develop a program for banking application with exception handling. Handle the exceptions in following cases:
   a) Account balance <1000
   b) Withdrawal amount is greater than balance amount
   c) Transaction count exceeds 3
   d) One day transaction exceeds 1 lakh.
8. Create a student database and store the details of the students in a table. Perform the SELECT, INSERT, UPDATE and DELETE operations using JDBC connectivity.
9. Design a login page using servlets and validate the username and password by comparing the details stored in the database.
10. Mini project (Anyone)

Syllabus

(Front End: Java, Back End: Oracle, define classes for the application and assign responsibilities)

a) Central Library OPAC Engine

b) ATM Banking

c) Online Shopping

d) E-Ticketing System

e) Student Information Management System

f) City Info Browser

g) E-mail Server

Syllabus

UNIX/LINUX PROGRAMMING LAB (CSP-009)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of this course are to:

1. Describe the basic file system in Linux and its file attributes.
2. Appraise different filters, process handling, regular expressions and network handling features using suitable commands.
3. Summarize different Linux commands to write Shell Programs.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

2. Demonstrate the basic knowledge of Linux commands and file-handling utilities by using a Linux shell environment.
3. Evaluate the concept of shell scripting programs by using AWK and SED commands.
4. Use tracing mechanisms for debugging.
5. Compile source code into an object and executable modules.
6. Use advanced network tools.

LIST OF EXPERIMENTS

1. Study of Unix/Linux general purpose utility command list (man, who, cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown etc.), vi editor, .bashrc, /etc/bashrc and environment variables.
2. Write a shell script program to: a) display list of user currently logged in; b) to copy contents of one file to another.
3. Write a program using sed command to print duplicated lines of Input.
4. Write a grep/egrep script to find the number of words character, words and lines in a file.
5. Write an awk script to: a). develop a Fibonacci series; b) display the pattern of given string or number.
6. Write a shell script program to a) display the process attributes; b) change priority of processes; c) change the ownership of processes; d)to send back a process from foreground ; e) to retrieve a process from background ; f) create a Zombie process
7. Write a program to create a child process and allow the parent to display “parent” and the child to display “child” on the screen
8. Write a makefile to compile a C program.

9. Study to execute programs using gdb to utilize its various features like breakpoints, conditional breakpoints. Also write a shell script program to include verbose and xtrace debug option for debugging.
10. Study to use ssh, telnet, putty, ftp, ncftp and other network tools.

Syllabus

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICALUNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)
Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

For

B.TECH

Computer Science & Engineering (Artificial Intelligence & Machine Learning)

3rd Year

Effective From – Session 2024-25

Syllabus

SEMESTER-V													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	CST-002	DC	Artificial Intelligence	3	1	0	30	20	50	100		150	4
2	CST-038	DC	Natural Language Processing	3	1	0	30	20	50	100		150	4
3	CST-030	DC	Machine Learning	3	1	0	30	20	50	100		150	4
4		DE	Departmental Elective–1	3	0	0	30	20	50	100		150	3
5		DE	Departmental Elective–2	3	0	0	30	20	50	100		150	3
6	CSP-015	DLC	Artificial Intelligence Lab	0	0	2		25	25		25	50	1
7	AIP-101	DLC	Natural Language Processing Lab	0	0	2		25	25		25	50	1
8	CSP-017	DLC	Machine Learning Lab	0	0	2		25	25		25	50	1
9	AIP-102	DLC	Mini Project-II or Internship-II*	0	0	2			50			50	1
10	AHT-009/ AHT-010	MC	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25	50			
11	GP-005	NC	General Proficiency						50				
			Total	17	3	8						950	22
12			Minor Course (Optional)**	3	1	0	30	20	50	100			4
	*The Mini Project-II or Internship-II (4-6weeks)will be conducted during summer break after IV semester and will be assessed during the V semester												
	MOOCs course												

Departmental Elective–1		
S. No.	**Subject Code**	**Subject Name**
1	CST-013	Graph Theory
2	AIT-101	Advanced Python Programming
3	CST-015	Software Engineering
4	CST-016	Queuing Theory & Modelling

Departmental Elective- 2		
S. No.	**Subject Code**	**Subject Name**
1	CST-017	Fault Tolerant Computing
2	CST-018	Real-Time System
3	CST-019	Distributed System
4	CST-011	Database management system

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS**-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks, PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture	**1 Hr Tutorial**	**2 or 3 Hr Practical**
1 Credit	**1 Credit**	**1 Credit**

Syllabus

SEMESTER-VI													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AIT-102	DC	Neural Networks	3	1	0	30	20	50	100		150	4
2	AIT-005	DC	Deep Learning	3	1	0	30	20	50	100		150	4
3	AIT-103	DC	Pattern and Anomaly Detection	3	1	0	30	20	50	100		150	4
4		DE	Departmental Elective-3	3	0	0	30	20	50	100		150	3
5	AHT-0XX	HSC	Open Elective-1	3	0	0	30	20	50	100		150	3
6	AIP-103	DLC	Neural Networks Lab	0	0	2		25	25		25	50	1
7	AIP-104	DLC	Deep Learning Lab	0	0	2		25	25		25	50	1
8	AIP-105	DLC	Pattern and Anomaly Detection Lab	0	0	2		25	25		25	50	1
9	AHT-009/AHT-010	MC	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25	50			
10	AHT-014	NC	Happiness and Well-being	2	0	0	25	25	50				
11	GP-006	NC	General Proficiency						50				
			Total	17	3	6						900	21
12			Minor Course (Optional)	3	1	0	30	20	50	100			4
		DLC	Internship-III/Mini Project-III*	To be completed at the end of the sixth semester (during the Summer).									
	MOOCs course												

Departmental Elective-3		
S. No.	Subject Code	Subject Name
1	CST-024	Internet of Things
2	CST-025	Quantum Computing
3	CST-026	Augmented Reality
4	AIT-006	Application of AI in Industry
5	CST-028	Reliable Computing

Open Elective-1		
S. No.	**Subject Code**	**Subject Name**
1	AHT-011	Total Quality Management
2	AHT-012	Managing E-Commerce and Digital Communication
3	AHT-013	Industrial safety and Hazard Management

Abbreviations: L-No. of Lecture hours per week, **T**-No. of Tutorial hours per week, **P**-No. of Practical hours per week, **CT**-Class Test Marks, **TA**-Marks of teacher's assessment including student's class performance and attendance, **PS**-Practical Sessional Marks, **ESE**-End Semester Examination, **TE**- Theory Examination Marks, PE- Practical External Examination Marks

Minor Courses (Optional) **: Select any subject from Annexure – II from other departments

1 Hr Lecture 1 Credit **1 Hr Tutorial 1 Credit** **2 or 3 Hr Practical 1 Credit**

Syllabus

ARTIFICIAL INTELLIGENCE (CST-022)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the various characteristics of Intelligent agents.
2. Learn the different search strategies in AI.
3. Learn to represent knowledge in solving AI problems.
4. Understand the different ways of designing software agents and know about the various applications of AI.

COURSE OUTCOMES: On successful completion of the course, the students will be able to

1. Build intelligent agents for search and games
2. Solve AI problems through programming with Python.
3. Learn optimization and inference algorithms for model learning.
4. Design and develop programs for an agent to learn and act in a structured environment.
5. Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systems and machine learning.

Unit 1- Introduction: What is AI, Foundations of AI, History of AI, The State of the Art, AI Techniques, Problem Solving: Problem solving agents, uniformed search strategies, Informed search strategies, Constraint Satisfaction Problems.

Unit 2- Knowledge Representation: Approaches and issues in knowledge representation, Knowledge Based Agents, Propositional Logic, Predicate Logic- Unification and Resolution, Weak slot –Filler Structure, Strong slot- Filler structure.

Unit 3- Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks representation, construction and inference, Brief introduction of Neural Networks, Fuzzy Logic and Genetic Algorithms

Unit 4- Planning and Learning: Planning with state space search, conditional planning, continuous planning, Multi-Agent planning. Forms of learning, Inductive Learning, Statistical learning method and Reinforcement learning.

Unit 5- Advanced Topics: Expert Systems- Representation- Expert System shells- Knowledge Acquisition with examples.

Syllabus

Game Playing-Minimax Search Procedure, Alpha-Beta Pruning, Imperfect, Real-Time Decisions.

Swarm Intelligent Systems- Ant Colony System, Development, Application and Working of Ant Colony System.

TEXTBOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prearson Education, 4th Edition, 2022.

2. Michael Negnevitsky, Artificial Intelligence, 3rd edition, Pearson Education.

3. I. Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS:

1. George F Luger, Artificial Intelligence, 6th edition, Pearson Education.

2. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008.

3. Nils J. Nilsson, ―The Quest for Artificial Intelligence, Cambridge University Press, 2009.

4. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.

5. Gerhard Weiss, ―Multi Agent Systems, Second Edition, MIT Press, 2013.

6. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

Syllabus

NATURAL LANGUAGE PROCESSING (CST-038)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of the course are to

1. Understand natural language processing and learn how to apply basic algorithms in this field.
2. Acquire the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. Design and implement applications based on natural language processing.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Have a broad understanding of the capabilities and limitations of current natural language technologies.
2. Able to model linguistic phenomena with formal grammars.
3. Be able to Design, implement and test algorithms for NLP problems.
4. Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP.
5. Able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

UNIT - I

Introduction: History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP , Applications of NLP**.**

UNIT - II

Word Level Analysis: Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.

UNIT - III

Syntax Analysis: Part-Of-Speech tagging (POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).

UNIT - IV

Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD), Dictionary based approach**.**

Syllabus

Pragmatics: Discourse reference resolution, reference phenomenon, syntactic & semantic constraints on co reference

UNIT – V

Applications (preferably for Indian regional languages): Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition.

TEXTBOOKS:

1. Daniel Jurafsky, James H. Martin ―Speech and Language Processing‖ Second Edition, Prentice Hall, 2008.
2. Christopher D.Manning and Hinrich Schutze, ― Foundations of Statistical Natural Language Processing ―, MIT Press, 1999.

REFERENCE BOOKS:

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Daniel M Bikel and Imed Zitouni ― Multilingual natural language processing applications Pearson, 2013.
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) ― The Handbook of Computational Linguistics and Natural Language Processing ― ISBN: 978-1-118-.
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O ‘Reilly.
5. Brian Neil Levine, An Introduction to R Programming.
6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial: An introduction into R application and programming

Syllabus

MACHINE LEARNING (CST-030)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the need for machine learning for various problem solving.

2. Study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.

3. Learn and design the appropriate machine learning algorithms for problem solving.

COURSE OUTCOME: On successful completion of this course, the students will be able to

1. Learn the basics of learning problems with hypothesis and version spaces.

2. Understand the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning.

3. Analyze the concept of neural networks for learning linear and non-linear activation functions.

4. Learn the concepts in tree, probability and graphical based models and methods.

5. Understand the fundamental concepts of Genetic Algorithm and Analyze and design the genetic algorithms for optimization engineering problems.

Unit 1- INTRODUCTION: Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

Unit 2- LINEAR MODELS: Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality –Interpolations and Basis Functions – Support Vector Machines.

Unit 3- TREE AND PROBABILISTIC MODELS: Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map

Syllabus

Unit 4- DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS: Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

Unit 5- GRAPHICAL MODELS: Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

TEXT BOOK:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014

3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.

REFERENCE BOOKS:

1. EthemAlpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series) Third Edition, MIT Press, 2014

2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

4. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Syllabus

Departmental Elective–1
GRAPH THEORY (CST-013)

L:T:P:: 3:0:0: **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to:

1. Understand the fundamentals of graph theory.
2. Study proof techniques related to various concepts in graphs.
3. Explore modern applications of graph theory.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Understand the basic concept of walk, path and circuit in a graph.
2. Perform the basic operation of Euler graph and digraph
3. Discuss the various spanning trees algorithms.
4. Understand the concept of edge connectivity, vertex connectivity and separable graphs.
5. Derive the relations between the reduced incidence matrix, the fundamental cycle matrix, and the fundamental cut-set matrix of a graph G.

UNIT I: INTRODUCTION: Introduction to Graphs, Basic definition – Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.

UNIT II:EULERIAN AND HAMILTONIAN GRAPHS : Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation, Directed paths and connectedness – Euler graphs.

UNIT III TREES AND GRAPH ALGORITHMS : Trees – properties, pendant vertex, Distance and centres in a tree - Rooted and binary trees, counting trees, spanning trees, Prim's algorithm and Kruskal's algorithm, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm.

UNIT IV CONNECTIVITY AND PLANAR GRAPHS : Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits, Planar graphs, Kuratowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual.

UNIT V: GRAPH REPRESENTATIONS AND VERTEX COLOURING : Matrix representation of graphs Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix. Coloring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problem and Fivecolour problem.

Syllabus

TEXTBOOKS:

1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds, "Graph Theory Applications", Springer ,2016.

REFERENCES:

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., ―Introduction to Graph Theory, Pearson Education, 2011.
3. John Clark, Derek Allan Holton, ―A First Look at Graph Theory, World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill , 2007.

Syllabus

Departmental Elective–1
Advanced Python Programming (AIT-101)

L:T:P:: 3:0:0 **Credits-03**

Course Objectives:

1. Understand and apply advanced Python programming concepts.
2. Develop proficiency in using Python libraries and frameworks for various tasks.
3. Learn techniques for optimizing and scaling Python code.
4. Explore best practices and design patterns for writing clean and maintainable Python code.
5. Gain practical experience through hands-on coding exercises and projects.

Prerequisites:

- Proficiency in basic Python programming
- Familiarity with object-oriented programming concepts
- Understanding of data structures and algorithms

Unit-wise Syllabus:

Unit 1: Advanced Python Language Features

- List comprehensions, generator expressions, and dictionary comprehensions
- Decorators and context managers
- Functional programming concepts (map, filter, reduce)
- Lambda functions and closures

Unit 2: Object-Oriented Programming in Python

- Review of basic OOP concepts (classes, objects, inheritance, polymorphism)
- Advanced OOP features in Python (multiple inheritance, method resolution order)
- Magic methods (dunder methods) and operator overloading
- Design patterns in Python (singleton, factory, strategy)

Unit 3: Concurrency and Parallelism

- Threads and threading module
- Multiprocessing and multiprocessing module
- Asynchronous programming with async/await and asyncio
- Parallel processing with concurrent.futures and multiprocessing

Syllabus

Unit 4: Python Performance Optimization

- Profiling and benchmarking Python code
- Techniques for optimizing Python code (vectorization, memoization)
- Using Cython for writing C extensions
- Memory management and garbage collection

Unit 5: Python Libraries and Frameworks

- Introduction to popular Python libraries and frameworks (NumPy, pandas, Matplotlib, Flask)
- Hands-on exercises and projects using selected libraries
- Best practices for integrating and utilizing third-party libraries
- Exploring documentation and community resources

Textbook:

- "Fluent Python" by Luciano Ramalho
- "Python Cookbook" by David Beazley and Brian K. Jones

References:

- "High Performance Python" by Micha Gorelick and Ian Ozsvald

Syllabus

SOFTWARE ENGINEERING (CST-015)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Learn and understand the principles of Software Engineering.
2. Learn methods of capturing, specifying, visualizing, and analyzing software requirements.
3. Apply Design and Testing principles to S/W project development.
4. Understand project management through life cycle of the project.

COURSE OUTCOMES: On successful completion of the course, the student will be able to

1. Identify appropriate software design model based on requirement analysis.
2. Formulate Software Requirements Specification (SRS) reports for the real world application.
3. Translate a specification into a design and identify the components to build the architecture.
4. Plan a software engineering process to account for quality issues and non-functionalrequirements.
5. Estimate the work to be done, resources required and the schedule for a software project plan.

Unit 1- : **Introduction to Software Engineering**: Introduction, software applications, importance of software evolution of software, Software Components, Software Characteristics, Software Crisis & myths. Software Engineering paradigms: introduction, principles & Processes, Software Quality Attributes. Comparison between software engineering & computer science, & software engineering & Engineering. Some terminologies: product & process, deliverables and milestones, measures, metrics& indicators. Programs & software products. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, RAD model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Unit 2- Software Requirement Analysis: Structured analysis, object-oriented analysis, software requirement specification, and validation.

Unit 3- Design and Implementation of Software: software design fundamentals, design methodology (structured design and object-oriented design), design verification, monitoring and control coding.

Unit 4- Testing: Testing fundamentals, white box and black box testing, software testing strategies: unit testing, integration testing, validation testing, system testing, debugging.

Unit 5- Software Reliability: Metric and specification, fault avoidance and tolerance, exception handling, defensive programming.Software Maintenance – maintenance characteristics, maintainability, maintenance tasks, maintenance side effects. CASE tools, software certification- requirement, types of certifications, third part certification. Software Re-Engineering, reverse software Engineering. Software Configuration Management Activities, Change Control Process,

Syllabus

Software Version Control, CASE: introduction, levels of case, architecture, case building blocks, objectives, case repository, characteristics of case tools, categories, Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

TEXTBOOKS:

1. Roger Pressman, ―Software Engineering: A Practitioner ‘s Approach, McGraw Hill, ISBN 007–337597–7.
2. Ian Sommerville, ―Software Engineering, Addison and Wesley, ISBN 0-13-703515-2.

