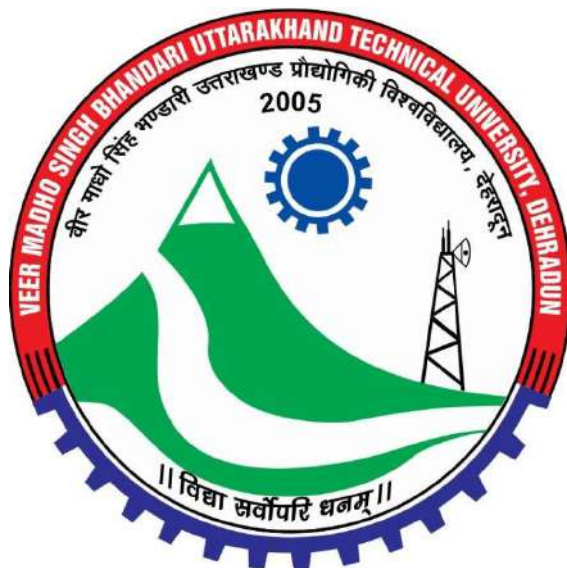


VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(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

Approved in 13th Meeting of Executive Council held on 27th March 2023 subsequent to the 14th Meeting of Academic Council held on 20th March 2023

(For admission in 2022-23 and onwards)



Syllabus

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SYLLABUS

For

B.TECH

(Computer Science and Engineering)

2ND Year

Effective From – Session 2023-24



Syllabus

SEMESTER-III													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
				L	T	P	Sessional Exam			ESE			
							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



Syllabus

SEMESTER-IV														
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit	
				L	T	P	Sessional Exam			ESE				
							CT	TA	Total	TE	PE			
1	AHT-006/ ECT-033	BSC/ ESC	Advanced Applied Mathematics / Digital Electronics	3	0	0	30	20	50	100		150	3	
2	AHT- 007/AHT- 008	HSC	Technical Communication/ Universal Human Value	2	1	0	30	20	50	100		150 150	3 4	
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 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 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

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 Fourier transforms, 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.



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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 predictor-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 Publishing House, 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, 5th ed.
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.



Syllabus

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 assess the application of the digital circuits.
6. Understand the design flow of VLSI Circuits

COURSE OUTCOMES: 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.



Syllabus

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



Syllabus

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



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



Syllabus

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



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Harmony in the nature. Four orders of nature; existence as co-existence, harmony at all levels of existence.

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)



Syllabus

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(\wedge), OR(\vee), NOT(\sim), 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.



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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 sekharaiyah-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



Syllabus

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.



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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.



Syllabus

OBJECT ORIENTED PROGRAMMING (CST-004/CSO-053)

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 Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes. Polymorphism: Virtual Functions, Virtual Attribute and Inheritance, Virtual Functions and Hierarchy, Pure Virtual



Syllabus

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 I/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

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:



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- a) Prim's algorithm.
 - b) Kruskal's algorithm.
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.



Syllabus

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.



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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



Syllabus

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 equivalentents 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.



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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 radius. If (distance between two balls centers) \leq (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 b are 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



Syllabus

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.



Syllabus

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, Indentation, 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.



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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”, 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978- 8126562176
5. Reema Thareja, “Python Programming using problem-solving approach”, Oxford university press, 2017.



Syllabus

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



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Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

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.



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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. Carl Hamacher “ Computer Organization and Embedded Systems”, 6th Edition, McGraw Hill Higher Education.
3. Miles Murdocca and Vincent Heuring “Computer Architecture and Organization: An integrated Approach” 2nd edition, Wiley Publication.



Syllabus

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.



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

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.



Syllabus

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.



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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, 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, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekar, 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.



Syllabus

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.



Syllabus

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.



Syllabus

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)

(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.



Syllabus

10. Study to use ssh, telnet, putty, ftp, ncftp and other network tools.



VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

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 and Engineering)

3RD Year

Effective From – Session 2024-25



SEMESTER-V													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
				L	T	P	Sessional Exam			ESE			
							CT	TA	Total	TE	PE		
1	CST-010	DC	Design and Analysis of Algorithms	3	1	0	30	20	50	100		150	4
2	CST-011	DC	Database Management System	3	1	0	30	20	50	100		150	4
3	CST-012	DC	Compiler Design	3	1	0	30	20	50	100		150	4
4	CST-0XX	DE	Departmental Elective-1	3	0	0	30	20	50	100		150	3
5	CST-0XX	DE	Departmental Elective-2	3	0	0	30	20	50	100		150	3
6	CSP-010	DLC	Design and Analysis of Algorithms Lab	0	0	2		25	25		25	50	1
7	CSP-011	DLC	Database Management System Lab	0	0	2		25	25		25	50	1
8	CSP-012	DLC	Compiler Design Lab	0	0	2		25	25		25	50	1
9	CSP-013	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	CST-014	Computer Graphics
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-020	Fuzzy Logic

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



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	CST-021	DC	Computer Networks	3	1	0	30	20	50	100	150	4	
2	CST-022	DC	Artificial Intelligence	3	1	0	30	20	50	100	150	4	
3	CST-023	DC	Operating System	3	1	0	30	20	50	100	150	4	
4	CST-0XX	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	CSP-014	DLC	Computer Networks Lab	0	0	2		25	25		25	50	1
7	CSP-015	DLC	Artificial Intelligence Lab	0	0	2		25	25		25	50	1
8	CSP-016	DLC	Operating System 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	CST-027	Web Technology
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 Hr Tutorial 2 or 3 Hr Practical
1 Credit 1 Credit 1 Credit



DESIGN & ANALYSIS OF ALGORITHMS (CST-010)

L:T:P:: 3:1:0

Credits-04

COURSE OUTCOMES: The objectives of this course are to:

1. Understand and apply the algorithm analysis techniques.
2. Analyze the efficiency of alternative algorithmic solutions for the same problem.
3. Understand different algorithm design techniques.
4. Understand the limitations of Algorithmic power.

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

1. Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. Analyze randomized algorithms and approximation algorithms.

Unit 1- Introduction: Characteristics of an algorithm, Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average, and worst-case behavior, Sorting techniques and their performance analysis, Time a space trade-off.

Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and master's theorem.

Unit 2- Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch- and-Bound and Back tracking methodologies for the design of an algorithms, Illustrations of these techniques for Problem-Solving, Knapsack, Matrix Chain Multiplication, Activity selection and LCS Problem.

Unit 3- Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS), Shortest path algorithms, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm, Binomial Heap and Fibonacci Heap.

Unit 4- Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Standard NP-complete problems and Reduction techniques.



Unit 5- Advanced Topics: Approximation algorithms and Randomized algorithms, Distributed Hash Table

TEXTBOOKS:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 4TH Edition, MITPress/McGraw-Hill.
2. Ellis Horowitz, Sartaj Sahni and SanguthevarRajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

REFERENCE BOOKS:

1. Jon Kleinberg and ÉvaTardos,Algorithm Design, 1ST Edition, Pearson.
2. Michael T Goodrich and Roberto Tamassia,Algorithm Design: Foundations, Analysis, and Internet Examples, Second EditionWiley.
3. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.



DATABASE MANAGEMENT SYSTEMS (CST-011)

L:T:P:: 3:1:0

Credits-04

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.

Unit 4-Transaction processing: Transaction Concepts, ACID Properties, Two-Phase Commit, Save Points, Concurrency Control techniques: Locking Protocols, Two Phase Locking, timestamp-based protocol, Multi-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.



COMPILER DESIGN (CST-012)

L:T:P:: 3:1:0

Credits-04

OBJECTIVES: The objectives of this course are to:

1. Learn the various phases of compiler and various parsing techniques.
2. Understand intermediate code generation and run-time environment.
3. Learn to implement front-end of the compiler and code generator.

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

1. Understand the different phases of compiler.
2. Design a lexical analyser for a sample language using LEX tool.
3. Apply different parsing algorithms to develop the parsers for a given grammar using YACC tool.
4. Understand syntax-directed translation and run-time environment.
5. Learn to implement code optimization techniques and a simple code generator.

UNIT - I

INTRODUCTION TO COMPILERS: Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

UNIT- II

SYNTAX ANALYSIS: Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies, Recursive Descent Parser, Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT- III

SYNTAX-DIRECTED TRANSLATION: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.