REFERENCE BOOKS:

1. Carlo Ghezzi, ―Fundamentals of Software Engineering, Prentice Hall India, ISBN-10: 0133056996.
2. Rajib Mall, ―Fundamentals of Software Engineering, Prentice Hall India, ISBN-13: 9788120348981.
3. Pankaj Jalote, ―An Integrated Approach to Software Engineering, Springer, ISBN 13: 9788173192715.
4. S K Chang, ―Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1.
5. Tom Halt, ―Handbook of Software Engineering, ClanyeInternational ISBN- 10: 1632402939.

Syllabus

QUEUING THEORY AND MODELING (CST-016)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.

2. Understand the basic concepts of random processes which are widely used in IT fields.

3. Understand the concept of queueing models and application in engineering.

4. Provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

COURSE OUTCOMES: On successful completion of this course, the students shall be able to

1. Have a fundamental knowledge of the basic concepts of probability.

2. Have a well-founded knowledge of various probability distributions which can describe real-life phenomena.

3. Acquire skills in estimating expected values of variables and handling situations involving more than one random variable and functions of random variables.

4. Understand the stochastic processes and phenomena which evolve concerning time in a probabilistic manner.

5. Expose the basic characteristic features of Markov chains, queuing systems and queuing models.

Unit 1- Probability Models: Sample Space, Events and their algebra, graphical methods of representing events, Probability Axioms and their applications, Condition probability, Independence of Events, Bayes' Rule and Bernoulli Trials.

Unit 2- Random variables, and their event spaces: Probability mass function, Distribution functions, some discrete distributions (Bernoulli, Binomial, Geometric, Poisson, uniform, Probability Generating Function, Discrete random vectors, Continuous random variables: pdf some continuous distributions (Gamma, Normal), Exponential functions of random variables, joint1y distributed random variables.

Unit 3- Expectation: Expectation of functions of more than one random variable, Moments and transforms of some distributions (Uniform, Bernoulli, Binomial, Geometric, Poisson. Exponential, Gamma, Normal), Computation of mean time to failure.

Unit 4- Stochastic Processes: Classification of stochastic processes, the Bernoulli process, renewal process, renewal model of program behavior.

Unit 5- Markov Chains: Computation of n-step transition probabilities, State classification and limiting distributions, Irreducible finite chains with aperiodic states, M/G/l queuing system, Discrete parameter

Birth Death processes, Analysis of program execution time. Continuous parameter Markov Chains, Birth-Death process with special cases, Non-Birth-Death Processes.

TEXTBOOKS:

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., ―Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.

2. Ibe, O.C., ―Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.

REFERENCE BOOK:

1. Hwei Hsu, "Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.

2. Taha, H.A., "Operations Research", 9th Edition, Pearson India Education Services, Delhi, 2016.

3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.

4. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

Syllabus

DEPARTMNTAL ELECTIVE -2

FAULT-TOLERANT COMPUTING (CST-017)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand fault-tolerant design principles.

2. Identify the requirement of fault-tolerant systems.

3. Understand fault-tolerant distributed systems and its requirement.

4. Design algorithms for fault-tolerant systems.

COURSE OUTCOMES: On successful completion of the course, the student will be able to

1. Understand research problems and challenges in fault tolerance computing.

2. Identify the state-of-the-art techniques and tools to address research problems and challenges.

3. Develop strong technical reviewing, writing, and presentation skills.

4. Design more reliable systems that can tolerate S/W faults.

5. Design more reliable systems that can tolerate H/W faults.

Unit 1- Basics of Fault Tolerance: Fault Classification, Types of Redundancy, Basic Measures of Fault Tolerance, Reliability concepts, Failures & faults, Reliability and Failure rate, Relation between reliability and mean time between failure, maintainability and availability, Fault Tolerant Design: Basic concepts-static, dynamic, hybrid, triple modular redundant system (TMR), Data redundancy, Time redundancy and software Redundancy concepts.

Unit 2- Hardware Fault Tolerance: canonical and Resilient Structures- Series and Parallel Systems, Non- Series/Parallel Systems, *M*-of-*N* Systems, Voters, Variations on *N*-Modular Redundancy, Duplex Systems, Other Reliability Evaluation Techniques-Poisson Processes, Markov Models, Fault-Tolerance Processor-Level Techniques, Watchdog Processor, Simultaneous Multithreading for Fault Tolerance, Byzantine Failures, Byzantine Agreement with Message Authentication.

Unit 3- Testability for Hardware: testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of control and syndrome testable designs. Design for testability by means of scan: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architectures full scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs.

Unit 4- Software Fault Tolerance: Acceptance Tests Single-Version Fault Tolerance- Wrappers, Software Rejuvenation, Data Diversity, Software Implemented Hardware Fault Tolerance (SIHFT), *N*-Version Programming- Consistent Comparison Problem, Version Independence, Recovery Block

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Approach- Basic Principles, Success Probability Calculation, Distributed Recovery Blocks, Preconditions, Postconditions, and Assertions, Exception-Handling- Requirements from Exception-Handlers, Basics of Exceptions and Exception- Handling, Language Support, Software Reliability Models- Jelinski–Moranda Model, Littlewood–Verrall Model, Musa–Okumoto Model, Model Selection and Parameter Estimation, Fault-Tolerant Remote Procedure Calls-Primary-Backup Approach, The Circus Approach.

Unit 5- Checkpointing: Basics of checkpoint, Checkpoint Level, Optimal Checkpointing- An Analytical Model, Time Between Checkpoints-A First-Order Approximation, Optimal Checkpoint Placement, Reducing Overhead, Reducing Latency, Checkpointing in Distributed Systems-The Domino Effect and Livelock, A Coordinated Checkpointing Algorithm, Time-Based Synchronization, Diskless Checkpointing, Message Logging, Checkpointing in Shared-Memory Systems- Bus-Based Coherence Protocol, Directory-Based Protocol, Checkpointing in Real-Time Systems.

TEXTBOOKS:

1. Israel Koren And C. Mani Krishna, “Fault-Tolerant Systems, Morgan Kaufmann publisher

2. Parag K. Lala, “Fault Tolerant & Fault Testable Hardware Design”, 1984, PHI

REFERENCE BOOKS:

1. Fault Tolerant Computer System Design, D. K. Pradhan, Prentice Hall, 1996.

2. Probability and Statistics with Reliability, Queuing and Computer Science Applications, Kishor S. Trivedi, John Wiley & Sons Inc., 2016.

3. ZainalabedinNavabi, “Digital System Test and Testable Design using HDL models and Architectures”, Springer International Edition.

4. MironAbramovici, Melvin A. Breuer and Arthur D. Friedman, “Digital Systems Testing and Testable Design”, Jaico Books

Syllabus

DEPARTMNTAL ELECTIVE -2

REAL-TIME SYSTEM (CST-018)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Develop an understanding of various Real Time systems Application
2. Obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
3. Get in-depth hands-on experience in designing and developing a real operational system.

COURSE OUTCOMES: On successful completion of the course, the student will be able to

1. Grasp a fundamental understanding of goals, components, and evolution of real time systems.
2. Explain the concepts of real time scheduling.
3. Learn the scheduling policies of modern operating systems.
4. Understand the resource access control techniques in real time systems.
5. Understand the concept of real time communication.

Unit 1-Introduction: Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Unit 2-Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Unit 3-Resources Access Control: Effect of Resource Contention and Resource Access Control (RAC), No pre-emptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

Unit 4-Multiprocessor System Environment: Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol,Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.

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Unit 5-Real Time Communication: Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.

TEXTBOOKS:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005.

REFERENCE BOOKS:

1. Real Time Systems – Mall Rajib, Pearson Education

2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Syllabus

DEPARTMNTAL ELECTIVE -2

DISTRIBUTED SYSTEMS (CST-019)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to
1. Understand the foundations of distributed systems.
2. Learn clock synchronisation issues and the need for global state in distributed systems.
3. Learn distributed mutual exclusion and deadlock detection algorithms.
4. Understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
5. Learn the characteristics of peer-to-peer and distributed shared memory systems.

COURSE OUTCOMES: On Successful completion of the course, the students will be able to
1. Acquire the theoretical and conceptual foundations of distributed computing.
2. Conceptualize the ideas of distributed operating systems and their issues.
3. Understand the issues involved in distributed resource environment.
4. Realize the importance of transaction and how to recovery the system from deadlocks.
5. Explore the principles of fault tolerance and its protocols.

Unit 1- Distributed Environment: Introduction, Limitations, Remote Procedure Call, Remote Object Invocation, Message-Oriented Communication, Unicasting, Multicasting and Broadcasting, Group Communication.

Unit 2-Distributed Operating Systems: Issues in Distributed Operating Systems, Threads in Distributed Systems, Clock Synchronization, Causal Ordering, Global States, Election Algorithms, Distributed Mutual Exclusion, Distributed Deadlock, Agreement Protocols

Unit 3- Distributed Resource Management: Distributed Shared Memory, Data-Centric Consistency Models, Client-Centric Consistency Models, Distributed File Systems, Sun NFS.

Unit 4- Distributed Transaction Processing: Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison, Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery, Overview of Replication and Distributed Multimedia Systems.

Unit 5- Fault Tolerance and Consensus: Introduction to Fault Tolerance, Distributed Commit Protocols, Byzantine Fault Tolerance, Impossibilities in Fault Tolerance.

TEXTBOOK(S):

1. A.S.Tanenbaum, M.Van Steen, “Distributed Systems”, Pearson Education, 2007.

2. MukeshSinghal, NiranjanG.Shivaratri “Advanced Concepts in Operating Systems”, McGrawHill Series in Computer Science, 2011.

REFERENCE BOOKS:

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, 3rd Edition, Pearson Education Asia, 2002.

2. M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Addison Wesley, 2004.

3. Andrew S.Tenenbaum “Modern Operating system”, 3rd Edition, Pearson Addison Wesley, 2008.

Syllabus

DEPARTMNTAL ELECTIVE -2

DATABASE MANAGEMENT SYSTEM (CST-011)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to:

1. Learn the fundamentals of data models and to represent a database system using ER diagrams.
2. Study SQL and relational database design.
3. Understanding the internal storage structures using different file and indexing techniques which will help in physical DB design.
4. Understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
5. Have the knowledge about the Storage and Query Processing Techniques

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Write relational algebra expressions for that query and optimize the developed expressions.
2. Design the databases using E-R method and normalization.
3. Understand the concepts of function dependencies and various normal forms.
4. Understand the concept of transaction atomicity, consistency, isolation, and durability properties in context of real life examples.
5. Develop the understanding of query processing and advanced databases.

Unit 1-Introduction: Data Abstraction, Data Independence, Data Definition Language(DDL),Data Manipulation Language(DML), 3 level Database System Architecture. Database models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit 2-Relational Model: Structure of relational database, Relational Algebra: Fundamental operations, Additional Operations, Extended Relational-Algebra operations, Tuple Relational Calculus – Domain Relational Calculus. SQL: Basic structure, Set operations, Aggregate functions, Null Values, Nested subqueries, Views, Data Definition Language, Embedded SQL, Dynamic SQL, Domain Constraints, Referential Integrity and Triggers.

Unit 3-Relational database design: Functional Dependencies, First, Second, Third Normal Forms, Closure, Armstrong's Axioms, Canonical cover, Decomposition, Properties of Decomposition, Dependency Preservation, Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.

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Unit 4-Transaction processing: Transaction Concepts, ACID Properties, Two-Phase Commit, Save Points, Concurrency Control techniques: Locking Protocols, Two Phase Locking, timestamp-based protocol, Mult version and optimistic Concurrency Control schemes, Database recovery.

Unit 5-Storage Structure, Query Processing and Advanced database: Storage structures: RAID. File Organization: Organization of Records, Indexing, Ordered Indices, B+ tree Index Files, B tree Index Files. Query Processing: Overview, Measures of Query Cost, Query optimization.
Advanced Database: Object-oriented and object-relational databases, logical databases, web databases, distributed databases, data warehousing and data mining.

TEXTBOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.

REFERENCE BOOK:

1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, ―Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems, Tata McGraw Hill, 2011.

Syllabus

ARTIFICIAL INTELLIGENCE LAB (CSP-015)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the various characteristics of Intelligent agents and implement the different search strategies in AI.

2. Learn to represent knowledge in solving AI problems

3. Design the different ways of designing software agents.

4. Identify the various applications of AI.

COURSE OUTCOMES: On successful completion of the course, the students will be able to

1. Implement the Artificial Intelligence techniques for building well engineered and efficient intelligent systems.

2. Describe the nature of AI problem and provide the solution as a particular type.

3. Learn optimization and inference algorithms for model learning.

4. Solve game challenging problems

5. Design and develop programs for an agent to learn and act in a structured environment.

LIST OF PRACTICALS

1. Write a python program to implement simple Chatbot ?

2. Implementation of following algorithms:

a. A* and Uniform cost search algorithms.

b. Implement AO* Search algorithm.

c. Write a python program to implement Breadth First Search Traversal.

d. Implementation of TSP using heuristic approach.

3. Implementation of Hill-climbing to solve 8- Puzzle Problem.

4. Write a python program to implement Water Jug Problem?

5. Write a program to implement Hangman game using python.

6. Write a program to implement Tic-Tac-Toe game using python.

7. Write a Program for Expert System by Using Forward Chaining.

8. Write a python program to remove stop words for a given passage from a text file using NLTK?

9. Write a python program to implement stemming for a given sentence using NLTK?

10. Write a python program to implement Lemmatization using NLTK.

11. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

12. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a.CSV file. Compute the accuracy of the classifier, considering few test data sets.

Syllabus

Natural Language Processing lab (AIP-101)

L:T:P:: 0:0:2 **Credits-1**

Course Outcomes: At the end of the Course, the Student will be able to:

1: Use the NLTK and spaCy toolkit for NLP Programming.

2: Analyze various corpora for developing programs.

3: Develop various pre-processing techniques for a given corpus.

4: Develop programming logic using NLTK functions.

5: Build applications using various NLP techniques for a given corpus. (L6)

LIST OF PROGRAMS:

1. Installation and exploring features of NLTK and spaCy tools. Download Word Cloud and few corpora.

2. (i)Write a program to implement word Tokenizer, Sentence and Paragraph Tokenizers.

(ii) Check how many words are there in any corpus. Also check how many distinct words are there?

3. (i) Write a program to implement both user-defined and pre-defined functions to generate

(a) Uni-grams

(b) Bi-grams

(c) Tri-grams

(d) N-grams

(ii) Write a program to calculate the highest probability of a word (w2) occurring after another word(w1).

4. (i)Write a program to identify the word collocations.

(ii) Write a program to print all words beginning with a given sequence of letters.

(iii) Write a program to print all words longer than four characters.

5. (i) Write a program to identify the mathematical expression in a given sentence.

(ii) Write a program to identify different components of an email address.

6. (i) Write a program to identify all antonyms and synonyms of a word.

(ii) Write a program to find hyponymy, homonymy, polysemy for a given word.

7. (i) Write a program to find all the stop words in any given text.

(ii) Write a function that finds the 50 most frequently occurring words of a text that are not stopwords.

8. Write a program to implement various stemming techniques and prepare a chart with the performance of each method.

9. Write a program to implement various lemmatization techniques and prepare a chart with the performance of each method.

10. (i) Write a program to implement Conditional Frequency Distributions (CFD) for any corpus.

(ii) Find all the four-letter words in any corpus. With the help of a frequency distribution (FreqDist), show these words in decreasing order of frequency.

(iii) Define a conditional frequency distribution over the names corpus that allows you to see which initial letters are more frequent for males versus females.

11. (i) Write a program to implement Part-of-Speech (PoS) tagging for any corpus.

(ii) Write a program to identify which word has the greatest number of distinct tags? What are they, and what do they represent?

(iii) Write a program to list tags in order of decreasing frequency and what do the 20 most frequent tags represent?

(iv) Write a program to identify which tags are nouns most commonly found after? What do these tags represent?

12. Write a program to implement TF-IDF for any corpus.

13. Write a program to implement chunking and chinking for any corpus.

14. (i) Write a program to find all the mis-spelled words in a paragraph.

(ii) Write a program to prepare a table with frequency of mis-spelled tags for any given text.

15. Write a program to implement all the NLP Pre-Processing Techniques required to perform further NLP tasks.

Syllabus

MACHINE LEARNING LAB (CSP-017)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of the course are to

1. Effective use of the various machine learning tools.
2. Understand the Selection of data, learning model, model complexity and identify the trends.
3. Understand and implement a range of machine learning algorithms along with their strengths and weaknesses.

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Make use of Data sets in implementing the machine learning algorithms.
2. Understand the implementation procedures for the machine learning algorithms.
3. Design Java/Python programs for various Learning algorithms.
4. Apply appropriate data sets to the Machine Learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real world problems.

Lab Experiments:

1. Implement and demonstrate the FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate

the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Syllabus

MINI PROJECT-II /INTERNSHIP-II(AIP-102)

L:T:P::0:0:2 **Credits-01**

ABOUT INTERNSHIP/MINI PROJECT

It is an organized method or activity of enhancing and improving engineering students' skill sets and knowledge, which boosts their performance and consequently helps them meet their career objectives. Industrial Training is essential in developing the practical and professional skills required for an Engineer and an aid to prospective employment.

OBJECTIVES OF INTERNSHIP/MINI PROJECT:

1. The main objective of the internship/mini projectis to expose the students to the actual working environment and enhance their knowledge and skill from what they have learned in college.
2. Another purpose of this program is to enhance the good qualities of integrity, responsibility, and self-confidence. Students must follow all ethical values and good working practices.
3. It is also to help the students with the safety practices and regulations inside the industry and to instils the spirit of teamwork and good relationship between students and employees.

COURSE OUTCOMES: At the end of internship/mini project, the students will be able to

1. Understand organizational issues and their impact on the organization and employees.
2. Identify industrial problems and suggest possible solutions.
3. Relate, apply and adapt relevant knowledge, concepts and theories within an industrial organization, practice and ethics.
4. Apply technical knowledge in an industry to solve real world problems.
5. Demonstrate effective group communication, presentation, self-management, and report writing skills**.**

Syllabus

CONSTITUTION OF INDIA (AHT-009)

L:T:P:: 2:0:0 **Credits-0**

COURSE OBJECTIVES: The objectives of this course are to

1. To acquaint the students with legacies of constitutional development in India and help to understand the most diversified legal document of India and philosophy behind it.
2. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. Understand the basic knowledge and salient features of Indian Constitution.
2. Identify and explore the basic features and modalities about Indian constitution.
3. Discusses the essence of Union and its territories, Citizenship, Fundamental Rights, DPSP and Fundamental Duties.
4. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
5. Differentiate different aspects of Indian Legal System and its related bodies.

Unit-1 Constitutional Framework

Meaning of Terms and Phrases frequently used in political system like constitution, constitutionalism, Rule of Law, Federal system, Government and so on. Historical Background of Indian Constitution, Making of Indian Constitution, Salient features of Indian Constitution, Preamble of Indian Constitution.

Unit-2 Different Parts, Articles, and their significance

Part I to IVA (Union and its territories w.r.t. Indian States, Citizenship, Fundamental Rights conferred to citizens and foreigners, Directive Principles of State Policy– Its importance and implementation and Fundamental Duties and its legal status), Article 1 to 51A and their significance.

Unit-3 System of Government

Parliamentary Form of Government in India – The constitution powers and status of the President of India, Federal structure and distribution of legislative and financial powers between the Union and the States, Emergency Provisions: National Emergency, President Rule, Financial Emergency and Amendment of the Constitutional Powers and Procedure and the significance of basic structure in Indian Judicial system

Unit-4 Working of Central, State & Local Self Government as per constitution

Framework for central government (President, Vice president, Prime Minister, Central council of ministers, Parliament, Supreme court and so on), Framework for state government (Governor, Chief Minister, state legislature, High court and so on) and Framework for local self government (Panchayatiraj, Municipalities) and Union Territories.

Unit-5 Constitutional, Non-Constitutional and other bodies

Discussion on Various constitutional bodies like Election Commission, UPSC, SPSC, Finance commission, NCSC, NCST, NCBC, CAG and AGI. Discussion on Various non-constitutional bodies like NITI Aayog, NHRC, CIC, CVC, CBI, Lokpal and Lokayukta. Discussion on Various other constitutional bodies like Co- operative societies, Official Language, Tribunals etc.

Text/Reference books-

1. M. Laxmikanth, “Indian Polity”, McGraw- Hill, 6th edition, 2020
2. D.D. Basu, “Introduction to the Indian Constitution”, LexisNexis, 21st edition, 2020
3. S.C. Kashyap, “ Constitution of India”, Vitasta publishing Pvt. Ltd., 2019

Syllabus

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (AHT-010)

L:T:P:: 2:0:0 **Credits-0**

COURSE OBJECTIVES: The objectives of this course are to

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyses it and apply it to their day to day life.
3. To make the students know the need and importance of protecting traditional knowledge.
4. To make the students understand the concepts of Intellectual property to protect the traditional knowledge.
5. This course is also concentrating on various acts in protecting the environment and Knowledge management impact on various sectors in the economy development of the country.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

1. Understand the concept of Traditional knowledge and its importance.
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.
5. Know the contribution of scientists of different areas.

Unit – 1 Introduction to Traditional and Culture Knowledge

Define culture, traditional, civilization and heritage knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK). Indigenous traditional knowledge Vs western traditional knowledge vis-à-vis formal knowledge.

Unit-2 Protection of Traditional Knowledge

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of

traditional knowledge Protection, value of traditional knowledge in global economy, Role of Government to harness traditional knowledge.

Unit – 3 Traditional Knowledge and Intellectual Property

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Global legal forums for increasing protection of Indian Traditional Knowledge.

Unit – 4 Traditional Knowledge in Different Sectors

Traditional knowledge in engineering, biotechnology and agriculture, traditional medicine system, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of traditional knowledge.

Unit – 5 Education System in India

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Text/Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.
3. Traditional Knowledge System in India, by Amit Jha, 2009.
4. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
5. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh Pratibha Prakashan 2012.

Syllabus

Neural Networks (AIT-102)

L:T:P:3:1:0 **CREDITS-04**

Course Objectives:

1. Understand the theoretical foundations of neural networks, including perceptrons, activation functions, and backpropagation.
2. Learn to design and implement neural network models for solving classification, regression, and other tasks.
3. Explore advanced neural network architectures and techniques, such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and deep learning.
4. Gain practical experience through hands-on programming assignments and projects.
5. Analyze and interpret neural network models and their performance.

Unit 1: Introduction to Neural Networks

- History and basic concepts of neural networks
- Perceptrons and the McCulloch-Pitts model
- Activation functions and their properties

Unit 2: Multilayer Perceptrons (MLPs)

- Feedforward neural networks
- Backpropagation algorithm for training MLPs
- Gradient descent optimization techniques

Unit 3: Advanced Architectures

- Convolutional Neural Networks (CNNs) for image processing
- Recurrent Neural Networks (RNNs) for sequence modeling
- Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU)

Unit 4: Deep Learning

- Introduction to deep learning and its applications
- Deep feedforward networks and libraries (e.g., TensorFlow, PyTorch)
- Training deep neural networks with stochastic gradient descent

Unit 5: Optimization and Applications

- Optimization techniques: Adam, RMSprop, SGD with momentum
- Regularization methods: Dropout, Batch normalization
- Applications: Image classification, Sentiment analysis, Reinforcement learning

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Textbook:

- "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal
- "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

References:

- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

Syllabus

Deep Learning (AIT-005)

L:T:P:: 3:1:0 **Credits-04**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the context of neural networks and deep learning
2. Know how to use a neural network
3. Understand the data needs of deep learning
4. Have a working knowledge of neural networks and deep learning
5. Explore the parameters for neural networks

COURSE OUTCOMES: On Successful completion of the course, the students will be able to

1. Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.
2. Become familiar with neural networks
3. This topics course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data
4. Discussing recent models from supervised learning
5. Discussing recent models from unsupervised learning

UNIT 1

INTRODUCTION: Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT 2

DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning.

UNIT 3

DIMENTIONALITY REDUCTION: Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet,

VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

UNIT 4

OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

UNIT 5

A brief introduction to Directed Graphical Models, A brief introduction to Markov Networks, Restricted Boltzmann Machines.

TEXT BOOKS:

1. CosmaRohillaShalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

REFERENCE BOOKS:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Syllabus

Pattern and Anomaly Detection (AIT-103)

L:T:P:: 3:1:0 **Credits-04**

Course Objectives:

1. Understand the concepts and importance of pattern and anomaly detection in real-world applications.
2. Learn various techniques for detecting patterns in structured and unstructured data.
3. Explore statistical methods and machine learning algorithms for anomaly detection.
4. Develop skills in implementing pattern and anomaly detection algorithms using Python and relevant libraries.
5. Apply pattern and anomaly detection techniques to real-world datasets and evaluate their performance.

Prerequisites:

- Basic knowledge of statistics and probability
- Familiarity with Python programming language
- Understanding of fundamental machine learning concepts

Syllabus:

Unit 1: Introduction to Pattern and Anomaly Detection

- Definition and significance of pattern and anomaly detection
- Applications in various domains (fraud detection, cybersecurity, predictive maintenance)
- Challenges and considerations in pattern and anomaly detection tasks

Unit 2: Exploratory Data Analysis (EDA) for Pattern Detection

- Data visualization techniques for exploring patterns in data
- Statistical measures for identifying patterns and correlations
- Feature selection and engineering for pattern detection tasks

Unit 3: Traditional Statistical Methods for Anomaly Detection

- Z-score method and Gaussian distribution for univariate anomaly detection
- Multivariate anomaly detection techniques (Mahalanobis distance, Hotelling's T-squared statistic)
- Time series anomaly detection using statistical measures (mean, median, standard deviation)

Unit 4: Machine Learning Approaches to Pattern and Anomaly Detection

- Supervised learning techniques for pattern detection (classification, regression)

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- Unsupervised learning techniques for anomaly detection (clustering, density estimation)
- Semi-supervised and ensemble methods for anomaly detection

Unit 5: Advanced Topics in Pattern and Anomaly Detection

- Deep learning approaches for pattern detection and anomaly detection
- Time series anomaly detection using recurrent neural networks (RNNs) and LSTM networks
- Anomaly detection in high-dimensional data using autoencoders
- Transfer learning and domain adaptation for anomaly detection tasks

Textbook:

- "Pattern Recognition and Machine Learning" by Christopher M. Bishop
- "Anomaly Detection Principles and Algorithms" by Chong Ho Yu and Mark G. J. van der Laan

References:

- "Data Science for Business" by Foster Provost and Tom Fawcett

Syllabus

DEPARTMENTAL ELECTIVE -3

INTERNET OF THINGS (CST-024)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand Smart Objects, IoT Architectures and learn about various IOT-related protocols.

2. Build simple IoT Systems using Arduino and Raspberry Pi.

3. Understand data analytics and cloud in the context of IoT.

4. Develop IoT infrastructure for popular applications

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

1. Understand the application areas of IOT

2. Explore interconnection and integration of the physical world

3. Design & develop IOT Devices

4. Realize the revolution of Internet in Mobile Devices, Cloud &Sensor Networks

5. Understand the building blocks of Internet of Things and their characteristics.

Unit 1-INTRODUCTION TO IOT: Internet of Things - Physical Design- Logical Design- IOT Enabling Technologies - IOT Levels & Deployment Templates - Domain Specific IOTs - IOT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

Unit 2-IOT ARCHITECTURE: M2M high-level ETSI architecture - IETF architecture for IoT – OGC architecture - IoT reference model - Domain model - information model - functional model – communication model - IoT reference architecture

Unit 3-IOT PROTOCOLS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security

Unit 4-BUILDING IOT WITH RASPBERRY PI & ARDUINO: Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks - Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

Unit 5-CASE STUDIES AND REAL-WORLD APPLICATIONS: Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation,

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Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT, Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT

TEXTBOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCE BOOKS:

1. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015.

2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012.

3. Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.

5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

Syllabus

DEPARTMENTAL ELECTIVE -3

QUANTUM COMPUTING (CST-025)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Impart knowledge about the quantum-mechanical phenomena such as superposition and entanglement to perform computation.

2. Introduce the fundamental concepts, Quantum Computing.

3. Enable the students to understand the quantum computing and quantum information in depth.

COURSE OUTCOMES: On successful completion of the course, the students will be able to

1. Explain the working of Quantum Computing program.

2. Understand its architecture and programing model.

3. Develop quantum logic gate circuits.

4. Develop quantum algorithm.

5. Program quantum algorithm on major toolkits.

Unit 1- Introduction to Quantum Computing: Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.) Origin of Quantum Computing, Overview of major concepts in Quantum Computing, Qubits and multi-qubits states, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement.

Unit 2-Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices, and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

Unit 3-Building Blocks for Quantum Program: Architecture of a Quantum Computing platform, Details of qbit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement ,Universal quantum gates, Quantum Fourier Transform.

Unit 4-Quantum Algorithms: Basic techniques exploited by quantum algorithms. The quantum search algorithm, Quantum Walks, Major Algorithms, Shor's Algorithm, Grover's Algorithm Deutsch's Algorithm,Deutsch -Jozsa Algorithm

Unit 5-Toolkits: OSS Toolkits for implementing Quantum program, IBM quantum experience, Microsoft Q, (QPU/QVM)

TEXTBOOKS:

1. Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers:

Essential Algorithms And Code Samples, SHROFF/ O'Reilly.

2. Dr. Christine Corbett Moran, Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit, Kindle Edition Packt

3. V.K Sahni, Quantum Computing (with CD), TATA McGrawHill.

REFERENCE BOOKS:

1. Chris Bernhardt, Quantum Computing for Everyone (The MIT Press).

2. Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Information", Cambridge (2002).

3. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd (2012).

4. Scott Aaronson, "Quantum Computing since Democritus", Cambridge (2013).

5. P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge

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DEPARTMENTAL ELECTIVE -3

AUGEMENTED REALITY (CST-026)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Gain the knowledge of historical and modern overviews and perspectives on virtual reality.

2. Learn the fundamentals of sensation, perception, and perceptual training.

3. Have the scientific, technical, and engineering aspects of augmented and virtual reality systems.

4. Learn the technology of augmented reality and implement it to have practical knowledge.

COURSE OUTCOME: On successful completion of the course, the students will be able to

1. Understand geometric modelling and Virtual environment.

2. Study about Virtual Hardware and Software

3. Present geometric model for VR systems

4. Identify which type hardware and software is suitable to design their own VR systems

5. Develop Virtual Reality applications.

Unit 1-Introduction to Virtual Reality: Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of

virtual reality, Historical development of VR, Scientific Landmark,3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism-Stereographic image.

Unit 2-Geometric Modelling: Geometric Modelling: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

Unit 3-Virtual Environment: Animating the Virtual Environment: Introduction, The dynamics of numbers,Linear and Non-linear interpolation, the animation of objects, linear and non-linear translation. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Unit 4-VR Hardware and Software: Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR

systems. VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

Unit 5-VR Applications: Introduction, Engineering, Entertainment, Science, Training. The Future: Virtual environment, modes of interaction.

TEXTBOOKS:

1. Coiffet, P., Burdea, G. C., (2003), "Virtual Reality Technology," Wiley-IEEE Press, ISBN: 9780471360896

2. Schmalstieg, D., Höllerer, T., (2016), "Augmented Reality: Principles & Practice," Pearson, ISBN: 9789332578494

3. Norman, K., Kirakowski, J., (2018), " Wiley Handbook of Human Computer Interaction," Wiley-Blackwell, ISBN: 9781118976135

4. LaViola Jr., J. J., Kruijff, E., McMahan, R. P., Bowman, D. A., Poupyrev, I., (2017), "3D User Interfaces: Theory and Practice," Pearson, ISBN: 9780134034324

5. Fowler, A., (2019), "Beginning iOS AR Game Development: Developing Augmented Reality Apps with Unity and C#," Apress, ISBN: 9781484246672

6. Hassanien, A. E., Gupta, D., Khanna, A., Slowik, A., (2022), "Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications," Springer, ISBN: 9783030941017

REFERENCE BOOKS:

1. Craig, A. B., (2013), "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann, ISBN: 9780240824086

2. Craig, A. B., Sherman, W. R., Will, J. D., (2009), "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann, ISBN: 9780123749437

3. John Vince, J., (2002), "Virtual Reality Systems, " Pearson, ISBN: 9788131708446

4. Anand, R., "Augmented and Virtual Reality," Khanna Publishing House

5. Kim, G. J., (2005), "Designing Virtual Systems: The Structured Approach", ISBN: 9781852339586

6. Bimber, O., Raskar, R., (2005), "Spatial Augmented Reality: Merging Real and Virtual Worlds," CRC Press, ISBN: 9781568812304

7. O'Connell, K., (2019), "Designing for Mixed Reality: Blending Data, AR, and the Physical World," O'Reilly, ISBN: 9789352138371

8. SanniSiltanen, S., (2012), "Theory and applications of marker-based augmented reality," Julkaisija – Utgivare Publisher, ISBN: 9789513874490

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DEPARTMENTAL ELECTIVE -3

APPLICATIONS OF AI IN INDUSTRY (AIT-006)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Artificial Intelligence is an umbrella term for tools and machines used across various industries for better decision making, increasing efficiency as well as eliminating repetitive work
2. It has applications in various sectors such as Healthcare, Automobile, Banking and Finance, Surveillance, Social Media, Entertainment, Education, etc.
3. It also has its applications in Space Exploration, Gaming, Robotics, Agriculture, and Ecommerce.
4. Apart from this, there are numerous industries who are on the verge of Transformation by Artificial Intelligence.