INTERMEDIATE-CODE GENERATION: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

UNIT- IV

RUN-TIME ENVIRONMENTS: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.



CODE GENERATION: Issues in the Design of a Code Generator, The Target Language, addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

UNIT- V

MACHINE-INDEPENDENT OPTIMIZATION: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs, peep-hole optimization.

TEXTBOOKS:

1. Compilers Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, PEA.
2. Introduction to Automata Theory Languages & Computation, 3rd Edition, Hopcroft, Ullman, PEA

REFERENCE BOOKS:

1. Theory of Computer Science, Automata Languages and Computation, 2nd Edition, Mishra, Chandra Shekaran, PHI.
2. Elements of Compiler Design, A.Meduna, Auerbach Publications, Taylor and Francis Group.



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.



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.



COMPUTER GRAPHICS (CST-014)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of this course are to

1. Provide a comprehensive introduction to computer graphics leading to understanding contemporary terminology, progress, issues, and trends.
2. Understand computer graphics techniques (2-D/3-D), focusing on 3D modelling, image synthesis, and rendering.
3. Introduce geometric transformations, geometric algorithms, software systems (OpenGL), 3D object models (surface, volume and implicit), visible surface algorithms, image synthesis, shading and mapping, ray tracing, radiosity, global illumination, photon mapping, and anti-aliasing.
4. Explore the interdisciplinary nature of computer graphics which is emphasized in the wide variety of examples and applications.

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

1. Develop the understanding of the fundamentals of Graphics concepts, and standards.
2. Understand the algorithms that form the foundation of computer graphics.
3. Provide 3D representation for their applications.
4. Understand various transformation techniques and their application.
5. Interpret parallel and oblique projections and their applications.

Unit 1- Introduction to computer graphics & graphics systems: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing, RGB color model, direct coding, lookup table, storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc., Active & Passive graphics devices, Computer graphics software.

Unit 2- Points & lines: Line drawing algorithms; DDA algorithm, Bresenhan's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit 3- 2D transformation & viewing Basic transformations: Translation, rotation, scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems, reflection shear, Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to viewport coordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

Unit 4- 3D transformations: Translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane, general parallel projection transformation, clipping, viewport



clipping, 3D viewing.

Unit 5- Curves representation: Surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color & shading models Light & color model, interpolative shading model and Texture

TEXTBOOKS:

1. Donald Hearn and Pauline Baker M, —Computer Graphics, Prentice Hall, New Delhi, 2007.
2. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Design, PHI, 2003.

REFERENCES:

1. Judith Jeffcoate, —Multimedia in practice: Technology and Applications, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, —Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics, CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, —Principles of Interactive Computer Graphics, Mc Graw Hill 1978.



SOFTWARE ENGINEERING (CST-015/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.



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, queueing systems and queueing 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, jointly 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/1 queueing system, Discrete parameter



BirthDeath 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.



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 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



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), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption 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.

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.



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, NiranjnG.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.



FUZZY LOGIC (CST-020)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of this course are to

1. Develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
2. Learn 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, α - 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.



DESIGN & ANALYSIS OF ALGORITHMS LAB (CSP-010)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Build a solid foundation in algorithms and their applications.
2. Implement various divide and conquer techniques examples, Greedy techniques examples, and Dynamic Programming techniques examples.
3. Provide a practical exposure of various algorithms.
4. Understand the importance of algorithm and its complexities.

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

1. Solve recurrence equations by considering time and space complexity.
2. Analyse the complexities of various problems in different domains.
3. Solve the problems that comprises of shortest route issue.
4. Solve the problems that address the issue of dynamic programming
5. Synthesize efficient algorithms in common engineering design situations.

LIST OF EXERCISES

1. Programming that uses recurrence relations to analyse recursive algorithms.
2. Computing best, average, and worst-case time complexity of various sorting techniques.
3. Performance analysis of different internal and external sorting algorithms with different type of data set.
4. Use of divide and conquer technique to solve some problem that uses two different algorithms for solving small problem.
5. Implementation of different basic computing algorithms like Hash tables, including collision-avoidance strategies, Search trees (AVL and B-trees).
6. Consider the problem of eight queens on an (8x8) chessboard. Two queens are said to attack each other if they are on the same row, column, or diagonal. Write a program that implements backtracking algorithm to solve the problem i.e. place eight non-attacking queens on the board.
7. Write a program to find the strongly connected components in a digraph.
8. Write a program to implement file compression (and un-compression) using Huffman's algorithm.
9. Write a program to implement dynamic programming algorithm to solve the all pairs shortest path problem.
10. Write a program to solve 0/1 knapsack problem using the following:
 - a) Greedy algorithm.
 - b) Dynamic programming algorithm.
 - c) Backtracking algorithm.
 - d) Branch and bound algorithm.



- 11.** Write a program that uses dynamic programming algorithm to solve the optimal binary search tree problem.
- 12.** Write a program for solving traveling salespersons problem using the following:
 - a) Dynamic programming algorithm.
 - b) The back tracking algorithm.
 - c) Branch and bound.



DATABASE MANAGEMENT SYSTEM LAB (CSP-011)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Understand data definitions and data manipulation commands.
2. Learn the use of nested and join queries.
3. Understand functions, procedures and procedural extensions of data bases.
4. Familiar with the use of a front-end tool and understand design and implementation of typical database applications

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

1. Understand, appreciate, and effectively explain the concepts of database Technologies.
2. Declare and enforce integrity constraints on a database using RDBMS.
3. Devise a complex query using SQL DML/DDL commands.
4. Create views and use in-built functions to query a database.
5. Write PL/SQL programs including stored procedures, stored functions and triggers.

LIST OF EXPERIMENTS

1. Build the following database schemas and perform the manipulation operations on these schemas using SQL DDL,DML,TCL and DCL commands.
(I) Database Schema for a customer-sale scenario
Customer(Custid : integer, cust_name: string)
Item(item_id: integer, item_name: string, price: integer)
Sale(bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following:-

- a) Create the tables with the appropriate integrity constraint
- b) Insert around 10 records in each of the tables
- c) List all the bills for the current date with the customer names and item numbers
- d) List the total Bill details with the quantity sold price of the item and the final amount
- e) List the details of the customer who have bought a product which has a price > 200
- f) Give a count of how many products have been bought by each customer
- g) Give a list of products bought by a customer having cust_id as 5
- h) List the item details which are sold as of today
- i) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount
- j) Create a view which lists the date wise daily sales for the last one week
- k) Identify the normalization of this schema. Justify your answer.
- l) If the schema is not normalized, then normalize the schema.

(II) Database Schema for a Employee-pay scenario



Employee(emp_id : integer, emp_name: string)

Department (dept_id: integer, dept_name:string)

Paydetails(emp_id : integer, dept_id: integer, basic: integer,deductions: integer, additions: integer, DOJ: date)

payroll(emp_id : integer, pay_date: date)

For the above schema, perform the following:—

- a) Create the tables with the appropriate integrity constraints
 - b) Insert around 10 records in each of the tables
 - c) List the employee details department wise
 - d) List all the employee names who joined after particular date
 - e) List the details of employees whose basic salary is between 10,000 and 20,000
 - f) Give a count of how many employees are working in each department
 - g) Give a name of the employees whose netsalary>10,000
 - h) List the details for an employee_id=5
 - i) Create a view which lists out the emp_name, department, basic, deductions,netsalary
 - j) Create a view which lists the emp_name and his netsalary
 - k) Identify the normalization of this schema. Justify your answer
 - l) If the schema is not normalized then normalize the schema.
2. Construct a PL/SQL program to find largest number from the given three numbers.
 3. Build a PL/SQL program to generate all prime numbers below 100.
 4. Construct a PL/SQL program to demonstrate %type and %row type attributes.
 5. Develop a PL/SQL procedure to find reverse of a given number.
 6. Create a PL/SQL procedure to update the salaries of all employees by 10% in their basic pay.
 7. Execute a PL/SQL procedure to demonstrate IN, OUT and INOUT parameters.
 8. Design a PL/SQL trigger before/after update on employee table for each row/statement.
 9. Create a PL/SQL trigger before/after delete on employee table for each row/statement.
 10. Build a PL/SQL trigger before/after insert on employee table for each row/statement.
 11. Design and build the following applications using SQL and front end tool and generate report
 - Student information system for your college.
 - Hospital Management System.
 - A video library management system.
 - Inventory management system for a hardware / sanitary item shop.
 - Banking System.
 - Railway Reservation System
 - Car Insurance Company



COMPILER DESIGN LAB (CSP-012)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the various phases in the design of a compiler.
2. Understand the design of top-down and bottom-up parsers.
3. Understand syntax directed translation schemes.
4. Introduce lex and yacc tools.