COURSE OUTCOMES: On successful completion of the course, the students will be able to

1. Understand the fundamental concepts of Machine Learning.
2. Understand the applications of ML in Banking, Insurance and Securities.
3. Demonstrate AI applications developed by Education sectors.
4. Demonstrate knowledge on future applications of healthcare using ML.
5. Understand the principles of AI applications through case studies.

UNIT 1: A BRIEF INTRODUCTION TO MACHINE LEARNING

Paradigms, Knowledge Representation, Data Acquisition, Data Pre-Processing, Feature Extraction and Processing, Feature Ranking and Selection, Feature Reduction, Model Learning, Evaluation and Deployment

UNIT 2: MACHINE LEARNING IN BANKING AND SECURITIES

Introduction, Analytics and Machine Learning Applications in Banking and Securities, Fraud Detection, Effective Application Screening, More Customer Acquisition and Retention, Better Knowledge of Customer Buying Habits, Efficient Cross-Selling, Improved Collections, Marketing Optimization, Increased Customer Lifetime Value, Effective Feedback Management.

UNIT 3: MACHINE LEARNING IN HEALTHCARE AND LIFE SCIENCES

Introduction, An Overview of Provider, Payer and Life Sciences Analytics, Business Value of Health Analytics - Value Life Cycle, Healthcare Analytics Framework- Key Drivers, Security, Privacy, and Risk Analytics in Healthcare, Meaningful Use and Role of Analytics - Complying with Regulatory Imperatives, Measuring the Impact of social media in Healthcare.

UNIT 4: MACHINE LEARNING IN EDUCATION

Introduction, Current Challenges in the Education Sector - Multiple Modes of Education, Rapidly Changing Education Trends, Targeting the Right Population, Curbing the Dropout Rate, Planning and Budgeting for Sustainable Expansion, Effective Development of Instructor and Curriculum, The Consequences of these Challenges - High Dropout Rate, Higher Debt Pressure on Dropouts, Increasing Loan Defaults, Failure of the

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Education System, Universities Lose Revenues, How Analytics Can Help? - What-if Scenarios Creation for Planning, Budgeting and Forecasting, Analytics for Educators, Analytics for Pupils, Smart Governance and Management of Education Programs, Career Prediction and Assisting Students in Choosing their Career Paths.

UNIT 5: MACHINE LEARNING IN INSURANCE

Introduction, Insurance Industry Overview, Emerging Trends - New Product Guidelines, Standard Proposal Forms and Need-Based Sales, Multi Tie-up for Banks, Role of Machine Learning in Insurance, Sales and Channel Management - Channel Strategy Optimization, Sales Reporting, Channel Management, Channel Analysis, Channel Profitability, Operations Management - New Business Processing, New Business Leakages, Customer Retention/Persistency, Attrition Analysis, Predicting Customer Behavior - Social Media Analytics, Use of GPS-Enabled Devices and CCTV Footage, Claims Management - Claims Payment Management, Claims Analysis, Marketing Management in Insurance Industry - Customer Segmentation, Product Management, Campaign Analysis, Profitability Management in Insurance Industry - Premium Analysis, Financial Analysis, Product Profitability Analysis, Underwriting Loss Analysis, Risk Management in Insurance - Reinsurance, Underwriting

TEXT BOOK:

1. Kaliraj, P., & Devi, T. (Eds.). (2021). Artificial Intelligence Theory, Models, and Applications (1st ed.). CRC Press, Taylor & Francis Group, Boca Raton, ebook ISBN 9781032008097 Auerbach Publications. https://doi.org/10.1201/9781003175865

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DEPARTMENTAL ELECTIVE -3

RELIABLE COMPUTING (CST-028)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the fault tolerant design principles

2. Identify the requirement of fault tolerant systems

3. Understand fault tolerant distributed systems and its requirement

4. Design algorithms for fault tolerant systems

COURSE OUTCOMES: O successful completion of this course, the students will be able to

1. Understand the risk of computer failures and their comparison with other equipment failures.

2. Analyze hardware and software fault-tolerant or non-fault-tolerant on the basis of dependability requirements.

3. Know the different advantages and limits of fault avoidance and fault tolerance techniques.

4. Understand the principles behind reliability

5. Gain knowledge in sources of faults and their prevention and forecasting.

6. Learn the programming tools in designing reliable systems

Unit 1-Reliability& fault: Definition, System reliability, Parameter values, Reliability models for hardware redundancy, Testing: Various testing methods, Definition, Fault types, Detection, Redundancy, Data diversity, Reversal checks, Byzantine failures, Integrated failure handling.

Unit 2- Hardware Fault Tolerance:-Definition, Fault types, Detection, Redundancy, Data diversity, Reversal checks, Byzantine failures, Integrated failure handling, canonical and Resilient Structures-Series and Parallel Systems, Non-Series/Parallel Systems, *M*-of-*N* Systems, Voters, Variations on N-Modular Redundancy, Duplex Systems, Other Reliability Evaluation Techniques-Poisson Processes, Markov Models, Fault-Tolerance Processor-Level Techniques, Watchdog Processor, Simultaneous Multithreading for Fault Tolerance, Byzantine

Failures, Byzantine Agreement with Message Authentication.

Unit 3-Testability for Hardware: testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of control and syndrome testable designs. Design for testability by means of scan: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architectures full scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs.

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Unit 4- Software Fault Tolerance: Acceptance Tests Single-Version Fault Tolerance- Wrappers, Software Rejuvenation, Data Diversity, Software Implemented Hardware Fault Tolerance (SIHFT), N-Version Programming- Consistent Comparison Problem, Version Independence, Recovery Block Approach- Basic Principles, Success Probability Calculation, Distributed Recovery Blocks, Preconditions, Postconditions, and Assertions, Exception-Handling- Requirements from Exception-Handlers, Basics of Exceptions and Exception- Handling

Unit 5-Programming Languages and Tools: Desired Language Characteristics, Data typing, control structures, Hierarchical decomposition, Packages, Exception handling, Over loading and Generics, Multitasking, Task scheduling, Timing specification., Flex, Euclid, Environments, Run time support.

Text Book:

1. Fault Tolerant Systems, I. Koren, Morgan Kauffman , 2007

2. Fault Tolerant Computer System Design,D. K. Pradhan, Prentice Hall, 1996.

Reference Book:

1. Probability and Statistics with Reliability, Queuing and Computer Science Applications, Kishor S. Trivedi, John Wiley & Sons Inc., 2016.

Syllabus

Open Elective-1

TOTAL QUALITY MANAGEMENT (AHT-011)

L:T:P:: 3:0:0 **Credits-03**

Course Objectives:

The course should enable the students:

1. To understand the concept of Quality in Manufacturing and Service units.
2. To understand the Implication of Quality in Business.
3. To understand the Organization Structure in TQM.
4. To understand how to implement Quality Programs in an Organization.
5. To have exposure to challenges in Quality Improvement Programs.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. Identify the significance of quality in an organization.
2.Describe how to manage quality improvement teams.
3. Describe how to organize management and quality policies in TQM.
4. Apply the tools of quality improvement programs in an organization.
5. Assess the benefits of implementing TQM Program in an organization.

Unit	Course Content	Lectures
I	**Introduction:** Evolution of Quality, Historical Perspectives, Relationship among Quality, Vision, Mission and Objectives of an Organization, Role of Quality in a Corporate Structure of an Organization, Attributes of Product and Service Quality, Quality Characteristics: Quality of Design, Quality of Performance and Quality of Conformance, Zero Defect and Continuous Improvement.	07
II	**Conceptualization of TQM:** Introduction to Total Quality Management (TQM), Barriers to TQM, Benefits of TQM implementation, Basic Approaches of TQM, TQM Models, Quality Information System and Planning. Importance of TQM in manufacturing and Service Industry.	07
III	**Organization Structure in TQM:** Role of Top Management, Quality Council, Quality Circles, Organization Structure for Quality Circles, Quality Policies, Role of Middle and Lower Management, Problem Solving Techniques.	07
IV	**Tools and Systems for Quality Management:** Basic Tools: Cause & Effect Diagram, Flow Diagrams, Trend Charts, Histogram, Scatter Diagram, Control Chart, Advanced Tools: Affinity Diagram, Inter Relationship Diagram, Tree Diagram, Matrix Diagram, Process Decision Program Chart (PDPC) and Matrix Data Analysis, Fault Tree Analysis, Quality Function Deployment (QFD) Definition and Phases in QFD. Taguchi Approach To Quality System Design, Six - sigma Definition & Implementation Steps, Just In Time Production System, Quality Production through JIT and Kanban, Failure Mode and Effect Analysis (FMEA): Scope, Mode, Illustrative Example and Applications.	10
V	**Quality Assurance:** Causes of Quality Failure, Quality Assurance: Need and Various Elements in Quality Assurance Programme, Quality Control-	09

	on Line and off Line, Statistical Concepts in Quality, Chance and Assignable Causes, Bench Making in Quality Management. Implementation and Need of ISO 9000: ISO 9000 - 2000 Quality System: Elements, Registration, Documentation, Implemental Steps, Quality Audit, Product and Process Audit Scope, Steps and Benefits.	

Books and References

1. Total Quality Management by Dale H Bersterfilled, PHI Publication.
2. Total Quality Management by N.V.R Naidu, G. Rajendra, New Age international Publication.
3. Total Quality Management by L. Sugandhi and Samuel Anand, PHI Publication.
4. Total Quality Management by R.S Naagarazan, New Age International Publication.

Syllabus

MANAGING E-COMMERCE AND DIGITAL COMMUNICATION (AHT-012)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES:

The course should enable the students:

1. To understand of concepts and techniques of internet marketing.
2. To study behavior and experience of online customer.
3. To study the various techniques of digital promotion.
4. To find out the opportunities for marketers on digital platform.
5. To understand the role of several e commerce models in customer value creation.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

1. Understand strategies used in digital marketing.
2. Apply interactive marketing communications to gratify online buyer.
3. Apply digital promotion techniques for marketing of product and services.
4. Evaluate the role of web analytics in social media marketing.
5. Apply and design various e commerce models for e-business.

Unit	Course Content	Lectures
I	**Introduction to digital marketing:** Digital marketing meaning scope and importance, Internet versus traditional marketing. Use of business to consumer and business to internet marketing, internet marketing strategy, Incorporating self-service technologies (SSTs).	08
II	**Online buyer behaviour and models:** marketing mix in online context. Managing online customer experience, planning website design, understanding site user requirement, site design and structure, integrated marketing communications (IIMC), measurement of interactive marketing communication, e-WOM.	08
III	**Digital promotion techniques:** email marketing, strategy to craft email marketing campaign, permission marketing, viral marketing, blogs, search engines marketing (SEM), Search engine optimization, content marketing.	08
IV	**Social media marketing:** designing content for social media marketing, mobile marketing advertising on mobile devices, mobile apps, tracking mobile marketing performance, and introduction to web analytics-meaning types, key metrics and tools.	08
V	**Introduction to e-Commerce and Retailing in Online Space:** advantages of e-Commerce Platforms, Differentiate Show-rooming and Web-rooming, e-tailing, e-Commerce Business Process, Business Models, Interpret e-Commerce Shopping Cart Software & Other Factors of e-Commerce based business, role of aggregators in e-Commerce business.	08

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Books and References

1. Kotler, P. and Keller, K.L. (2017) Marketing Management. 15 ° ed . India: Pearson Education .
2. Chaffey, D. and Ellis - Chadwick, F. (2012) . Digital Marketing Strategy. Implementation and Practice. 1st ed. Education
3. Digital Marketing: Cases from India by Rajendra Nargundkar and Romi Sainy, Notion Press, Inc.
4. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Rya Publisher.
5. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler, Publisher Wiley.

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INDUSTRIAL SAFETY AND HAZARD MANAGEMENT(AHT-013)

L:T:P: 3:0:0 **Credits-03**

COURSE OBJECTIVES:

The course should enable the students:

1. To impart knowledge about various aspects of industrial safety and occupational health.
2. To impart knowledge about Occupational Health and Toxicology.
3. To enable the students to identity hazard and assess risk.
4. To understand Acts and Rules of industrial safety and hazard management.
5. To teach about various safety acts and rules along with safety education and training.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

1. Identify the key aspects of industrial safety and mitigating them.
2. Describe various types of solution to problems arising in safety operations and hygiene.
3.Apply principles of OSHA in controlling industrial disasters and losses.
4. Identify various Acts and Rules of industrial safety and hazard management.
5. Assess the overall performance of safety protocols of chemical industries and hazard management.

UNIT I-

Concepts and Techniques: History of safety movement -Evolution of modern safety concept - Incident Recall Technique (IRT), disaster control, safety analysis, safety survey,safety inspection, safety sampling. Safety Audits - components of safety audit, types of audit,audit methodology, non - conformity reporting (NCR), audit checklist- identification of unsafe acts of workers and unsafe conditions in the industry.

UNIT II

Occupational Health and Toxicology: Concept and spectrum of health, functional units and activities of occupational health services, occupational related diseases and levels of prevention of diseases. Toxicology- local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems.

UNIT III

Hazard Identification and Risk Assessment: The process of risk management, hazard identification, evaluation (risk assessment, risk matrix), risk control implementation, action and recommendation.

UNIT IV

Acts and Rules: Indian boiler Act 1923, static and mobile pressure vessel rules (SMPV). motor vehicle rules, mines act 1952, workman compensation act, rules - electricity act and rules - hazardous wastes (management and handing) rules, 1989, with amendments in 2000 the building and other construction workers act 1996, Petroleum rules, Explosives Act 1963 Pesticides Act. Factories Act 1948 Air Act 1981 and Water Act 1974.

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UNIT V

Safety Education and Training: importance of training - identification of training needs training methods - programmes, seminars, conferences, competitions - method of promoting sale practice motivation communication - role of government agencies and private consulting agencies in safety training creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign - domestic Safety and Training.

Books and References

1. Industrial Accident Prevention by H.W Heinrich, McGraw - Hi 1980.
2. Safety Management in industry by NV. Krishnan, Jaico Publishing House, Bombay, 1997.
3. Loss Prevention in Process Industries by FP Lees, Butterworth London, 1990.
4. Safety at Work by J.R. Ridey Butterwort London 1983.

Syllabus

Neural Networks LAB(AIP-103)

L:T:P:: 0:0:2 **Credits-01**

Lab Description: The Neural Network Lab provides students with practical experience in designing, implementing, and training neural network models. Through a series of guided exercises and projects, students will gain proficiency in using neural networks for various tasks, including classification, regression, and sequence modeling.

Lab Objectives:

1. Understand the theoretical foundations of neural networks and deep learning.
2. Learn to implement neural network architectures using popular frameworks like TensorFlow or PyTorch.
3. Develop skills in training and fine-tuning neural network models for different applications.
4. Gain hands-on experience in solving real-world problems using neural networks.
5. Collaborate on projects to explore advanced topics and applications in neural networks.

Lab Schedule: The lab sessions are structured around the following topics:

Lab 1: Introduction to Neural Networks

- Setting up the programming environment (e.g., Anaconda, Jupyter Notebooks)
- Basic concepts of neural networks: neurons, activation functions, layers
- Implementing a simple feedforward neural network from scratch in Python

Lab 2: Neural Network Architectures

- Introduction to deep learning frameworks (TensorFlow, PyTorch)
- Building and training convolutional neural networks (CNNs) for image classification
- Implementing recurrent neural networks (RNNs) for sequence modeling tasks

Lab 3: Model Training and Optimization

- Training neural networks using stochastic gradient descent (SGD)
- Implementing advanced optimization techniques (e.g., Adam optimizer)
- Regularization methods: dropout, weight decay

Lab 4: Transfer Learning and Fine-tuning

- Transfer learning with pre-trained models (e.g., ImageNet)
- Fine-tuning pre-trained models for domain-specific tasks
- Hands-on exercises with transfer learning using TensorFlow or PyTorch

Lab 5: Advanced Topics in Neural Networks

- Generative Adversarial Networks (GANs) for image generation

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- Sequence-to-sequence models for machine translation or text generation
- Reinforcement learning with deep Q-learning networks (DQN)

Lab 6: Model Evaluation and Interpretation

- Evaluating neural network models using performance metrics (accuracy, loss)
- Interpretability of neural network models: visualizing activations, gradients
- Debugging and troubleshooting common issues in neural network training

Lab 7: Neural Network Applications

- Hands-on project: Applying neural networks to a real-world dataset or problem
- Project planning, implementation, and presentation
- Peer review and feedback on projects

Lab Materials:

- Programming environment (Anaconda distribution, Jupyter Notebooks)
- TensorFlow or PyTorch libraries for deep learning
- Datasets for hands-on exercises and projects

Syllabus

DEEP LEARNING LAB(AIP-104)

L:T:P:: 0:0:2 **Credits-01**

Course Outcomes: At the end of the Course the student shall be able to

CO1: Make use of deep learning APIs like Keras

CO2: Implement multiple conversions for Analysis

CO3: Apply deep learning techniques for object identification and segmentation

CO4: Implement RNN and CNN for multiple problems

CO5: Implement Autoencoders and GAN.