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

1. Understand the basic concepts; ability to apply automata theory and knowledge on formal languages.
2. Understand the basic concepts and application of Compiler Design
3. Apply their basic knowledge Data Structure to design Symbol Table, Lexical Analyser, Intermediate Code Generation, Parser (Top Down and Bottom-Up Design) and will able to understand strength of Grammar and Programming Language.
4. Understand various code optimization techniques and error recovery mechanisms.
5. Understand and Implement a Parser.

LIST OF PRACTICALS:

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language
2. Write a C program to identify whether a given line is a comment or not
3. Write a C program to test whether a given identifier is valid or not.
4. Write a C program to simulate lexical analyzer for validating operators.
5. To Study about Lexical Analyzer Generator(LEX) and Flex(Fast Lexical Analyzer)
6. Implement following programs using Lex:
 - a) Create a Lexer to take input from text file and count no of characters, no. of lines & no. of words.
 - b) Write a Lex program to count number of vowels and consonants in a given input string.
7. Implement following programs using Lex.
 - a) Write a Lex program to print out all numbers from the given file.
 - b) Write a Lex program to printout all HTML tags in file.
 - c) Write a Lex program which adds line numbers to the given file and display the same onto the standard output.
8. Write a Lex program to count the number of comment lines in a given C program. Also eliminate them and copy that program into separate file.
9. Write a C program for implementing the functionalities of predictive parser for the mini language.



10. Write a C program for constructing of LL (1) parsing.
11. Write a C program for constructing recursive descent parsing
12. Write a C program to implement LALR parsing.
13. Write a C program to implement operator precedence parsing.
14. To Study about Yet Another Compiler-Compiler(YACC).
15. Create Yacc and Lex specification files to recognizes arithmetic expressions involving +, -, * and / .
16. Create Yacc and Lex specification files are used to generate a calculator which accepts, integer and float type arguments.



INTERNSHIP-II / MINI PROJECT-II (CSP-013)

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 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 instill 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.



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



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.



COMPUTER NETWORKS (CST-021/CSO-051)

L:T:P:: 3:1:0

Credits-04

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.

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



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.

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, Pearson 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.



OPERATING SYSTEMS (CST-023)

L: T:P :: 3:1:0

Credits-04

COURSE OBJECTIVES: The objectives of this course are to

1. Learn and understand the Concepts of the operating systems.
2. Learn and understand operating system services.
3. The core structure, functions and design principles of operating system.
4. Interposes communications and basic concepts of virtualization.

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

1. Create processes and threads.
2. Develop process scheduling algorithms for a given CPU utilization specification, Throughput, Turnaround Time, Waiting Time, and Response Time.
3. Develop the techniques for optimally allocating memory to processes by increasing memory utilization and improving access time.
4. Design and implement a file management system.
5. Develop the I/O management functions in OS.

Unit 1- Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS -Layered, Microkernel Operating Systems, Concept of Virtual Machine.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multi threads

Unit 2- Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real-Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer-Consumer Problem, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.

Unit 3- Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation–Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation –Hardware support for paging, Protection and sharing, Disadvantages of paging.



Unit 4- Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

Unit 5- File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (Contiguous, linked, indexed).

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability.

TEXTBOOKS:

1. AviSilberschatz, Peter Galvin, Greg Gagne , Operating System Concepts Essentials, 9th Edition by, Wiley Asia Student Edition.
2. William Stallings , Operating Systems: Internals and Design Principles, 9th Edition (2022), Prentice Hall of India.

Reference Books:

1. RamazElmasri, A. Gil Carrick, David Levine, —Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, —Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, —Modern Operating Systems, Second Edition, Pearson Education, 2004.



INTERNET OF THINGS (IOT) (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 RASPBERRY 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, 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 Madiseti, —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.



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 programming 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 q-bit system of information representation: Bloch 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, RigettiPyQuil (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



AUGEMENTED REALITY (AR) (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



WEB TECHNOLOGY (CST-027)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of this course are to

1. Understand about client-server communication and protocols used during communication.
2. Design interactive web pages using Scripting languages.
3. Learn server-side programming using servlets and JSP.
4. Develop web pages using XML/XSLT.

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

1. Design simple web pages using mark-up languages like HTML and XHTML.
2. Create dynamic web pages using DHTML and java script that is easy to navigate and use.
3. Program server-side web pages that have to process request from client side web pages.
4. Represent web data using XML and develop web pages using JSP.
5. Understand various web services and how these web services interact.

UNIT-I Introduction to HTML: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;

Introduction to JavaScript: Scripts, Objects in Java Script, Dynamic HTML with Java Script

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX

UNIT-II Java Beans: Introduction to Java Beans, Advantages of Java Beans, JDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

UNIT-III Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Servlet, JSDK, The Servlet API, The javax.servelet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

UNIT-IV Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat

UNIT-V JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring



Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users
Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage
Considerations.

TEXT BOOK:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

REFERENCE BOOK:

1. Robert. W. Sebesta, "Programming the World Wide Web", 8thEdition(2022), Pearson Education, 2007.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown, Core Web Programming Second Edition, I I Volume I and II, Pearson Education, 2001.
4. Bates, —Developing Web ApplicationsI, Wiley, 2006



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: On 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.

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, Multi-tasking, 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.

**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- 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.	09



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.



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

Books and References

1. Kotler, P. and Keller, K.L. (2017) Marketing Management. 15^o 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.

**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 identify 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	Course Content	Lectures
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.	08
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.	08
III	Hazard Identification and Risk Assessment: The process of risk management, hazard identification, evaluation (risk assessment, risk matrix), risk control implementation, action and recommendation.	08
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.	08
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.	08

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 Butterworth London 1983.



COMPUTER NETWORKS LAB (CSP-014)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

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

1. Learn about hardware component like RJ-45 connector, CAT-6 Cable etc.
2. Implement the various services of data link layer.
3. Configuration of router, hub, switch etc
4. Configuration of server in programming mode they will learn about socket programming, client server programming for deeply understanding TCP/ IP model and various protocols.
5. Configure their own Network management systems in simulation area, they will work on Cisco networking, NS-2 or NS-3 tools for more clear understanding about computer network.

LIST OF PRACTICALS

1. Installation and configuration of NS2 and Qual Net
2. Creating a network: nodes, links and queues, Creating connections, traffic and computing routers
Insertion of errors and analysis of trace file.
3. Study of basic network command and network configuration commands.
4. Simple project on NS2 – wired, wireless and combination of wired and wireless
5. Implementation of new protocols in NS2
6. Simulation study of pure ALOHA protocol;
7. Simulation study of slotted ALOHA protocol;
8. Simulation study of Token Bus LAN protocol;
9. Simulation study of Token Ring LAN protocol;
10. Simulation study of WAN protocol like Frame Relay, X. 25
11. Study of 802. 11 wireless LAN protocols.
12. Implement the Distance Vector Routing protocol for finding the shortest path.
13. Write a program to connect server with client and passes information from one system to another and vice versa that by creating / establishing connection.



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.



OPERATING SYSTEMS LAB (CSP-016)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Learn Unix commands and shell programming.
2. Implement various CPU Scheduling Algorithms and Process Creation and Inter Process Communication.
3. Implement Deadlock Avoidance and Deadlock Detection Algorithms.
4. Implement Page Replacement Algorithms, File Organization and File Allocation Strategies.