LIST OF EXPERIMENTS:

1. Build a deep neural network model start with linear regression using a single variable.
2. Build a deep neural network model start with linear regression using multiple variables.
3. Write a program to convert speech into text.
4. Write a program to convert text into speech.
5. Write a program to convert video into frames.
6. Write a program for Time-Series Forecasting with the LSTM Model.
7. Build a feed forward neural network for prediction of logic gates.
8. Write a program to implement deep learning Techniques for image segmentation.
9. Write a program for object detection using image labeling tools.
10. Write a program to predict a caption for a sample image using LSTM.
11. Write a program for character recognition using CNN.
12. Write a program to predict a caption for a sample image using CNN.
13. Write a program for character recognition using RNN and compare it with CNN.
14. Write a program to detect Dog image using YOLO Algorithm.
15. Write a program to develop Autoencoders using MNIST Handwritten Digits.
16. Write a program to develop a GAN for Generating MNIST Handwritten Digits.

Syllabus

Pattern and Anomaly Detection lab (AIP-105)

L:T:P:: 0:0:2 **Credits-01**

List of programs:

1. **Statistical Methods**:
    - Z-score calculation for anomaly detection.
    - Grubb's test for outlier detection.
    - Dixon's Q-test for outlier detection.
    - Generalized ESD test for detecting multiple outliers.
2. **Machine Learning Algorithms**:
    - Isolation Forest: Implementation of the Isolation Forest algorithm for anomaly detection.
    - One-Class SVM: Implementation of Support Vector Machine for one-class classification.
    - Local Outlier Factor (LOF): Implementation of the LOF algorithm for outlier detection.
    - k-Nearest Neighbors (kNN): Implementation of kNN for anomaly detection.
3. **Deep Learning Techniques**:
    - Autoencoders: Implementing autoencoder architectures for anomaly detection.
    - Variational Autoencoders (VAEs): Implementing VAEs for anomaly detection with probabilistic encoding.
    - Recurrent Neural Networks (RNNs): Using RNNs for time-series anomaly detection.
    - Long Short-Term Memory (LSTM) networks: Implementing LSTM networks for sequence anomaly detection.
4. **Time-Series Analysis**:
    - Fourier Transform: Implementing Fourier analysis for frequency-based pattern detection.
    - Wavelet Transform: Implementing wavelet analysis for time-frequency pattern detection.
    - Seasonal-Trend Decomposition: Decomposing time series into trend, seasonal, and residual components.
5. **Evaluation and Visualization**:
    - Precision, Recall, F1-score calculation for evaluating anomaly detection models.

- Receiver Operating Characteristic (ROC) curve analysis.
- Area Under the Curve (AUC) calculation for evaluating model performance.
- Visualization of detected anomalies and patterns in time series or feature space.

6. **Real-World Applications**:
   - Network Anomaly Detection: Implementing anomaly detection algorithms for network traffic data.
   - Fraud Detection: Implementing anomaly detection techniques for detecting fraudulent transactions.
   - Predictive Maintenance: Implementing anomaly detection for identifying equipment failures in industrial settings.
   - Health Monitoring: Implementing anomaly detection for detecting anomalies in medical sensor data.
7. **Hyperparameter Tuning and Optimization**:
   - Grid Search: Implementing grid search for hyperparameter tuning.
   - Random Search: Implementing random search for hyperparameter tuning.
   - Bayesian Optimization: Implementing Bayesian optimization for hyperparameter tuning.

Syllabus

CONSTITUTION OF INDIA (AHT-009)

L:T:P:: 2:0:0 **Credits-0**

COURSE OBJECTIVES: The objectives of this course are to

4. To acquaint the students with legacies of constitutional development in India and help to understand the most diversified legal document of India and philosophy behind it.
5. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
6. To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
7. **COURSE OUTCOMES**

On successful completion of the course, the students will be able to

6. Understand the basic knowledge and salient features of Indian Constitution.
7. Identify and explore the basic features and modalities about Indian constitution.
8. Discusses the essence of Union and its territories, Citizenship, Fundamental Rights, DPSP and Fundamental Duties.
9. Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
10. Differentiate different aspects of Indian Legal System and its related bodies.

Unit-1 Constitutional Framework

Meaning of Terms and Phrases frequently used in political system like constitution, constitutionalism, Rule of Law, Federal system, Government and so on. Historical Background of Indian Constitution, Making of Indian Constitution, Salient features of Indian Constitution, Preamble of Indian Constitution.

Unit-2 Different Parts, Articles, and their significance

Part I to IVA (Union and its territories w.r.t. Indian States, Citizenship, Fundamental Rights conferred to citizens and foreigners, Directive Principles of State Policy– Its importance and implementation and Fundamental Duties and its legal status), Article 1 to 51A and their significance.

Unit-3 System of Government

Parliamentary Form of Government in India – The constitution powers and status of the President of India, Federal structure and distribution of legislative and financial powers between the Union and the States, Emergency Provisions: National Emergency, President Rule, Financial Emergency and Amendment of the Constitutional Powers and Procedure and the significance of basic structure in Indian

Judicial system

Unit-4 Working of Central, State & Local Self Government as per constitution

Framework for central government (President, Vice president, Prime Minister, Central council of ministers, Parliament, Supreme court and so on), Framework for state government (Governor, Chief Minister, state legislature, High court and so on) and Framework for local self government (Panchayatiraj, Municipalities) and Union Territories.

Unit-5 Constitutional, Non-Constitutional and other bodies

Discussion on Various constitutional bodies like Election Commission, UPSC, SPSC, Finance commission, NCSC, NCST, NCBC, CAG and AGI. Discussion on Various non-constitutional bodies like NITI Aayog, NHRC, CIC, CVC, CBI, Lokpal and Lokayukta. Discussion on Various other constitutional bodies like Co- operative societies, Official Language, Tribunals etc.

Text/Reference books-

4. M. Laxmikanth, "Indian Polity", McGraw- Hill, 6th edition, 2020
5. D.D. Basu, "Introduction to the Indian Constitution", LexisNexis, 21st edition, 2020
6. S.C. Kashyap, " Constitution of India", Vitasta publishing Pvt. Ltd., 2019

Syllabus

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (AHT-010)

L:T:P:: 2:0:0 **Credits-0**

COURSE OBJECTIVES: The objectives of this course are to

6. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
7. To make the students understand the traditional knowledge and analyses it and apply it to their day to day life.
8. To make the students know the need and importance of protecting traditional knowledge.
9. To make the students understand the concepts of Intellectual property to protect the traditional knowledge.
10. This course is also concentrating on various acts in protecting the environment and Knowledge management impact on various sectors in the economy development of the country.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

6. Understand the concept of Traditional knowledge and its importance.
7. Know the need and importance of protecting traditional knowledge.
8. Know the various enactments related to the protection of traditional knowledge.
9. Understand the concepts of Intellectual property to protect the traditional knowledge.
10. Know the contribution of scientists of different areas.

Unit – 1 Introduction to Traditional and Culture Knowledge

Define culture, traditional, civilization and heritage knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK). Indigenous traditional knowledge Vs western traditional knowledge vis-à-vis formal knowledge.

Unit-2 Protection of Traditional Knowledge

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of traditional knowledge Protection, value of traditional knowledge in global economy, Role of

Government to harness traditional knowledge.

Unit – 3 Traditional Knowledge and Intellectual Property

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Global legal forums for increasing protection of Indian Traditional Knowledge.

Unit – 4 Traditional Knowledge in Different Sectors

Traditional knowledge in engineering, biotechnology and agriculture, traditional medicine system, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of traditional knowledge.

Unit – 5 Education System in India

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

Text/Reference Books:

6. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
7. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.
8. Traditional Knowledge System in India, by Amit Jha, 2009.
9. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
10. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh Pratibha Prakashan 2012.

Syllabus

HAPPINESS AND WELL-BEING (AHT-014)

L:T:P: 2:0:0 **Credits-0**

COURSE OBJECTIVES: The objectives of this course are:

1. To obtain a basic understanding of Positive emotions, strengths and virtues; the concepts and determinants of happiness and well-being.
2. To bring an experience marked by predominance of positive emotions and informing them about emerging paradigm of Positive Psychology
3. Build relevant competencies for experiencing and sharing happiness as lived experience and its implication.
4. To become aware of contextual and cultural influences on health and happiness.

COURSE OUTCOMES: On successful completion of the course, the students will be able to

1. Provide an insight to see the importance of positive emotions, Strength and Virtues in everyday life and society.
2. Use the strength and virtues in improving human behavior and mental health.
3. Understand the biological, social, psychological and spiritual determinants of Happiness and well-being.
4. Light on research findings related to effects of happiness and well-being on mental illness and stress.
5. Give an insight of the Indian philosophy of happiness and life satisfaction in context of Karma, Moksha and destiny and role of socio-demographic and cultural factors in Happiness and well-being.
6. Establish work life balance in an individual's life.

UNIT I: Introduction to Positive Psychology

Importance of positive emotions in everyday life and society, Positive Emotions and well being: Hope & Optimism, Love. The Positive Psychology of Emotional Intelligence, Influence of Positive Emotions Strength and Virtues; implications for human behavior and mental health.

UNIT II: Happiness

Determinants of Happiness and well-being – biological, social, psychological and spiritual, Types of happiness- Eudaimonic and Hedonic, Traits associated with Happiness, Setting Goals for Life and Happiness, Research findings on effects of happiness and well-being on mental illness and stress.

UNIT III: Resilience and Well Being

Meaning, Nature and Approaches Theories of Resilience, Positive Response to loss, Post Traumatic Growth, Models of PTG as Outcome, Models of PTG as a Coping Strategy Benefit Finding, Mindfulness and Positive Thinking, Building Resilience and Wellbeing.

UNIT IV: Happiness and Well-being in the Indian context

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Indian philosophy of happiness and life satisfaction. – Karma, Moksha and destiny. theory of happiness and wellbeing in Taittiriya Upanishad, Role of socio-demographic and cultural factors in Happiness and well-being. Health and Happiness in contemporary India – rural and urban differences and similarities.

UNIT V: Positive work life

Employee engagement- what causes individuals to join an organization and why they stay or leave, person-centered approach to engagement Understand the concept of work as meaning, Impact of employee well-being on the organization and impact of feelings about work on the individual's well-being. Bringing Positive Psychology to Organizational Psychology

SUGGESTED READINGS:

1. Dandekar, R. N. (1963). On dharma. In De Bary (ed.) Sources of Indian Tradition. Delhi, India: Motilal Banarasidass Publishers.
2. Dandekar R. N. (1981). Exercises in Indology. Delhi, India: Ajanta Publishers.
3. Snyder, C.R., &Lopez,S.J.(2007). Positive psychology: The scientific and practical explorations of human strengths. Thousand Oaks, CA: Sage. Snyder, C. R., & Lopez, S. (Eds.). (2002). Handbook of positive psychology. New York: Oxford University Press.
4. Seligman, M. (2011). Flourish: A Visionary New Understanding of Happiness and Well-being, Atria Books.
5. Peterson, C. A. (2006). A Primer in Positive Psychology, Oxford University Press.
6. Nettle, D.S. (2006). Happiness: The Science Behind Your Smile, Oxford University Press.
7. Lyubomirsky, S. (2013). The Myths of Happiness: What Should Make You Happy, but Doesn't, What Shouldn't Make You Happy, but Does, Penguin

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VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICALUNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)
Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

For

B.TECH

Computer Science & Engineering (Artificial Intelligence & Machine Learning)

4rd Year

Effective From – Session 2024-25

EFFECTIVE FROM 2025-26

B.Tech. CSE (Artificial Intelligence and Machine Learning) (w.e.f. 2025-26)

SEMESTER-VII

Sl. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-015/ AHT-016	HSC	HSMC -1 / HSMC-2	3	0	0	30	20	50	100		150	3
2	XXT-0XX	DE	Departmental Elective-4	3	0	0	30	20	50	100		150	3
3	XXT-0XX	DE	Departmental Elective-5	3	0	0	30	20	50	100		150	3
4		OE	Open Elective-2	3	0	0	30	20	50	100		150	3
5	AIP-106	DLC	Project Seminar	0	0	2			50			50	1
6	AIP-107	DLC	Design Project	0	0	4			100			100	2
7	AIP-108	DLC	Mini Project-III or Internship-III*	0	0	2			50			50	1
8	AHT-017	MC	Disaster Management	3	0	0	30	20	50	100		150	3
9	AHT-018	NC	Innovations and Problem Solving (Audit Course)	2	1	0	15	10	25	50		-	-
10	GP-07	NC	General Proficiency						50			-	-
			Total	**17**	**1**	**8**						**950**	**19**
11	**Minor Course (Optional)****			3	1	0	30	20	50	50		150	4

*The Internship-III (4-6 weeks) conducted during summer break after VI semester and will be assessed during VII semester

Departmental Elective - 4		Departmental Elective - 5	
AIT-007	Robotics and its Applications	CST-034	Data Science
AIT-104	Decision support and Intelligence System	CST-035	Cryptography and Network Security
AIT-001	Genetic algorithm and its applications	CST-020	Fuzzy Logic
CST-032	Data Mining	CST-037	Cloud Computing
CST-033	Blockchain	AIT-105	Predictive Analytics Essentials

HSMC-1	AHT-015	Rural Development, Administration and Planning
HSMC-2	AHT-016	Project Management & Entrepreneurship

Open Elective-2: (This course can be taken only by the students of branches other than CSE and specialized branches of CSE in VII Semester. Student of CSE and specialized branches of CSE shall opt open electives offered by other departments)

Subject code	Subject name
CSO-051	Computer Network

** **Minor Course (Optional): Select any subject from Annexure-II from other department**

Abbreviations: L-No. of Lecture hours per week, T-No. of Tutorial hours per week, P-No. of Practical hours per week, CT- Class Test Marks, TA-Marks of teacher's assessment including student's class performance and attendance, PS-Practical Sessional Marks, ESE-End Semester Examination, TE-Theory Examination Marks, PE- Practical External Examination Marks

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

EFFECTIVE FROM 2025-26

B.Tech. CSE (Artificial Intelligence and Machine Learning) (w.e.f. 2025-26)

SEMESTER-VIII

Sl. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
							Sessional Exam			ESE			
				L	T	P	CT	TA	Total	TE	PE		
1	AHT-016/ AHT-015	HSC	HSMC -2 / HSMC-1	3	0	0	30	20	50	100		150	3
2	XXT-0XX	DE	Departmental Elective-6	3	0	0	30	20	50	100		150	3
3		OE	Open Elective-3	3	0	0	30	20	50	100		150	3
4		OE	Open Elective-4	3	0	0	30	20	50	100		150	3
5	AIP-109	DLC	Project	0	0	12			100		200	300	6
6	GP-08	NC	General Proficiency						50			-	-
			Total	**12**	**0**	**12**						**900**	**18**
7	**Minor Course (Optional)****			3	1	0	30	20	50	50	100	150	4

Subject code	Departmental Elective - 6
CST-039	Soft Computing
AIT-106	Intelligent Vehicle Technology
CST-041	Cyber and Digital Forensic
CST-042	Digital image Processing
CST-043	Big Data Analytics

Open Elective-3 and Open Elective-4: (This course can be taken only by the students of branches other than CSE and specialized branches of CSE in VIII Semester. Students of CSE and specialized branches of CSE shall opt open electives offered by other departments)

Open Elective-3		Open Elective-4	
CSO-052	Software Engineering	CSO-053	Object Oriented Programming

** **Minor Course (Optional): Select any subject from Annexure-II from other department**

Abbreviations: L-No. of Lecture hours per week, T-No. of Tutorial hours per week, P-No. of Practical hours per week, CT- Class Test Marks, TA-Marks of teacher's assessment including student's class performance and attendance, PS-Practical Sessional Marks, ESE-End Semester Examination, TE-Theory Examination Marks, PE- Practical External Examination Marks

1 Hr Lecture	1 Hr Tutorial	2 or 3 Hr Practical
1 Credit	1 Credit	1 Credit

Syllabus

RURAL DEVELOPMENT: ADMINISTRATION AND PLANNING (AHT-015)

L:T:P:: 3:1:0 **Credits-03**

Course Objectives

This course enables the students to:

1. Gain knowledge on the concepts related to administration, its importance and various approaches of Development Administration.
2. Gain skills on New Public Management, Public Grievances and Redressal Mechanisms, Accountability and Transparency in Administration and e-governance in the rural development sector.
3. Develop their competency on the role of Bureaucracy in Rural Development.