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

1. Understand the system calls and I/O system calls in UNIX
2. Evaluate the process scheduling algorithms FCFS, SJF, Priority and Round robin
3. Simulate the process of communication through various techniques
4. Simulate memory management schemes
5. Simulate File Allocation Techniques

LIST OF EXPERIMENTS

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time (2 sessions)
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each scheduling policy, compute and print the average waiting and turnaround times (2 Sessions).
6. Developing Applications using Inter Process communication (using shared memory and pipes)
7. Simulate the Producer-Consumer problem using semaphores (using UNIX system calls).
8. Simulate First fit, best fit and Worst fit memory management algorithms.
9. Simulate Page Replacement Algorithms (FIFO, LRU and Optimal)
10. Simulate the Paging memory management scheme



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



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



VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY
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SYLLABUS

For

B.TECH

(Computer Science and Engineering)

4TH Year

Effective From – Session 2025-26



SEMESTER-VII													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
				L	T	P	Sessional Exam			ESE			
							CT	TA	Total	TE	PE		
1	AHT-015 /AHT-016	HSC	Rural Development Administration and Planning/ Project Management and Entrepreneurship	3	1	0	30	20	50	100		150	3
2	CST-0XX	DE	Departmental Elective-4	3	0	0	30	20	50	100		150	3
3	CST-0XX	DE	Departmental Elective-5	3	0	0	30	20	50	100		150	3
4	CSO-0XX	OE	Open Elective-2	3	0	0	30	20	50	100		150	3
5	CSP-017	DLC	Machine Learning Lab	0	0	2		25	25		25	50	1
6	CSP-018	DLC	Project Seminar	0	0	2			50			50	1
7	CSP-019	DLC	Design Project	0	0	4			100			100	2
8	CSP-020	DLC	Mini Project-III or Internship-III*	0	0	2			50			50	1
9	AHT-017	MC	Disaster Management	2	0	0		50	50		50	100	2
10	AHT-018	NC	Innovations and Problem Solving	2	1	0	15	10	25	50			
11	GP-007	NC	General Proficiency						50				
			Total	12	1	12						900	19
12			Minor Course (Optional)**	3	1	0	30	20	50	100			4
*The Internship-III (4-6weeks) will be conducted during summer break after the VI semester and will be assessed during VII semester.													
MOOCs course													

Departmental Elective-4		
S. No.	Subject Code	Subject Name
1	CST-029	Ad-hoc & Sensor Networks
2	CST-030	Machine Learning
3	CST-031	Mobile Computing
4	CST-032	Data Mining
5	CST-033	Block Chain

Departmental Elective-5		
S. No.	Subject Code	Subject Name
1	CST-034	Data Science
2	CST-035	Cryptography & Network Security
3	CST-036	DevOps
4	CST-037	Cloud Computing
5	CST-038	Natural Language Processing

Open Elective -2 (This course can be taken only by the students of branches other than CSE and specialized branches of CSE in VIIth semester. Students of CSE and specialized branches of CSE shall opt open electives floated by other departments)

Open Elective-2		
S. No.	Subject Code	Subject Name
1	CSO-051	Computer Network

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



SEMESTER-VIII													
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-015 / AHT-016	HSC	Rural Development Administration and Planning/ Project Management and Entrepreneurship	3	0	0	30	20	50	100		150	3
2	CST-0XX	DE	Departmental Elective-6	3	0	0	30	20	50	100		150	3
3	CSO-0XX	OE	Open Elective-3	3	0	0	30	20	50	100		150	3
4	CSO-0XX	OE	Open Elective-4	3	0	0	30	20	50	100		150	3
5	CSP-021	DLC	Project	0	0	12			100		200	300	6
6	GP-008	NC	General Proficiency						50				
			Total	12	0	12						900	18
7			Minor Course (Optional)**	3	1	0	30	20	50	100			4
	MOOCs course												

Departmental Elective-6		
S. No.	Subject Code	Subject Name
1	CST-039	Soft Computing
2	CST-040	Software Project Management
3	CST-041	Cyber and Digital Forensics
4	CST-042	Digital Image Processing
5	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 VIIIth semester. Students of CSE and specialized branches of CSE shall opt open electives floated by other departments)

Open Elective-3		
S. No.	Subject Code	Subject Name
1	CSO-052	Software Engineering

Open Elective-4		
S. No.	Subject Code	Subject Name
1	CSO-053	Object Oriented Programming

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



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:

(8 hours)

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:

(8 hours)

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.

UNIT-III:

(8 hours)

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: (8 hours)

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: (8 hours)

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.



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:

(8 hours)

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

UNIT-II

(8 hours)

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.

UNIT-III:

(8 hours)

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

(8 hours)

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:

(8 hours)

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.; Harper and Row.
2. Business, Entrepreneurship and Management: Rao, V.S.P.; Vikas
3. Entrepreneurship: Roy Rajeev.
4. Text Book of Project Management: Gopalkrishnan, 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.



ADHOC AND SENSOR NETWORK (CST-029)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Learn Ad hoc network and Sensor Network fundamentals.
2. Understand the different routing protocols
3. Have an in-depth knowledge on sensor network architecture and design issues
4. Understand the transport layer and security issues possible in Ad hoc and Sensor networks

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

1. Impart the trends in emerging field of wireless ad hoc and sensor networking.
2. Focus on layered communication modeling, such as the media access control and network layer.
3. Understand the basic concept of QoS and Multicast routing protocol.
4. Address quality of service issues and network reliability for transmission of real-time information.
5. Learn the various routing protocols of ad hoc and sensor networks

Unit 1- ADHOC NETWORKS INTRODUCTION: Introduction to Wireless Communication Technology, Characteristics of the Wireless Channel, IEEE 802.11a/b Standard, Origin of Ad-hoc Packet Radio Networks, Architecture of PRNETS, Introduction to Ad-hoc Wireless Networks, Heterogeneity in Mobile Devices.

Unit 2- ADHOC NETWORK ROUTING PROTOCOLS: Introduction -to designing a Routing Protocol, Classifications of Routing Protocols, Destination Sequenced Distance Vector (DSDV), Dynamic Source Routing (DSR), Zone Routing Protocol (ZRP), Wireless Routing Protocol (WRP), Source—Initiated On—Demand Approaches, Ad hoc On-Demand Distance Vector Routing , AODV.

Unit 3- QoS AND Multicast Routing Protocol in MANET: Issues and challenges in providing QoS in Adhoc Wiress Networks, Introduction to QoS in Ad hoc Wireless Networks, Classifications of QoS Solutions, Introduction to Multicast Routing Protocol, Classifications of Multicast Routing Protocols.

Unit 4- WSN INTRODUCTION: Characteristic requirements, Challenges of sensor networks Emerging technologies for wireless sensor networks, Advantages of sensor networks, Sensor network applications.

Unit 5- WSN PROTOCOLS: Communication protocols, MAC protoacaols, Namlng and Addressing-Routing protocols, Energy efficient routing.



TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, —Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, 2004.
2. Holger Karl , Andreas willig, —Protocol and Architecture for Wireless Sensor Networks, John wiley publication, Jan 2006.

REFERENCE BOOKS:

1. Feng Zhao, Leonidas Guibas, —Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.
2. Charles E. Perkins, —Ad Hoc Networking, Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, —Wireless sensor networks: a survey, computer networks, Elsevier, 2002, 394 - 422.



MACHINE LEARNING (CST-030)

L:T:P:: 3:0:0

Credits-03

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

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. Ethem Alpaydin, —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.



MOBILE COMPUTING (CST-031)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the basic concepts of mobile computing and basics of mobile telecommunication system.
2. Become familiar with the network layer protocols and Ad-Hoc networks.
3. Know the basis of transport and application layer protocols.
4. Gain the knowledge about different mobile platforms and application development

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

1. Impart knowledge of mobile and wireless computing systems and techniques.
2. Understand the knowledge of wireless network
3. Understand the concepts of security and failure detection and recovery strategies.
4. Understand the concepts routing protocols.
5. Understand the working of mobile tracking in wireless network

Unit 1- Introduction: Issues, Challenges, and benefits of Mobile Computing, IEEE 802.11 & Bluetooth, Wireless Multiple access protocols, spread spectrum, cellular wireless networks.

Unit 2- Data Management Issues: Wireless computing, nomadic computing, ubiquitous computing and tunneling, data replication for mobile computers, adaptive Clustering for Mobile Wireless networks, LEACH and TORA, mobile TCP (M-TCP) Spooning TCP, Frequency for radio transmission.