Course Outcomes

After completion of the course student will be able to:

1. Students can understand the definitions, concepts and components of Rural Development.
2. Students will know the importance, structure, significance, resources of Indian rural economy.
3. Students will have a clear idea about the area development programmes and its impact.
4. Students will be able to acquire knowledge about rural entrepreneurship.
5. Students will be able to understand about the using of different methods for human resource planning.

Course Contents

UNIT-I:

Rural Planning & Development: Concepts of Rural Development, Basic elements of rural Development, and Importance of Rural Development for creation of Sustainable Livelihoods, An overview of Policies and Programmes for Rural Development- Programmes in the agricultural sector, Programmes in the Social Security, Programmes in area of Social Sector.

UNIT-II:

Rural Development Programmes: Sriniketan experiment, Gurgaon experiment, Marthandam experiment, Baroda experiment, Firkha development scheme, Etawapilot project, Nilokheri experiment, approaches to rural community development: Tagore, Gandhi etc.

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UNIT-III:

Panchayati Raj & Rural Administration: Administrative Structure: bureaucracy, structure of administration; Panchayati Raj Institutions Emergence and Growth of Panchayati Raj Institutions in India; People and Panchayati Raj; Financial Organizations in Panchayati Raj Institutions, Structure of rural finance, Government & Non-Government Organizations / Community Based Organizations, Concept of Self help group.

UNIT-IV:

Human Resource Development in Rural Sector: Need for Human Resource Development, Elements of Human Resource Development in Rural Sector Dimensions of HRD for rural development-Health, Education, Energy, Skill Development, Training, Nutritional Status access to basic amenities – Population composition.

UNIT-V:

Rural Industrialization and Entrepreneurship: Concept of Rural Industrialization, Gandhian approach to Rural Industrialization, Appropriate Technology for Rural Industries, Entrepreneurship and Rural Industrialization- Problems and diagnosis of Rural Entrepreneurship in India, with special reference to Women Entrepreneurship; Development of Small Entrepreneurs in India, need for and scope of entrepreneurship in Rural area.

Text Books/References:

1. Corporate Social Responsibility: An Ethical Approach - Mark S. Schwartz.
2. Katar Singh: Rural Development in India – Theory History and Policy.
3. Todaro M.P. Economic Development in III World war.
4. Arora R.C – Integrated Rural Development in India.
5. Dhandekar V.M and Rath N poverty in India.
6. A.N.Agarwal and Kundana Lal: Rural Economy of India
7. B.K.Prasad: Rural Development-Sarup& Son’s Publications.

Syllabus

PROJECT MANAGEMENT & ENTREPRENEURSHIP (AHT-016)

L:T:P:: 3:1:0 **Credits-03**

COURSE OBJECTIVES:

The course should enable the students to:

1 Understand the concepts of Project Management for planning to execution of projects.
2 Understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3 Be capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.
4 Understand the concepts of Entrepreneurship, role of entrepreneur in economic development, steps for establishing an enterprise.

COURSE OUTCOMES:

After completion of the course student will be able to:

1. Understand project characteristics and various stages of a project.
2. Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
3. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
4. Describe Entrepreneurship, Examine role of entrepreneur in economic development.
5. Describe the steps to establish an enterprise.

UNIT-I:

Entrepreneurship: Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clellend's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes.

UNIT-II

Entrepreneurial Idea and Innovation: Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness.

Syllabus

UNIT-III:

Project Management: Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal, Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.

UNIT-IV

Project Financing: Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.

UNIT-V:

Social Entrepreneurship: Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.

Case study and presentations: Case study of successful and failed entrepreneurs. Power point presentation on current business opportunities.

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harperand Row.
2. Business, Entrepreneurship and Management: Rao, V.S.P.;Vikas
3. Entrepreneurship: Roy Rajeev.
4. Text Book of Project Management: Gopal krishnan, P.and Ramamoorthy, V.E.;McMill.
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.;PHI.
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.;MGH.

Syllabus

Departmental Elective-4

ROBOTICS AND ITS APPLICATIONS (AIT-007)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. To provide an introduction to Robotics
2. Robotics Automation including robot classification, design and selection, analysis and applications in industry.
3. To provide information on various types of end effectors, their design, interfacing and selection.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

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

1. list and explain the basic elements of industrial robots
2. Analyze robot kinematics and its control methods.
3. classifythe various sensors used in robots for better performance.
4. summarize various industrial and non-industrial applications of robots.

UNIT 1- ROBOT BASICS:

Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot.

UNIT 2- ROBOT ELEMENTS:

Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot.

UNIT 3- ROBOT KINEMATICS AND CONTROL:

Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming

UNIT 4- ROBOT SENSORS:

Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.

UNIT 5- ROBOT APPLICATIONS:

Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.

Syllabus

TEXT BOOKS:

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology, Programming and Applications”, Tata –McGraw Hill Pub. Co., 2008.
2. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.
3. Klafter.R.D, Chmielewski.T.A, and Noggin’s., “Robot Engineering: An Integrated Approach”’, Prentice Hall of India Pvt. Ltd., 1994.

REFERENCE BOOKS

1. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, “Robotics control, sensing, vision and intelligence”, Tata- McGraw Hill Pub. Co., 2008
2. Yu. “Industrial Robotics”, MIR Publishers Moscow, 1985.

Syllabus

Departmental Elective-4

Decision Support and Intelligence System (AIT-104)

L:T:P:3:0:0 **CREDITS-3**

Course Objectives:- The primary objectives of the course is to knowledge and skills of

(A) concept of managerial decision systems

(B) DSS components and identify sources of data for business intelligence

(C) Categorize the methodologies involved in DSS development

(D) AI and Expert systems.

Course Outcomes:-

1. Understand concept of managerial decision systems and outline its various phases.
2. Demonstrate DSS components and identify sources of data for business intelligence.
3. Categorize the methodologies involved in DSS development.
4. Analyze evolution of enterprise DSS and knowledge management initiatives.
5. Infer AI and Expert systems evolution and probe advances in intelligent support systems.

Unit-I Decision Making

Managerial decision making and information systems - framework and concept for decision support, Decision making - introduction – definition - systems and models, phases of decision making process - Personality Types – Gender - Human Cognition - and Decision Styles.

Unit- II Modeling and Analysis

Definition – Characteristics and capabilities of DSS – DSS components - Modeling and issues – Static and dynamic models – Certainty, Uncertainty and Risk – Influence Diagrams – Structure of Mathematical models.

Unit- III DSS Development

Introduction – Traditional and alternative development methodologies - Change Management – DSS Technology Levels and Tools – Development Platforms – Tool Selection

Unit-IV Enterprise DSS and Knowledge Management

Communication support – Collaboration support - Group support systems and technologies –GSS meeting process – Creativity and idea generation – Enterprise information systems –Evolution – Characteristics and capabilities of executive support systems – Organizational DSS - Organizational learning and transformation – Knowledge management initiatives – approaches – implementation.

Unit-V Business Intelligence

Nature and Sources of data – Data collection, problems and quality – Database organizations and structures -Data warehousing, Data mining and Data visualization.

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Text Books:

1. Efraim Turban, Jay E Aronson, Ting Peng Liang, Decision Support and Intelligent Systems, Prentice Hall of India, 7th Edition 2005.

2. Elain Rich and Kevin Knight, Artificial intelligence, TMH, 2006.

3. Efraim Turban, Ramesh Sharda, Dursun Delen, Decision support and Business Intelligence systems, Pearson Education, 9th Edition, 2011.

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Departmental Elective-4

Genetic Algorithms and its Applications (AIT-001)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to:

1. Genetic Algorithm (GA) is a search-based optimization technique based on the principles of Genetics and Natural Selection.
2. It is frequently used to find optimal or near-optimal solutions to difficult problems which otherwise would take a lifetime to solve.

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Explain the principles underlying Evolutionary Computation in general and Genetic Algorithms in particular.
2. Get acquainted with the theoretical foundation of genetic algorithms.
3. Apply Evolutionary Computation Methods to find solutions to complex problems
4. Analyze and experiment with parameter choices in the use of Evolutionary Computation
5. Summarize current research in Genetic Algorithms and Evolutionary Computing

Unit 1-Introduction

A brief history of evolutionary computation, Elements of Genetic Algorithms, A simple genetic algorithm, Applications of genetic algorithms Evolving computer programs, data analysis & prediction, evolving neural networks, Modeling interaction between learning & evolution, modeling sexual selection, measuring evolutionary activity.

Unit -II- Theoretical Foundation of genetic algorithm

Schemas & Two-Armed and k-armed problem, royal roads, exact mathematical models of simple genetic algorithms, Statistical- Mechanics Approaches.

Unit -III Computer Implementation of Genetic Algorithm

Data structures, Reproduction, crossover & mutation, mapping objective functions to fitness form, fitness scaling, coding, a multiparameter, mapped, fixed point coding, discretization and constraints.

Unit -IV Applications of genetic algorithms

The risk of genetic algorithms, De Jong & function optimization, Improvement in basic techniques, current application of genetic algorithms.

Unit -V Advanced operators & techniques in genetic search

Dominance, duplicity, & abeyance, inversion & other reordering operators. Other micro operators, Niche & speciation, multiobjective optimization, knowledge based techniques, genetic algorithms & parallel processors.

Text Books

1. David E. Goldberg, "Genetic algorithms in search, optimization & Machine Learning" Pearson Education, 2006
2. Melanle Mitchell, "An introduction to genetic algorithms", Prentice Hall India, 2002.
3. Michael D. Vose, "The simple genetic algorithm foundations and theory, Prentice Hall India, 1999

4. Masatoshi Sakawa, "Genetic Algorithms & Fuzzy Multiobjective Optimization", Kluwer Academic Publisher, 2001

Reference Books

1. D. Quagliarella, J Periaux, C Poloni& G Winter, "Genetic Algorithms in Engineering & Computer science", John Wiley & Sons, First edition, 1997
2. PinakiMzumder, Elizabeth M. Raudnick, "Genetic Algorithms for VLSI design, layout and test automation", Pearson Education, 2006

Syllabus

Departmental Elective-4

DATA MINING (CST-032)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Present methods for mining frequent patterns, associations, and correlations.

2. Describes methods for data classification and prediction, and data–clustering approaches.

3. Covers mining various types of data stores such as spatial, textual, multimedia, streams.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Interpret the contribution of data warehousing and data mining to the decision-support level of organizations

2. Evaluate different models used for OLAP and data preprocessing

3. Categorize and carefully differentiate between situations for applying different data-mining techniques: frequent pattern mining, association, correlation, classification, prediction, and cluster and outlier analysis

4. Design, implement and evaluate the performance of different data-mining algorithms

5. Propose data-mining solutions for different applications

Unit 1- DATA WAREHOUSE: Data Warehousing - Operational Database Systems vs Data Warehouses -

Multidimensional Data Model - Schemas for Multidimensional Databases – OLAP operations – Data Warehouse Architecture – Indexing – OLAP queries & Tools.

Unit 2- DATA MINING & DATA PREPROCESSING: Introduction to KDD process – Knowledge Discovery from Databases - Need for Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

Unit 3- ASSOCIATION RULE MINING: Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Item sets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint – Based Association Mining.

Unit 4- CLASSIFICATION & PREDICTION: Classification vs Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures –Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Unit 5- CLUSTERING: Cluster Analysis - Types of Data in Cluster Analysis – A Categorization of Major

Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Data Visualization: Principles, Parallel Coordinates, Visualization Neural Networks, Visualization of trees.

TEXTBOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.

2. Data Mining, pang-ning tan and Michael steinbach, second edition, Pearson Education.

3. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

4. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.

REFERENCE BOOKS:

1. K.P. Soman, ShyamDiwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

2. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition

Syllabus

Departmental Elective-4

BLOCKCHAIN (CST-033)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Study the concepts of blockchain technologies.

2. Cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus.

3. Familiarize potential applications for Bit coin-like crypto currencies.

4. Learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Understand Blockchain technology.

2. Develop Blockchain based solutions and write smart contract using Hyperledger Fabric and Ethereum frameworks.

3. Build and deploy Blockchain application for on premise and cloud-based architecture.

4. Develop the concepts for safe use of crypto currency

5. Integrate ideas from various domains and implement them using Blockchain technology

Unit 1-Introduction: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain. Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

Unit 2-Understanding Blockchain with Crypto currency: Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashcashPoW, BitcoinPoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Unit 3-Understanding Blockchain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned Blockchain- Distributed consensus in

closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Unit 4-Enterprise application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Blockchain

Unit 5-Blockchain application development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda.

TEXT BOOKS:

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O‟Reilly, first edition – 2015.

2. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017.

3. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.

4. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, first edition – 2012.

REFERENCE BOOKS:

1. Ritesh Modi, “Solidity Programming Essentials: A Beginner‟s Guide to Build Sma Ethereum and Block Chain”, Packt Publishing.

2. Antony Lewis, “The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Digital Assets)”, Mango Publications.

3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015.

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Departmental Elective 5

DATA SCIENCE (CST-034)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVE: The objectives of the course are to

1. Learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration.

2. Understand the basic types of data and basic statistics.

3. Identify the importance of data reduction and data visualization techniques

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Demonstrate the mathematical foundations needed for data science.

2. Collect, explore, clean and manipulate data.

3. Demonstrate the basic concepts of machine learning.

4. Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering.

5. Build data science applications using Python based toolkits.

Unit 1-Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting

Unit 2-Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK Visualizing Data: Bar Charts, Line Charts, Scatterplots Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning, Manipulating Data, Rescaling, Dimensionality Reduction

Unit 3-Mathematical Foundations: Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution

Unit 4-Machine Learning: Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series-Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks- Learning and Generalization, Overview of Deep Learning.

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Unit 5-Case Studies of Data Science Application: Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.

2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.

3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

2. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.

3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.

4. Paul Teetor, "R Cookbook", O'Reilly, 2011.

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Departmental Elective 5

CRYPTOGRAPHY & NETWORK SECURITY (CST-035)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Explain the importance and application of each of confidentiality, integrity, authentication and availability.

2. Understand various cryptographic algorithms and basic categories of threats to computers and networks.

3. Describe the enhancements made to IPv4 by IPSec.

4. Understand Intrusions, intrusion detection, Web security and Firewalls.

COURSE OUTCOMES: On Successful completion of this course, the students will be able to

1. Identify the various attacks and its issues.

2. Learn usage of cryptographic algorithms for avoiding basic level threats.

3. Comprehend the issues involved in Integrity, Authentication and Key Management techniques.

4. Realize the importance of user authentication and Kerberos concepts.

5. Acquire the knowledge of network and system security domain.

Unit 1- Introduction of Cryptography: Introduction To security: Attacks, Services and Mechanisms, Conventional Encryption: Conventional Encryption Model, Steganography, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Cryptanalysis, Block Cipher Modes of Operations.Double DES, Triples DES, Blowfish, International Data Encryption Algorithm,Placement of Encryption Function, Key Distribution, Random Number Generation and Traffic confidentiality

Unit 2- Number Theory and Public Key Encryption: Fermat's and Euler's Theorem, Primality Testing, Chinese Remainder Theorem , Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm.

Unit 3- Key Management: Key Management scenario in secret key and public key cryptography, Diffie Hellman Key Exchange algorithm, OAKLEY and ISAKMP key management protocol, Elliptic Curve Cryptography

Unit 4-Hash Functions: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures, Digital Signature Standard (DSS).

Unit 5- Network and System Security: Authentication Applications: Kerberos, X.509, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header,

Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (SET), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.

2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.

2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.

3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.

4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.

5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.

6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

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Department Elective 5

FUZZY LOGIC (CST-020)

L:T:P:: 3:0:0 **Credits-03**

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COURSE OBJECTIVES: The objectives of this course are to

1. Develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
2. Lean about scalar variables' fuzzification and membership functions' defuzzification.
3. Learn three different inference methods to design fuzzy rule-based system.
4. Develop fuzzy decision making by introducing some concepts and also Bayesian decision methods.
5. Learn different fuzzy classification methods.

COURSE OUTCOMES: On successful completion of the course, the students will be able to

1. Understand the basic ideas of fuzzy sets, operations and properties of fuzzy sets, and fuzzy relations.
2. Understand the basic features of membership functions, fuzzification process and defuzzification process.
3. Design fuzzy rule-based system.
4. Know about combining fuzzy set theory with probability to handle random and non-random uncertainty, and the decision-making process.
5. Gain the knowledge about fuzzy C-Means clustering.

Unit – I: Classical Sets: Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets.
Classical and Fuzzy Relations: Cartesian product, crisp relations-cardinality, operations, and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

UNIT II: Fuzzification and Defuzzification : Features of the membership functions, various forms, fuzzification, defuzzification to crisp sets, l- cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, other forms of the implication operation.

UNIT III : Fuzzy Systems : Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of

fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories.

UNIT IV: Fuzzy Decision Making: Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multi objective decision making, Fuzzy Bayesian, Decision method, Decision making under Fuzzy states and fuzzy actions.

UNIT V: Fuzzy Classification: Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition.

TEXTBOOK(s):

1. Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.

2. George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi,1995.

REFERENCE BOOK(s):

1. S.Rajasekaran, G.A.Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms, Synthesis and Applications, PHI, New Delhi,2003.

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Department Elective 5

CLOUD COMPUTING (CST-037)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Provides an insight into cloud computing.

2. Enable students to deliver an application built in the cloud with the concept of application-based building blocks for processing of data.

3. Appreciate the emergence of cloud as the next generation computing paradigm.

COURSE OUTCOMES: Upon completion of this course, the students will be able to

1. Impart the knowledge of cloud computing and technologies, issues in cloud computing etc.

2. Design and develop cloud and implement various services on cloud.

3. To develop an understating of virtualization technology and its different dimensions.

4. Investigate the issues and challenges in implementing cloud security.

5. Compare and contrast various open and proprietary cloud platforms

Unit 1- Introduction to Cloud Computing: Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud.

Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

Unit 2- Introduction to Cloud Technologies: Study of Hypervisors, Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services.

Virtualization Technology: Virtual machine technology, Virtual Machine migration, virtualization applications in enterprises, Pitfalls of virtualization.

Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications,

Unit 3- Data and Security in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, Map-Reduce model, Enterprise batch processing using Map-Reduce.

Cloud computing security challenges: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud

Unit 4- Service Management and Monitoring in Cloud: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud.

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Monitoring in cloud: Implementing real time application over cloud platform, Cloud Federation, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Cloud Middleware, load balancing, resource optimization, resource dynamic reconfiguration,

Unit 5- Cloud computing platforms: Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, Open Nebula, Nimbus, T-Platform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform

TEXT BOOK:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012.

2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCE BOOK:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.

2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.

3. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010.

4. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy an Enterprise Perspective on Risks and Compliance", O'Reilly, 2009.

Syllabus

Department Elective 5

Predictive Analytics Essentials (AIT-105)

L:T:P:3:0:0 **CREDITS-3**

Course Objectives:

1. To summarize the fundamentals of predictive analytics.
2. To illustrate the application of machine learning for predictive analytics.
3. To utilize predictive analysis models for solving problems.

Course Outcomes: By learning the course, the students will be able to

1. illustrate the steps involved in predictive analytics and modeling.
2. demonstrate data cleaning procedures and preprocessing.
3. examine association rule mining and descriptive modeling for prediction.
4. utilize Machine learning in predictive analytics.
5. discover the role of ensembles and text mining methods.
6. apply predictive modeling for solving real world problems.

Module 1: Overview of Predictive Analytics and Modeling

What is Analytics? – What is Predictive Analytics? – Business Intelligence - Predictive Analytics vs.Business Intelligence - Predictive Analytics vs. Statistics - Predictive Analytics vs. Data Mining - Challenges in Using Predictive Analytics - Predictive Analytics Processing Steps: CRISP-DM - Business Understanding - Defining Data for Predictive Modeling - Defining the Target Variable - Defining Measures of Success for Predictive Models - Doing Predictive Modeling.

Module 2: Data Exploration and Pre-processing

Data Preparation: Variable Cleaning – Feature Creation.

Module 3: Association Rule Mining and Descriptive Modeling

Item sets and Association Rules – Parameter Settings – Data Organization – Measures of Interesting Rules – Deploying Association Rules – Building Classification Rules from Association Rules - Descriptive Modeling: Data Preparation Issues with Descriptive Modeling – Principal Component Analysis – Clustering Algorithms - Interpreting Descriptive Models: Standard Cluster Model Interpretation.

Module 4: Utilizing Machine Learning in Predictive Modeling

Predictive Modeling: Decision Trees – Logistic Regression – Neural Networks – K-Nearest Neighbor – Naïve Bayes – Regression Models – Linear Regression – Other Regression Algorithms.

Module 5: Ensemble Modeling and Text Mining

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Model Ensembles: Motivation for Ensembles – Bagging – Boosting – Improvements to Bagging and Boosting – Model Ensembles and Occam's razor – Interpreting Model Ensembles - Text Mining: Motivation – A Predictive Modeling Approach – Structured vs Unstructured Data – Why Text Mining is Hard – Data Preparation Steps – Text Mining Features – Modeling with Text Mining Features - Regular Expressions - Model Deployment: Considerations – Deployment Steps.

Module 6: Application of Predictive Analytics to solve Problems

Case Studies: Survey Analysis – Help Desk.

Text Book:

Dean Abbot, "Applied Predictive Analysis", Wiley, 2014. ISBN: 9781118727966.

Reference Books:

1. Daniel T. Larose, Chantal T. Larose, Data Mining and Predictive Analytics, Wiley, 2015, ISBN: 9781118116197.

2. Eric Siegel, Predictive Analytics, Wiley, Kindle Edition, ASIN: B019HR9X4U.

3. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, Kindle Edition, For Dummies, ASIN: B01LWWNQFK.

4. Kjell Johnson, Max Kuhn, Applied Predictive Modeling, Springer, 2016, ISBN: 9781461468486.

5. Thomas W. Miller, Modeling Techniques in Predictive Analytics, Pearson FT Press, 2014, ISBN: 978-0133892062.

6. Alvaro Fuentes, "Hands on Predictive Analytics with Python", Packt Publishing, 2018, ISBN: 9781789138719.

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OPEN ELECTIVE-2

COMPUTER NETWORK (CSO-051)

L:T:P:: 3:0:0 **CREDITS-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the protocol layering and physical level communication.
2. Analyze the performance of a network .and understand the various components required to build different networks.
3. Learn the functions of network layer and the various routing protocols.
4. Familiarize the functions and protocols of the Transport layer.

COURSE OUTCOMES: On completion of the course, the students will be able to

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of local area networks (LANs, wide-area networks (WANs) and Wireless LANs (WLANs).
3. Address the issues related to network layer and various routing protocols.
4. Configure DNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP.
5. Configure Bluetooth, Firewalls using open source available software and tools.

Unit 1- Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit 2- Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols- Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, high level data link control(HDLC), Point To Point protocol (PPP).

Unit 3- Network Layer: Repeater, Hub, Switches, Bridges, Gateways, Switching, Logical addressing – IPV4, IPV6, Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit 4- Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

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Unit 5- Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography , Digital Signature.

TEXTBOOK:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013

Syllabus

R PROGRAMMING LAB (AIP-002)

L:T:P:: 0:0:2 **Credits-01**

COURSE OBJECTIVES: The objectives of the course are to

1. Demonstrate use of basic functions
2. Create their own customized functions
3. Construct tables and figures for descriptive statistics
4. Learn to understand new data sets and functions by yourself
5. Work on built in real time cases for analysis and visualization

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Setup R Programming Environment.
2. Understand and use R – Data types.
3. Understand and use R – Data Structures.
4. Develop programming logic using R – Packages.
5. Analyze data sets using R – programming capabilities

LIST OF EXPERIMENTS:

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.
2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)
3. Write a program to find list of even numbers from 1 to n using R-Loops.
4. Create a function to print squares of numbers in sequence.
5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.
6. Implement different String Manipulation functions in R.
7. Implement different data structures in R (Vectors, Lists, Data Frames)
8. Write a program to read a csv file and analyze the data in the file in R
9. Create pie chart and bar chart using R.
10. Create a data set and do statistical analysis on the data using R.

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PROJECT SEMINAR (AIP-106)

L:T:P:: 0:0:2 **CREDITS-01**

THE OVERVIEW OF PROJECT SEMINAR

The course is accompanied by seminars that introduce new approaches to understand and further elaborate different facets of innovation thinking and to provide participants with practical training as well as ready to use state of the art knowledge. Besides, students will present on a regular basis the development of their business plans of practical oriented innovation projects. At last, students will be asked to defend their developed business plans of projects with consideration of discussed aspects. The aim of this course is to consolidate, expand and exercise theoretical and practical skills for successful implementation of projects from start to finish by developing business plans of innovative projects.

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Prepare and develop practically applicable business plan for an innovative project with consideration of addressed issues.
2. Develop the sub-skills required for business plans of innovation projects presentation and group discussions.
3. Acquire the soft skills and interpersonal skills which will help them in their workplace needed for these functions.
4. Develop planning skills of the innovative projects and business ideas in order to improve professional competencies.
5. Make presentation on the topic, answer the queries/questions that come forward, clarify, and supplement if necessary, and submit a report.

The Project Seminar consists of four major topics:

1. Project introduction
2. Project environment
3. Project assessment
4. Project presentation

Project introduction includes an introductory session where students will understand how to apply specific tools and models in innovation project management, as well as how to manage teamwork. Also, during this topic, the ideas of projects will be introduced with taking into account appropriate cases of specific projects across different industries. The session ends with the choice of core stream for which students will be asked to prepare a project.

Project environment allows students to learn market analysis, including identification of current trends in the industry by using suitable strategic planning tools, and evaluating external/internal risk factors. In addition, the competition analysis and the estimation of risks in innovative projects will be introduced.

Project assessment provides understanding and practical knowledge of assessment and forecasting of potential markets by using various approaches within the innovation project management, as well as cost analysis and assessment of the impact of innovation on the cost structure.

Project presentation assumes that students will apply learned knowledge and skills by developing business plans of

innovation projects, its discussions, and presentations. An oral defense will be held at the last class (final colloquium), in which students present the developed business plan of the innovation project with consideration of addressed issues.

The assessment of the Project Seminar

The activities on the Project Seminar classes and developed projects are assessed separately. Students form groups of 3-5 members to develop business plan of practical innovative project plan i.e., project. The final grade will be calculated in accordance with the syllabus of this course. Students are expected to develop and gradually improve their business plans of innovation projects with regular presentations of interim results. Apart from that, by the end of the course students are supposed to submit their final version of business plans of projects as an essay. The oral defense of group project will be held on the final colloquium.

Syllabus

DESIGN PROJECT (AIP-107)

L:T:P:: 0:0:4 **CREDITS-02**

COURSE OBJECTIVES: The objectives of the course are to

1. Develop skills in doing literature survey, technical presentation, and report preparation.
2. Enable project identification and execution of preliminary works on final semester project.

COURSE OUTCOMES: On successful completion of this course, the students shall be able to

1. Discover potential research areas in the field of information technology.
2. Create very precise specifications of the IT solution to be designed.
3. Have introduction to the vast array of literature available about the various research challenges in the field of IT.
4. Use all concepts of IT in creating a solution for a problem.
5. Have a glimpse of real world problems and challenges that need IT-based solutions.

Syllabus

Internship-III/Mini Project-III (AIP-108)

L:T:P:: 0:0:2 **CREDITS-01**

ABOUT INTERNSHIP/MINI PROJECT

It is an organized method or activity of enhancing and improving engineering students' skill sets and knowledge, which boosts their performance and consequently helps them meet their career objectives. Internship/Mini Project is essential in developing the practical and professional skills required for an Engineer and an aid to prospective employment.

OBJECTIVES OF INTERNSHIP/MINI PROJECT:

1. The main objective of Internship/Mini Project is to expose the students to the actual working environment and enhance their knowledge and skill from what they have learned in college.
2. Another purpose of this program is to enhance the good qualities of integrity, responsibility, and self-confidence. Students must follow all ethical values and good working practices.
3. It is also to help the students with the safety practices and regulations inside the industry and to instils the spirit of teamwork and good relationship between students and employees.

COURSE OUTCOMES: At the end of Industrial Training, the students will be able to

1. Understand organizational issues and their impact on the organization and employees.
2. Identify industrial problems and suggest possible solutions.
3. Relate, apply, and adapt relevant knowledge, concepts and theories within an industrial organization, practice and ethics.
4. Apply technical knowledge in an industry to solve real world problems.
5. Demonstrate effective group communication, presentation, self-management, and report writing skills**.**

Syllabus

DISASTER MANAGEMENT (AHT-017)

L:T:P:: 2:0:0 **CREDITS-02**

COURSE OBJECTIVES:

The course should enable the students:

1. To introduce the students to various types of natural and manmade disasters.
2. To understand causes and impact of disasters.
3. To understand approaches of Disaster Management.
4. To build skills to respond to disaster.

COURSE OUTCOMES:

At the end of the course, Student will be able:

1. To provide students an exposure to disasters, their significance and types.
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
3. To understand approaches of Disaster Management.
4. To build skills to respond to disaster.

Unit-1 Introduction to Disasters

Concepts, and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks). Disaster Types, Trends, Causes, Consequences and Control of Disasters, Geological Disasters; Hydro-Meteorological, Biological, Technological and Manmade Disasters.

Unit-2 Disasters: Classification, Causes, Impacts

(Including social, economic, political, environmental, health, psychosocial, etc.)
Differential impacts-in terms of caste, class, gender, age, location, disability. Global trends in disasters urban disasters, pandemics, complex emergencies, Climate change.

Unit-3 Approaches to Disaster Risk Reduction:

Disaster cycle- its analysis, Phases, Culture of safety, prevention, mitigation and preparedness, community based DRR, Structural- nonstructural measures, roles and responsibilities of community, Panchayati Raj Institutions/ Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders.

Unit-4 Inter-relationship between Disasters & Development

Factors affecting Vulnerabilities, differential impacts, Impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources

Unit-5 Disaster Risk Management in India:

Hazard and Vulnerability profile of India. Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)

Text/Reference Books:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)

Syllabus

2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

Syllabus

INNOVATIONS AND PROBLEM SOLVING(AHT-018)

L:T:P:: 2:1:0 **CREDITS-0**

PREREQUISITE:
Basic Engineering Aptitude

COURSE OBJECTIVES:
This subject aims to inculcate critical thinking abilities and application of knowledge for problem solving. It will expose the students with various simple methods and practices that are essential to development of new systems, problem formulation and problem solving in technical and non-technical fields. This course will stimulate the work environment of the modern day engineers and technologists by familiarizing them with the state-of-the art results, design and analysis tools in various disciplines, the ability to extract relevant information to formulate and solve problems arising in practice.

COURSE OUTCOMES:
The course will enable students to,

1. Identify the market and value proposition
2. Carry out rigorous and accessible formulation to problems
3. Solutions via reducing the search space
4. Eliminating tradeoffs to reduce dimension of optimization problems
5. Execution through developing strategies for experiment, construction and monetization.
6. Simulate the work environment of the modern engineer or knowledge worker in general.

Unit – I **8 Hrs**
Introduction to Critical Design Thinking

- Understanding critical thinking, creative thinking, and problem solving through examples.
- New ways to solve problems.

Unit – II **8 Hrs**
Theory of Inventive Problem Solving

- Examples of inventive problem solving,
- Era of technical systems,
- Science of inventing,
- Art of inventing,
- Amazing world of tasks

Unit – III **8 Hrs**
Logic and Tools for Creativity and Clarity of Thought

- TRIZ tools for creativity and solutions,
- World's known solutions,
- Fundamentals of Problem solving,
- Thinking in Time and Scale,
- Uncovering and solving contradictions,
- Fast Thinking with ideal outcome.

Unit – IV **8 Hrs**
Modeling for Problem Solving

- Moving from problem to ideal final result,

Syllabus

- Tradeoffs and inherent contradictions,
- Invisible reserves,
- Law of increasing ideality,
- Evaluation of solutions,
- Enriching models for problem solving.

Unit – V **8 Hrs**

Principles for Innovation

- General review,
- Segmentation, Separation,
- Local quality, symmetry change, merging and multifunctionality,
- Nested doll and weight compensation,
- Preliminary counteraction, preliminary action, and beforehand compensation,
- Equipotentiality, the other way around and curvature increase,
- Dynamic parts, partial or excessive actions, dimensionality change, mechanical vibration
- Periodic action, continuity of useful action, and hurrying,
- Blessing in disguise, feedback, and intermediary,
- Self service, copying, cheap disposables, and mechanical interaction substitution
- Pneumatics and hydraulics, flexible shells and thin films, and porous materials,
- Optical property changes, homogeneous, and discarding and recovering,
- Parameter changes, phase transitions, and thermal expansion,
- Strong oxidants, inert atmosphere, and composite materials,
- How to select most suitable principle out of 40 ways to create good solutions

References

1. ABC-TRIZ Introduction to Creative Design Thinking with Modern TRIZ Modeling by Michael A. Orloff
2. TRIZ And Suddenly the Inventor Appeared TRIZ, the Theory of Inventive Problem Solving by GenrichAltshuller
3. TRIZ for Engineers Enabling Inventive Problem Solving by Karen Gadd
4. Simplified TRIZ New Problem Solving Applications for Engineers and Manufacturing Professionals by Rantanen K., Domb E.

Syllabus

DEPARTMENTAL ELECTIVE -6

SOFT COMPUTING (CST-039)

L:T:P:: 3:0:0 **CREDITS-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Familiarize with soft computing concepts.
2. Introduce and use the idea of Neural networks, fuzzy logic and use of heuristics based on human experience
3. Introduce and use the concepts of Genetic algorithm and its applications to soft computing using some applications.