Unit 3- Distributed location Management: pointer forwarding strategies, Process communication techniques, Socket Programming, RPC, RMI, Mobile IP, TCP Over wireless. Hidden and exposed terminal problems.

Unit 4- Routing Protocols: Routing Protocol, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), and Destination Sequenced Distance – Vector Routing (DSDV), Cluster Based Routing Protocol (CBRP).

Unit 5- Fault tolerance and security: Security and fault tolerance, transaction processing in Mobile computing environment. Mobile Agent Systems: Aglets, PMADE, Case Studies, agent failure scenarios, node failure detection and recovery.

TEXT BOOKS:

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt. Ltd, New Delhi – 2012



REFERENCE BOOKS:

1. Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems, Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computing, Springer, 2003.
3. William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition, TataMcGraw Hill Edition ,2006.
4. C.K.Toh, —AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.



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



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 toBlockchain, 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; 1st edition, 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 Smart 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.



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.

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 Steinbach, 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 Tector, "R Cookbook", O'Reilly, 2011.



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/MIME 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.



DEVOPS (CST-036)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. Implement automated system update and DevOps lifecycle.

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

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assess, collaborate, and adopt Devops in real-time projects

Unit 1-Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

Unit 2-Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.

DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

Unit 3-Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

Unit 4-Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

Unit 5-Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development



Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXTBOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN10: 1788392574.
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOK:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.



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.

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, OpenNebula, 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.



NATURAL LANGUAGE PROCESSING (CST-038)

L:T:P:: 3:0:0

Credits-03

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.

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



COMPUTER NETWORKS (CST-021/CSO-051)

L:T:P:: 3:1:0

Credits-04

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.



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



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-S algorithm 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.



PROJECT SEMINAR (CSP-018)

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.



DESIGN PROJECT (CSP-019)

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.



Internship-III/Mini Project-III – (CSP-020)

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 instill 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.



DISASTER MANAGEMENT (AHT-017)

L:T:P:: 3:0:0

Credits-03

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)
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.



INNOVATIONS AND PROBLEM SOLVING(AHT-18)

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,
- 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 Genrich Altshuller
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.



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, Backpropagation learning, Fundamentals of Associative Memory, Associative memory models, Auto associative memory, Bi-directional hetero associative memory.

Unit 3- Competitive Networks: Introduction to Competitive Neural 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, snowflake 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.

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence – E Charniak and D McDermott, Pearson Education
2. Artificial Intelligence and Expert Systems – Dan W. Patterson, Prentice Hall of India.



SOFTWARE PROJECT MANAGEMENT (CST-040)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Introduce the primary important concepts of project management related to managing software development projects.
2. Become familiar with the different activities involved in Software Project Management
3. Know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.

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

1. Identify the different project contexts and suggest an appropriate management strategy.
2. Practice the role of professional ethics in successful software development.
3. Identify and describe the key phases of project management.
4. Determine an appropriate project management approach through an evaluation of the business context and scope of the project
5. Manage the people and control the defects.

Unit 1- Basic Concepts: Product, Process and Project, Definition, Components of Software Project Management(SPM), Challenges and Opportunities, Tools and Techniques, Managing Human Resource and Technical Resource, Costing and pricing of projects, Training and development, Project management technique, Product Life Cycle , Project Life Cycle Models.

Unit 2- Format Process Models and Their Use: Definition and Format Model for a Process, ISO 9001 and CMM Models and their relevance to Project Management, Other Emerging Models like People CMM

Unit 3- Umbrella Activities In Projects: Metrics, Methods and Tools for Metrics, Issues of Metrics in multiple Projects, Configuration Management, Software Quality Assurance, Quality Standards and Certifications, Process and Issues in obtaining Certifications, Risk issues in Software Development and Implementation, Identification of Risks , Resolving and Avoiding risks, Tools and Methods for Identifying Risk Management.

Unit 4- Instream Activities In Project: Project Initiation, Project Planning, Execution and Tracking, Project Wind up, Concept of Process, Project Database.



Unit 5- Engineering And Issues In Project Management: Requirements, Design, Development, Testing, Maintenance, Deployment, Engineering Activities and Management Issues in Each Phase, Special Considerations in Project Management for India and Geographical Distribution Issues.

TEXT BOOK(S)

1. Royce and Walker, “Software Project Management”, 2nd Edition, Pearson Education, 2002.

REFERENCES

1. Bob Hughes and Mike Cotterell, “Software Project Management”, 5th Edition, Tata McGrawHill, 2011.
2. Kelker, S. A, “Software Project Management”, 2nd Edition, Prentice Hall, 2003.
3. Gopaldaswamy Ramesh, "Managing Global Projects", 1st Reprint Edition, Tata McGraw Hill,2006.
4. Robert K. Wysocki, “Executive's Guide to Project Management”, 2nd Edition, John Wiley & Sons, 2011.
5. Teresa and luckey, Joseph Phillips, “Software project Management for dummies”, 3rd Edition, Wiley publishing Inc., 2006.



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.



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.



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.

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.



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 in a 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 operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zookeeper - IBM InfoSphere Big Insights and Streams.



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, Guoqing 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 Madiseti, “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.



SOFTWARE ENGINEERING (CST-015/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.
Tom Halt, —Handbook of Software Engineering, ClanyeInternational ISBN- 10: 1632402939



OBJECT ORIENTED PROGRAMMING (CST-004/CSO-053)

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 Multiple 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 I/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)



PROJECT (CSP-021)

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.

List of Minor Courses offered by Computer Sc. & Engineering Department to B.Tech. Programme

Sl. No.	Award of Degree	Eligible Major B.Tech. Degree programmes (Discipline / Branch of Study as Prescribed by the University from time to time) For minor Degree	Offering Department	Minor Degree (After successfully passing the subjects worth 20 Credits as available against each Minor)																											
1	B. Tech. in branch name with Minor in “ <i>Artificial Intelligence & Machine Learning</i> ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	Artificial Intelligence & Machine Learning <table border="1"> <tbody> <tr> <td>1</td> <td>AIML-001</td> <td>Introduction to AI & Machine Learning</td> </tr> <tr> <td>2</td> <td>AIML-002</td> <td>Introduction to Data Analytics</td> </tr> <tr> <td>3</td> <td>AIML-003</td> <td>Deep Learning and Neural Network</td> </tr> <tr> <td>4</td> <td>AIML-004</td> <td>Specific topics in Artificial Intelligence</td> </tr> <tr> <td>5</td> <td>AIML-005</td> <td>Applications of AI</td> </tr> <tr> <td>6</td> <td>AIMLP-001</td> <td>Introduction to AI & Machine Learning Lab</td> </tr> <tr> <td>7</td> <td>AIMLP-002</td> <td>Introduction to Data Analytics Lab</td> </tr> <tr> <td>8</td> <td>AIMLP-003</td> <td>Deep Learning and Neural Network Lab</td> </tr> <tr> <td>9</td> <td>AIMLP-004</td> <td>Capstone Project</td> </tr> </tbody> </table>	1	AIML-001	Introduction to AI & Machine Learning	2	AIML-002	Introduction to Data Analytics	3	AIML-003	Deep Learning and Neural Network	4	AIML-004	Specific topics in Artificial Intelligence	5	AIML-005	Applications of AI	6	AIMLP-001	Introduction to AI & Machine Learning Lab	7	AIMLP-002	Introduction to Data Analytics Lab	8	AIMLP-003	Deep Learning and Neural Network Lab	9	AIMLP-004	Capstone Project
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2	B. Tech. in branch name with Minor in “ <i>Cyber Security</i> ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	<table border="1"> <thead> <tr> <th colspan="3">Cyber Security</th> </tr> </thead> <tbody> <tr> <td data-bbox="1430 107 1507 217">1</td> <td data-bbox="1507 107 1619 217">CSET-001</td> <td data-bbox="1619 107 1919 217">Principles of Information Security</td> </tr> <tr> <td data-bbox="1430 217 1507 302">2</td> <td data-bbox="1507 217 1619 302">CSET-002</td> <td data-bbox="1619 217 1919 302">Foundations of Cyber Security</td> </tr> <tr> <td data-bbox="1430 302 1507 386">3</td> <td data-bbox="1507 302 1619 386">CSET-003</td> <td data-bbox="1619 302 1919 386">Ethical Hacking Fundamentals</td> </tr> <tr> <td data-bbox="1430 386 1507 470">4</td> <td data-bbox="1507 386 1619 470">CSET-004</td> <td data-bbox="1619 386 1919 470">Digital Forensics</td> </tr> <tr> <td data-bbox="1430 470 1507 555">5</td> <td data-bbox="1507 470 1619 555">CSET-005</td> <td data-bbox="1619 470 1919 555">Security Incident & Response Management</td> </tr> <tr> <td data-bbox="1430 555 1507 639">6</td> <td data-bbox="1507 555 1619 639">CSEP-001</td> <td data-bbox="1619 555 1919 639">Principles of Information Security Lab</td> </tr> <tr> <td data-bbox="1430 639 1507 735">7</td> <td data-bbox="1507 639 1619 735">CSEP-002</td> <td data-bbox="1619 639 1919 735">Ethical Hacking Fundamentals Lab</td> </tr> <tr> <td data-bbox="1430 735 1507 820">8</td> <td data-bbox="1507 735 1619 820">CSEP-003</td> <td data-bbox="1619 735 1919 820">Digital Forensics Lab</td> </tr> <tr> <td data-bbox="1430 820 1507 904">9</td> <td data-bbox="1507 820 1619 904">CSEP-004</td> <td data-bbox="1619 820 1919 904">Capstone Project</td> </tr> </tbody> </table>	Cyber Security			1	CSET-001	Principles of Information Security	2	CSET-002	Foundations of Cyber Security	3	CSET-003	Ethical Hacking Fundamentals	4	CSET-004	Digital Forensics	5	CSET-005	Security Incident & Response Management	6	CSEP-001	Principles of Information Security Lab	7	CSEP-002	Ethical Hacking Fundamentals Lab	8	CSEP-003	Digital Forensics Lab	9	CSEP-004	Capstone Project
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3	B. Tech. in branch name with Minor in “ <i>Data Science</i> ” ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	<table border="1"> <thead> <tr> <th colspan="3" data-bbox="1428 94 1955 129">Data Science</th> </tr> </thead> <tbody> <tr> <td data-bbox="1428 129 1516 211">1</td> <td data-bbox="1516 129 1629 211">DST001</td> <td data-bbox="1629 129 1955 211">Introduction To Data Science</td> </tr> <tr> <td data-bbox="1428 211 1516 305">2</td> <td data-bbox="1516 211 1629 305">DST002</td> <td data-bbox="1629 211 1955 305">Artificial Intelligence & Machine Learning</td> </tr> <tr> <td data-bbox="1428 305 1516 415">3</td> <td data-bbox="1516 305 1629 415">DST003</td> <td data-bbox="1629 305 1955 415">Analyzing, Visualizing, And Applying Data Science with Python</td> </tr> <tr> <td data-bbox="1428 415 1516 467">4</td> <td data-bbox="1516 415 1629 467">DST004</td> <td data-bbox="1629 415 1955 467">Web Data Mining</td> </tr> <tr> <td data-bbox="1428 467 1516 548">5</td> <td data-bbox="1516 467 1629 548">DST005</td> <td data-bbox="1629 467 1955 548">Business Intelligence and Data Visualization</td> </tr> <tr> <td data-bbox="1428 548 1516 630">6</td> <td data-bbox="1516 548 1629 630">DSP001</td> <td data-bbox="1629 548 1955 630">Introduction To Data Science Lab</td> </tr> <tr> <td data-bbox="1428 630 1516 711">7</td> <td data-bbox="1516 630 1629 711">DSP002</td> <td data-bbox="1629 630 1955 711">Artificial Intelligence & Machine Learning Lab</td> </tr> <tr> <td data-bbox="1428 711 1516 844">8</td> <td data-bbox="1516 711 1629 844">DSP003</td> <td data-bbox="1629 711 1955 844">Analyzing, Visualizing, And Applying Data Science with Python Lab</td> </tr> <tr> <td data-bbox="1428 844 1516 935">9</td> <td data-bbox="1516 844 1629 935">DSP004</td> <td data-bbox="1629 844 1955 935">Capstone Project</td> </tr> </tbody> </table>	Data Science			1	DST001	Introduction To Data Science	2	DST002	Artificial Intelligence & Machine Learning	3	DST003	Analyzing, Visualizing, And Applying Data Science with Python	4	DST004	Web Data Mining	5	DST005	Business Intelligence and Data Visualization	6	DSP001	Introduction To Data Science Lab	7	DSP002	Artificial Intelligence & Machine Learning Lab	8	DSP003	Analyzing, Visualizing, And Applying Data Science with Python Lab	9	DSP004	Capstone Project
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4	B. Tech. in branch name with Minor in “ Internet of Things ” ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	Internet of Things		
				1	IoTT-001	Internet of Things Architectures, Protocols and Systems Programming
				2	IoTT-002	Embedded Systems and Internet of Things
				3	IoTT-003	IoT Applications and Web development
				4	IoTT-004	Machine Learning for Internet of Things
				5	IoTT-005	Internet of Things Security
				6	IoTP-001	Embedded Systems and Internet of Things Lab
				7	IoTP-002	IoT Applications and Web development Lab
				8	IoTP-003	Machine Learning for Internet of Things Lab
				9	IoTP-004	Capstone Project

***If required the student may opt requisite fundamental course/s for a minor specialization as audit course.**

**Minor Degree in “Artificial Intelligence & Machine Learning”**

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme			End Semester		Total	Credit	Sem
			L	T	P	CT	TA	TOTAL	TE	PE			
1	AIML-001	Introduction to AI & Machine Learning	3	0	0	30	20	50	100		150	3	III
2	AIML-002	Introduction to Data Analytics	3	0	0	30	20	50	100		150	3	IV
3	AIML-003	Deep Learning and Neural Network	3	0	0	30	20	50	100		150	3	V
4	AIML-004	Specific topics in Artificial Intelligence	3	0	0	30	20	50	100		150	3	VI
5	AIML-005	Applications of AI	3	0	0	30	20	50	100		150	3	VII
6	AIMLP-001	Introduction to AI & Machine Learning Lab	0	0	2		25	25		25	50	1	III
7	AIMLP-002	Introduction to Data Analytics Lab	0	0	2		25	25		25	50	1	IV
8	AIMLP-003	Deep Learning and Neural Network Lab	0	0	2		25	25		25	50	1	V
9	AIMLP-004	Capstone Project	0	0	4		50	50		50	100	2	VII
		GRAND TOTAL									1000	20	

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, TA: Teacher Assessment, TE: Theory End Semester Exam., PE: Practical End Semester Exam.



AIML-001: INTRODUCTION TO AI & MACHINE LEARNING

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To review and strengthen important mathematical concepts required for AI & ML.
2. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

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

1. Design and implement machine learning solutions to classification, regression, and clustering problems.
2. Evaluate and interpret the results of the different ML techniques.
3. Design and implement various machine learning algorithms in a range of Real-world applications.
4. Apply different machine learning algorithms.
5. Analyze data models to study patterns.

Unit 1- Introduction to AI: Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic, and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions, and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

Unit 2- Idea of Machine Learning: Idea of Machines learning from data, Classification of problem - Regression and Classification, Supervised and Unsupervised learning.

Unit 3- Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.

Unit 4- Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.

Unit 5- Clustering Algorithms: Discussion on clustering algorithms and use-cases centered around clustering and classification.

TEXTBOOKS:

1. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer , 2011.
3. T. Hastie, Tibshirany , J. Friedman. The Elements of Statistical Learning, 2e, 2011.

REFERENCE BOOKS:



1. Saroj Kaushik , Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited , 2017.



AIML-002: INTRODUCTION TO DATA ANALYTICS

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. Provide you with the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Produce Python code to statistically analyze a dataset.
4. Critically evaluate data visualizations based on their design and use for communicating stories from data.

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

1. Explain how data is collected, managed, and stored for data science.
2. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
3. Apply various processes to extract features of data.
4. Understand the key techniques and theory behind data visualization.
5. Understand key applications of data science that are commonly linked to ethical issues.