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

1. Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions
2. Recognize the feasibility of applying a soft computing methodology for a particular problem.
3. Design the methodology to solve problem and decision making using fuzzy logic, genetic algorithms and neural networks.
4. Mining the bulk of data present in the warehouse.
5. Effectively use existing software tools to solve real problems using a soft computing approach.

Unit 1- Introduction to Genetic Algorithm: Introduction to soft computing, soft computing vs hard computing, Genetic Operators and Parameters, Genetic Algorithms in Problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues, challenges and applications of G.A.

Unit 2- Artificial Neural Networks & Learning : Introduction to Learning concept: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Neural Model and Network Architectures, Model of Artificial Neuron, Different Activation Functions, Perceptron network, Perceptron Learning, Supervised Hebbian Learning, Adaptive Linear Neuron, Backpropagation network, Backpropogation learning, Fundamentals of Associative Memory, Associative memory models, Auto associative memory, Bi-directional hetero associative memory.

Unit 3- Competitive Networks: Introduction to Competitive Nerual Networks, Principles of Competitive Learning, Hopfield Network, Computing with Neural Nets and applications of Neural Network.

Unit 4- Introduction to Fuzzy Sets: Introduction to fuzzy sets, difference between fuzzy sets and crisp sets theory, Operations on Fuzzy sets, Fuzzy properties, Fuzzy Relations, Fuzzy Measures, Applications of Fuzzy Set Theory to different branches of Science and Engineering.

Unit 5- Knowledge discovery in databases: KDD process, star schema, snowflack schema, Data mining and web mining using soft computing techniques. new datawarehouse architecture, database vs datawarehouse bioinformatics, amazon

redshift, google big query, panoply.

TEXT BOOKS:

1. E – Neuro Fuzzy and Soft computing – Jang J.S.R., Sun C.T and Mizutami, Prentice hall New Jersey, 1998
2. Fuzzy Logic Engineering Applications – Timothy J.Ross, McGraw Hill, NewYork, 1997.
3. Fundamentals of Neural Networks – Laurene Fauseett, Prentice Hall India, New Delhi, 1994.

Syllabus

DEPARTMENTAL ELECTIVE -6

Intelligent vehicle Technology (AIT-106)

L:T:P:3:0:0 **CREDITS-3**

Course Description: This course provides an in-depth understanding of intelligent vehicle technologies, including advanced driver assistance systems (ADAS), autonomous vehicles, and connected vehicle technologies. Students will learn about the underlying principles, algorithms, and technologies that enable intelligent vehicles to perceive, interpret, and respond to their environment.

Prerequisites:

- Basic knowledge of automotive engineering.
- Understanding of computer programming (preferably Python).
- Familiarity with concepts in artificial intelligence and machine learning.

Course Objectives:

- Understand the fundamentals of intelligent vehicle technologies
- Learn about sensor fusion techniques for perception in autonomous vehicles
- Study algorithms for decision making and control in autonomous driving
- Explore the challenges and ethical considerations in the deployment of autonomous vehicles
- Gain hands-on experience with simulation tools and platforms for intelligent vehicle development.

Syllabus:

Unit 1- Introduction to Intelligent Vehicles: Historical perspective,Types of intelligent vehicle technologies, Applications and industry trends

Unit 2- Sensors and Perception: Sensor types and their principles (LiDAR, RADAR, cameras, etc.), Sensor fusion techniques,Perception algorithms for environment modelling.

Decision Making and Control: Path planning algorithms, Behavior planning, Control systems for vehicle dynamics

Unit 3 - Machine Learning for Intelligent Vehicles: Supervised, unsupervised, and reinforcement learning,Applications of machine learning in autonomous driving, Data labeling and annotation

Unit 4- Connected Vehicle Technologies: Vehicle-to-everything (V2X) communication, Cooperative driving systems, Security and privacy concerns

Unit 5- Autonomous Vehicle Testing and Validation: Simulation tools and platforms, Field testing methodologies, Safety and regulatory considerations

Syllabus

Challenges and Future Directions: Ethical considerations in autonomous driving, Social acceptance and adoption challenges, Emerging trends and future developments.

Textbook:

- "Autonomous Vehicle Technology: A Guide for Technicians and Engineers" by Tom Denton

References:

- "Probabilistic Robotics" by Sebastian Thrun, Wolfram Burgard, and Dieter Fox.
- "Introduction to Autonomous Robots" by Nikolaus Correll, Bradley Hayes, and Ayush Agrawal.

Syllabus

DEPARTMENTAL ELECTIVE -6

CYBER AND DIGITAL FORENSICS (CST-041)

L:T:P:: 3:0:0 **CREDITS-03**

COURSE OBJECTIVE: The objectives of the course are to

1. Understand the basics of the cyber forensics.
2. Introduce the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Digital Forensics

COURSE OUTCOMES: Upon completion of this course, the students will be able to

1. Understand the concept of cybercrime and emerging crime threats and attacks in cyberspace.
2. Demonstrate the various types of cyber laws and their applicability.
3. Apply the forensic science techniques to data acquisition and evidence collection
4. Get the practical exposure to forensic tools from the scenarios of passive and active attacks.
5. Demonstrate the use of anti-malware tools for enhancing system network protection.

Unit 1: Introduction to IT laws & Cyber Crimes: Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security.

Legal and Ethical Principles: Introduction to Forensics – The Investigative Process – Code of Ethics, Ethics of Investigations, Evidence Management – Collection, Transport, Storage, access control, disposition

Unit 2- Forensic Science: Principles and Methods –Scientific approach to Forensics, Identification and Classification of Evidence, Location of Evidence, Recovering Data, Media File Forensic Steps, Forensic Analysis – Planning, Case Notes and Reports, Quality Control .

Unit 3- Digital Forensics: Hardware Forensics – Hidden File and Anti- forensics - Network Forensics – Virtual Systems - Mobile Forensics Digital Watermarking Protocols: A Buyer-Seller Watermarking Protocol, an Efficient and Anonymous Buyer-Seller Watermarking Protocol, Extensions of Watermarking Protocols, Protocols for Secure Computation

Unit 4- Application Forensics, Tools and Report Writing – Application Forensics, Email and Social Media Investigations, Cloud Forensics, Current Digital Forensic Tools, Report Writing for Investigations.

Unit 5- Counter Measures: Defensive Strategies for Governments and Industry Groups, Tactics of the Military, Tactics of Private Companies, Information Warfare Arsenal of the future, and Surveillance Tools for Information Warfare of the Future.

Syllabus

TEXT BOOKS:

1. Bill Nelson, Christopher Steuart, Amelia Philips, "Computer Forensics and Investigations", Delmar Cengage Learning; 5th edition January 2015.
2. Chuck Eastom, "Certified Cyber Forensics Professional Certification", McGraw Hill, July 2017.
3. Nilakshi Jain, Dhananjay Kalbande, "Digital Forensic: The fascinating world of Digital Evidence" Wiley India Pvt Ltd 2017.
4. John R.Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, 2015.

REFERENCE BOOKS:

1. MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.
2. Clint P Garrison "Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data , Syngress Publishing, Inc. 2010.

Syllabus

DEPARTMENTAL ELECTIVE -6

DIGITAL IMAGE PROCESSING (CST-042)

L:T:P:: 3:0:0 **CREDITS-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the image fundamentals and mathematical transforms necessary for image processing.
2. Expose students to current applications in the field of digital image processing.

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

1. Learn the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. To learn and understand various image compression and Segmentation techniques used in digital image processing.
5. Understand the various image representation techniques and perform feature and object detection techniques.

Unit 1-Introduction: Digital Image Processing, The origins of Digital Image Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations, An introduction to mathematical tool used in digital image processing.

Unit 2-Image Enhancement in the spatial domain: Background, some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, smoothing spatial filters, Sharpening spatial filters, Concept of Sampling.

Unit 3-Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter.

Unit 4-Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression: Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG, introduction to color image processing, color fundamentals, color models, Pseudo color image processing.

Unit 5-Morphology and Segmentation: Erosion, Dilation, Duality, Opening and Closing, Hit-and Miss transform, Morphological **Algorithms:** Boundary Extraction, Hole filling, Extraction of connected components, Convex Hull, Concept of Thinning and Thickening.

Syllabus

Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Thresholding, Region based segmentation. Introduction Object Recognition, pattern and Pattern classes.

TEXT BOOK:

1. Rafael C. Gonzalez, Richard E. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Pearson, 2002.

REFERENCE BOOKS:

1. Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, _Multidimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, _Digital Image Processing‘, John Wiley, New York, 2002
5. Milan Sonka et al _Image processing, analysis and machine vision‘, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

Syllabus

DEPARTMENTAL ELECTIVE -6

BIG DATA ANALYTICS (CST-043)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of the course are to

1. Make students comfortable with tools and techniques required in handling large amounts of datasets.
2. Uncover various terminologies and techniques used in Big Data.
3. Use several tools publicly available to illustrate the application of these techniques.
4. Know about the research that requires the integration of large amounts of data.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Identify and distinguish big data analytics applications.
2. Design efficient algorithms for mining the data from large volumes.
3. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
4. Understand the fundamentals of various big data analytics techniques.
5. Present cases involving big data analytics in solving practical problems.

UNIT – I

Introduction to big data: Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

UNIT – II

Mining data streams: Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams –Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness ina Window – Decaying Window - Real time Analytics Platform(RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.

UNIT – III

Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job Run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features-Hadoop environment.

UNIT – IV

Frameworks: Applications on Big Data Using Pig and Hive – Data processing operatorsin Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zookeeper - IBM Infosphere Big Insights and Streams.

Syllabus

UNIT – V

Predictive Analytics- Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

TEXTBOOKS:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.

REFERENCE BOOKS:

1. Michael Minelli, Michele Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley,2013.
2. Frank J. Ohlhorst, Big Data Analytics: Turning Big Data into Big Money, Wiley, 2012.
3. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, MC Press, 2012.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
6. Jeffrey Aven, Hadoop in 24 hours, person education 2018.
7. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, Reprinted 2008.
8. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer, 2007.
9. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
10. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands- On Approach ",VPT, 2016
11. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014.

Syllabus

Open Elective-3

SOFTWARE ENGINEERING (CSO-052)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to

1. Learn and understand the principles of Software Engineering.
2. Learn methods of capturing, specifying, visualizing, and analyzing software requirements.
3. Apply Design and Testing principles to S/W project development.
4. Understand project management through life cycle of the project.

COURSE OUTCOMES: On successful completion of the course, the student will be able to

1. Identify appropriate software design model based on requirement analysis.
2. Formulate Software Requirements Specification (SRS) reports for the real world application.
3. Translate a specification into a design and identify the components to build the architecture.
4. Plan a software engineering process to account for quality issues and non-functional requirements.
5. Estimate the work to be done, resources required and the schedule for a software project plan.

Unit 1- : Introduction to Software Engineering: Introduction, software applications, importance of software evolution of software, Software Components, Software Characteristics, Software Crisis & myths. Software Engineering paradigms: introduction, principles & Processes, Software Quality Attributes. Comparison between software engineering & computer science, & software engineering & Engineering. Some terminologies: product & process, deliverables and milestones, measures, metrics& indicators. Programs & software products. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, RAD model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Unit 2- Software Requirement Analysis: Structured analysis, object-oriented analysis, software requirement specification, and validation.

Unit 3- Design and Implementation of Software: software design fundamentals, design methodology (structured design and object-oriented design), design verification, monitoring and control coding.

Unit 4- Testing: Testing fundamentals, white box and black box testing, software testing strategies: unit testing,integration testing, validation testing, system testing, debugging.

Unit 5- Software Reliability: Metric and specification, fault avoidance and tolerance, exception handling,defensive programming.Software Maintenance – maintenance characteristics, maintainability, maintenance tasks, maintenance side effects. CASE tools, software certification- requirement, types of certifications, third part certification. Software Re-Engineering, reverse software Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, CASE: introduction,

levels of case, architecture, case building blocks, objectives, case repository, characteristics of case tools, categories, Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

TEXTBOOKS:

1. Roger Pressman, ―Software Engineering: A Practitioner ‘s Approach, McGraw Hill, ISBN 007–337597–7.

2. Ian Sommerville, ―Software Engineering, Addison and Wesley, ISBN 0-13-703515-2.

REFERENCE BOOKS:

1. Carlo Ghezzi, ―Fundamentals of Software Engineering, Prentice Hall India, ISBN-10: 0133056996.

2. Rajib Mall, ―Fundamentals of Software Engineering, Prentice Hall India, ISBN-13: 9788120348981.

3. Pankaj Jalote, ―An Integrated Approach to Software Engineering, Springer, ISBN 13: 9788173192715.

4. S K Chang, ―Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1.

5. Tom Halt, ―Handbook of Software Engineering, ClanyeInternational ISBN- 10: 1632402939

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Syllabus

Open Elective-4

OBJECT ORIENTED PROGRAMMING (CSO-053)

L:T:P:: 3:0:0 **Credits-03**

COURSE OBJECTIVES: The objectives of this course are to:

1. Provide flexible and powerful abstraction.
2. Allow programmers to think the problem in terms of the structure rather than in terms of structure of the computer.
3. Decompose the problem into a set of objects.
4. Objects interact with each other to solve the problem.
5. Create new type of objects to model elements from the problem space

COURSE OUTCOMES: On successful completion of the course, the student will be able to:

1. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
2. Apply some common object-oriented design patterns.
3. Specify simple abstract data types and design implementations using abstraction functions to document them.
4. Design a convenient way for the handling problems using templates and use simple try-catch blocks for Exception Handling.
5. Manage I/O streams and File I/O oriented interactions.

Unit 1- Object Oriented Programming Concepts: Classes and Objects, Methods and Messages, Abstraction and Encapsulation, Inheritance, Abstract Classes, Polymorphism. Introduction to C++: Classes and Objects, Structures and Classes, Unions and Classes, Friend Functions, Friend Classes, Inline Functions, Static Class Members, Scope Resolution Operator, Nested Classes, Local Classes, Passing Objects to Functions, Returning objects, object assignment. Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, Type Checking, this Pointer, Pointers to Derived Types, Pointers to Class Members, References, Dynamic Allocation Operators.

Unit 2- Function Overloading and Constructors: Function Overloading, Constructors, parameterized constructors, Copy Constructors, Overloading Constructors, Finding the Address of an Overloaded Function,Default Function Arguments, Function Overloading and Ambiguity. Operator overloading: Creating member Operator Function, Operator Overloading Using Friend Function, Overloading New and Delete, Overloading Special Operators, Overloading Comma Operator.

Syllabus

Unit 3- Inheritance and Polymorphism: Inheritance: Base-Class Access Control, Inheritance and Protected Members, Inheriting Muitiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes. Polymorphism: Virtual Functions, Virtual Attribute and Inheritance, Virtual Functions and Hierarchy, Pure Virtual Functions, Early vs. Late Binding, Run-Time Type ID and Casting Operators: RTTI, Casting Operators, Dynamic Cast.

Unit 4- Templates and Exception Handling: Templates: Generic Functions, Applying Generic Functions, Generic Classes, The type name and export Keywords, Power of Templates, Exception Handling: Fundamentals, Handling Derived Class Exceptions, Exception Handling Options, Understanding terminate() and unexpected(), uncaught_exception () Function, exception and bad_exception Classes, Applying Exception Handling.

Unit 5- I/O System Basics: Streams and Formatted 1/O. File I/O: File Classes, File Operations. Namespaces: Namespaces, std Namespace. Standard Template Library: Overview, Container Classes, General Theory of Operation, Lists, string Class, Final Thoughts on STL.

TEXTBOOKS:

1. Object Oriented Programming with C++ by E. Balagurusamy, McGraw-Hill Education (India).
2. ANSI and Turbo C++ by Ashoke N. Kamthane, Pearson Education

REFERENCE BOOKS:

1. Big C++ - Wiley India.
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India).
3. C++ and Object Oriented Programming – Jana, PHI Learning.
4. Object Oriented Programming with C++ - Rajiv Sahay, Oxford.
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)

Syllabus

PROJECT (AIP-109)

L:T:P:: 0:0:12 **Credits-06**

COURSE OBJECTIVE:

The objective of Project is to enable the student to extend further the investigative study taken up under project either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.

COURSE OUTCOME: On successful completion of this course, the students shall be able to

1. Review and finalize the approach to the problem relating to the assigned topic and prepare an action plan for preparing conducting the investigation and assign responsibilities for teamwork
2. Conduct detailed analysis, modeling, simulation, design, problem solving, or experiment as needed on the assigned topic
3. Develop product/process, test, draw results and conclusions, and give direction for future research and prepare a paper for conference presentation/publication in journals, if possible
4. Prepare a project report in the standard format for being evaluated by the Department and make final presentation on the project before a Departmental Committee.