Unit 1- Introduction to Data Science: Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.

Unit 2- Processes of Data Analytics: Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion, and Predictions.

Unit 3- Feature Generation and Selection: Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, the role of domain expertise, and place for imagination)- Feature Selection algorithms.

Unit 4- Data Visualization: Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.

Unit 5- Application of Data Science: Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.

TEXTBOOKS:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.



2. Jake Vander Plas, Python Data Science Handbook , Shroff Publisher /O'Reilly Publisher Media.
3. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher /O'Reilly Publisher Media.

REFERENCE BOOKS:

1. Joel Grus, Data Science from Scratch, Shroff Publisher /O'Reilly Publisher Media.
2. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher.



AIML-003: DEEP LEARNING AND NEURAL NETWORK

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To strengthen important Mathematical concepts required for Deep learning and neural network.
2. To get a detailed insight of advanced algorithms of ML.

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

1. Understand the basics of Neural Networks.
2. Analyze ANN model and understand the ways of accuracy measurement.
3. Develop a convolutional neural network for multi-class classification in images.
4. Apply RNNs to Time Series Forecasting, NLP, Text, and Image Classification.
5. Creating the networks using TensorFlow and Keras.

Unit 1- NEURAL NETWORK: Characteristics of Neural Networks, Structure and working of a biological neural network, artificial neural network: terminology, models of neurons: McCulloch Pitts model, Perceptron model, Adaline model, topology, Basic learning laws. Functional Units for Artificial Neural Network for Pattern Recognition Task.

Unit 2- TRAINING NEURAL NETWORK: Initialization, batch normalization, Hyper parameter optimization ,Optimization algorithms:-SGD, Nesterov Momentum, Adagrad, RMS Prop, Adam. Regularization methods: dropouts, ensembles, data augmentation, update rules, transfer learning.

Unit 3- CONVOLUTIONAL NEURAL NETWORK: Back propagation, Gradient-Based Learning. Model of a biological neuron, activation functions:- different types, comparison, Convolutional Neural Networks: Convolution / Pooling Layers, spatial arrangement, layer patterns, layer sizing patterns. ImageNet, GoogleNet, ResNet, Visualizing Convolutional Neural Networks, Classification using CNN.

Unit 4- RECURRENT NEURAL NETWORK: Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM). Applications of Recurrent Neural Networks in real world: word prediction ,Chatbots, Image captioning.

Unit 5- TENSORFLOW AND KERAS: Creating and deploying networks using TensorFlow- open source machine learning platform and Keras-python deep learning API.

TEXTBOOKS:

1. John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons.
2. Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, Shroff Publisher /O'Reilly Publisher Media.



REFERENCE BOOKS:

1. Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford.

AIML-004: SPECIFIC TOPICS IN ARTIFICIAL INTELLIGENCE

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. Give fundamental knowledge to the students so that they can understand what the AI is and study important topics related to the field.

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

1. Design and implement Artificial Neural networks.
2. Decide when to use which type of NN.
3. Implement signal processing using MATLAB.
4. Understand Knowledge representation and Distributed AI along with its applications.
5. Understand basic concepts of Neuro Computing.

Unit 1- INTRODUCTION TO DEEP LEARNING: Bayesian Filtering; Recurrent Neural Networks, Deep Neural Networks, Deep Reinforcement Learning.

Unit 2- SPECIAL NETWORKS: Self- Play Networks, Generative Adversarial Networks, Learning from Concept-Drifting Data Streams.

Unit 3- SIGNAL PROCESSING: Audio Signal Processing Basics, mir toolbox contains many useful audios processing library functions, VOICEBOX: Speech Processing Toolbox for MATLAB, Audio processing in MATLAB.

Unit 4- KNOWLEDGE-BASED SYSTEMS: Architectures for second-generation knowledge-based systems, Distributed AI and its applications.

Unit 5- NEUROCOMPUTING: An introduction to neurocomputing and its possible role in AI, The role of uncertainty measures and principles in AI.

TEXTBOOKS:

1. Dr. Nilakshi Jain, Artificial Intelligence: Making a System Intelligent, John Wiley & Sons.
2. Artificial Intelligence & Soft Computing for Beginners, 3rd Edition-2018, by Anindita Das, Shroff Publisher.

REFERENCE BOOKS:



1. New Artificial Intelligence (Advanced), Takashi Mae da and Furnia Aoki, Ohmsha Publisher.

AIML-005: APPLICATIONS OF AI

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is:

1. To give deep knowledge of AI and how AI can be applied in various fields to make the life easy.

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

1. Design and implement AI.
2. Decide when to use which type of AI.
3. Understand automation and robotics.
4. Implement AI Models and Understand Security Concepts in AI.
5. Understand the concepts of Blockchain Technology.

Unit 1- NATURAL LANGUAGE PROCESSING: Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.

Unit 2- APPLICATIONS TO REAL LIFE: Emotion Recognition using human face and body language, AI-based system to predict the diseases early, Smart Investment analysis, AI in Sales, and Customer Support.

Unit 3- ROBOTICS PROCESSES: Robotic Processes Automation for supply chain management.

Unit 4- AI MODELLING: AI-Optimized Hardware, Digital Twin i.e., AI Modelling, Information Technology & Security using AI.

Unit 5- RECENT TOPICS IN AI/ ML: AI/ML in Smart solutions, AI/ML in Social Problems handling, Blockchain and AI.

TEXTBOOKS:

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
2. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, published July 2018.

REFERENCE BOOKS:

1. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.
2. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, published March 2017



AIMLP-001: INTRODUCTION TO AI & MACHINE LEARNING LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. Implement AI & ML concepts.

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

1. Understand various AI Techniques.
2. Understand the clustering models.
3. Implement classification models.
4. Analyze data models to study patterns.
5. Design and implement various machine learning algorithms in a range of Real-world applications.

The suggested list of Experiments:

1. Implementation of logical rules in Python.
2. Using appropriate data apply the concept of Linear regression.
3. Using appropriate data apply the concept of Gradient decent.
4. Using appropriate data apply the concept of Logistic regression.
5. To add the missing value in any data set.
6. Perform and plot under fitting and over fitting in a data set.
7. Implementation of clustering algorithms. 8. Implementation of classification algorithms.



AIMLP-002: INTRODUCTION TO DATA ANALYTICS LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To understand basics of machine learning in data science.
2. To understand various basic machine learning algorithm that can be used with various type of data.

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

1. Write programs to create GUI-based Python applications and to solve real-world problems.
2. Identify the process of data analysis for a given data set.
3. Make use of Numpy functions to perform various mathematical operations on arrays.
4. Use Pandas to perform data analysis in machine learning applications.
5. Construct various plots on real data to identify useful insights.

The suggested list of Experiments:

1. Program on Numpy Aggregations: Min, Max, and etc. Example What Is the Average Height of prime ministers of india?
2. Program using Numpy Comparisons, Masks, and Boolean Logic example: Counting Rainy Days.
3. Program using Numpy Fancy Indexing example: Selecting Random Points.
4. Write a NumPy program to create a 3x3 identity matrix.
5. Write a NumPy program to create a vector of length 10 with values evenly distributed between 5 and 50.
6. Program using Pandas to Combining Datasets: Join.
7. Program using Pandas on Pivot Tables.
8. Program using Pandas to Vectorized String Operations.
9. Program using Pandas to Work with Time Series Example: Visualizing Seattle Bicycle Counts.
10. Write a NumPy program to swap rows and columns of a given array in reverse order.
11. Write a NumPy program to compute the mean, standard deviation, and variance of a given array along the second axis.
12. Write a NumPy program to sort the student id with increasing height of the students from given students id and height. Print the integer indices that describes the sort order by multiple columns and the sorted data.



AIMLP-003: DEEP LEARNING AND NEURAL NETWORK LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To implement ANN and Deep Learning concepts.

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

1. Understand and implement the clustering and classification models.
2. Identify optimal hyperparameter values and appropriate architecture for a given problem and data using optimization techniques.
3. Analyze the characteristics of the given data and perform necessary pre-processing tasks to structure the data using Python libraries.
4. Utilize Python machine learning libraries and packages for building deep neural architectures to solve AI problems.
5. Work independently to solve problems with effective communication.

The suggested list of Experiments:

1. Implementation of MP model.
2. Implementation of feed forward neural network.
3. Implementation of back propagation neural network.
4. Implement all activation function of neural network for any pattern recognition application.
5. Implement any one of ImageNet or GoogLeNet.
6. Construct and implement multi-layer feed forward neural network for handwritten digit classification problem.
7. Classify images appropriately using CNN.
8. Implement LSTM Neural Network for Time Series Prediction.
9. Perform splitting of data for training, testing, and validation using k-fold cross validation.
10. Implement a binary and multi class image classification using Convolution Neural Network.
11. Perform hyper parameter tuning using Bayesian optimization technique for a Convolution Neural Network.
12. Analyze the effectiveness of various optimization algorithms with an image classification problem.
13. Solve the overfitting problem in a neural architecture using DropOut technique.
14. Study the efficiency of the transfer learning approach for a classification problem on the following architectures: VGG-16, Alexnet, and Inception-V3.



15. Solve a seq2seq problem (machine translation) using LSTM Recurrent Neural Architecture.
16. Solve a time series forecasting (stock prediction) using LSTM RNN.
17. Implement the image dimensionality reduction problem using a AutoEncoder architecture.

AIMLP-004: CAPSTONE PROJECT

L: T: P: : 0: 0: 4

Credits – 2

COURSE OBJECTIVES: The main objective of Capstone Project is to let the students apply the knowledge of theoretical concepts which they have learnt as a part of the curriculum of the minor degree using real time problems or situations.

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

1. Understand, plan, and execute a Capstone Project with team.
2. Acquired knowledge within the chosen area of technology for project development.
3. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
4. Communicate and report effectively project related activities and findings.
5. Expose the world of research, technology, and innovation.

COURSE GUIDELINES:

The Capstone project is desirable to be done in a group of 2 students. Each group has to prepare a title related to any engineering discipline, and the title must emulate any real world problem.

Submit an early proposal. This proposal is a 1-2page(s) report, describes what the project is about and the final product's output. The project proposal will be submitted to the respective guide.

Every individual student will be assigned a faculty to guide them. There will be three major reviews which will be carried out as listed below.

Review #	Requirement	Mark Weightage	
		Internal	External
0	Area / Title selection	-	-
1	Literature review / Proposal for the Project	10%	-
2	Mathematical Modelling/Circuit Design	20%	-
3	Final simulation / Hardware presentation	20%	-
End Semester Exam	Final Viva-Voce and project demonstration	-	50%

The assessment of term work shall be done on the basis of the following.



1. Continuous assessment
2. Performing the experiments in the laboratory
3. Oral examination conducted on the syllabus and term work mentioned above.



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 and Engineering)

2ND Year

Effective From – Session 2023-24



Syllabus

SEMESTER-III													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
				L	T	P	Sessional Exam			ESE			
							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



Syllabus

SEMESTER-IV														
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit	
				L	T	P	Sessional Exam			ESE				
							CT	TA	Total	TE	PE			
1	AHT-006/ ECT-033	BSC/ ESC	Advanced Applied Mathematics / Digital Electronics	3	0	0	30	20	50	100		150	3	
2	AHT- 007/AHT- 008	HSC	Technical Communication/ Universal Human Value	2	1	0	30	20	50	100		150 150	3 4	
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 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 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

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 Fourier transforms, 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.



Syllabus

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 predictor-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 Publishing House, 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, 5th ed.
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.



Syllabus

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 assess 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.



Syllabus

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



Syllabus

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



Syllabus

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



Syllabus

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



Syllabus

Harmony in the nature. Four orders of nature; existence as co-existence, harmony at all levels of existence.

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)



Syllabus

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(\wedge), OR(\vee), NOT(\sim), 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.



Syllabus

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 sekharaiyah-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



Syllabus

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.



Syllabus

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.



Syllabus

OBJECT ORIENTED PROGRAMMING (CST-004/CSO-053)

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 Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes. Polymorphism: Virtual Functions, Virtual Attribute and Inheritance, Virtual Functions and Hierarchy, Pure Virtual



Syllabus

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 I/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

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:



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- a) Prim's algorithm.
 - b) Kruskal's algorithm.
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.



Syllabus

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.



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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 equivalentents 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.



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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 radius. If (distance between two balls centers) \leq (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 b are 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.



Syllabus

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, Indentation, 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.



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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”, 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978- 8126562176
5. Reema Thareja, “Python Programming using problem-solving approach”, Oxford university press, 2017.



Syllabus

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



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Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops and desktop.

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.



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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. Carl Hamacher “ Computer Organization and Embedded Systems”, 6th Edition, McGraw Hill Higher Education.
3. Miles Murdocca and Vincent Heuring “Computer Architecture and Organization: An integrated Approach” 2nd edition, Wiley Publication.



Syllabus

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.



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

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.



Syllabus

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.



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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, 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, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekar, 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.



Syllabus

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.



Syllabus

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.



Syllabus

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)

(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.



Syllabus

10. Study to use ssh, telnet, putty, ftp, ncftp and other network tools.



VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

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 and Engineering)

3RD Year

Effective From – Session 2024-25



SEMESTER-V													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
				L	T	P	Sessional Exam			ESE			
							CT	TA	Total	TE	PE		
1	CST-010	DC	Design and Analysis of Algorithms	3	1	0	30	20	50	100		150	4
2	CST-011	DC	Database Management System	3	1	0	30	20	50	100		150	4
3	CST-012	DC	Compiler Design	3	1	0	30	20	50	100		150	4
4	CST-0XX	DE	Departmental Elective-1	3	0	0	30	20	50	100		150	3
5	CST-0XX	DE	Departmental Elective-2	3	0	0	30	20	50	100		150	3
6	CSP-010	DLC	Design and Analysis of Algorithms Lab	0	0	2		25	25		25	50	1
7	CSP-011	DLC	Database Management System Lab	0	0	2		25	25		25	50	1
8	CSP-012	DLC	Compiler Design Lab	0	0	2		25	25		25	50	1
9	CSP-013	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	CST-014	Computer Graphics
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-020	Fuzzy Logic

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



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	CST-021	DC	Computer Networks	3	1	0	30	20	50	100	150	4	
2	CST-022	DC	Artificial Intelligence	3	1	0	30	20	50	100	150	4	
3	CST-023	DC	Operating System	3	1	0	30	20	50	100	150	4	
4	CST-0XX	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	CSP-014	DLC	Computer Networks Lab	0	0	2		25	25		25	50	1
7	CSP-015	DLC	Artificial Intelligence Lab	0	0	2		25	25		25	50	1
8	CSP-016	DLC	Operating System 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	CST-027	Web Technology
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 Hr Tutorial 2 or 3 Hr Practical
1 Credit 1 Credit 1 Credit



DESIGN & ANALYSIS OF ALGORITHMS (CST-010)

L:T:P:: 3:1:0

Credits-04

COURSE OUTCOMES: The objectives of this course are to:

1. Understand and apply the algorithm analysis techniques.
2. Analyze the efficiency of alternative algorithmic solutions for the same problem.
3. Understand different algorithm design techniques.
4. Understand the limitations of Algorithmic power.

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

1. Analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. Analyze randomized algorithms and approximation algorithms.

Unit 1- Introduction: Characteristics of an algorithm, Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average, and worst-case behavior, Sorting techniques and their performance analysis, Time a space trade-off.

Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and master's theorem.

Unit 2- Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch- and-Bound and Back tracking methodologies for the design of an algorithms, Illustrations of these techniques for Problem-Solving, Knapsack, Matrix Chain Multiplication, Activity selection and LCS Problem.

Unit 3- Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS), Shortest path algorithms, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm, Binomial Heap and Fibonacci Heap.

Unit 4- Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Standard NP-complete problems and Reduction techniques.



Unit 5- Advanced Topics: Approximation algorithms and Randomized algorithms, Distributed Hash Table

TEXTBOOKS:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 4TH Edition, MITPress/McGraw-Hill.
2. Ellis Horowitz, Sartaj Sahni and SanguthevarRajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

REFERENCE BOOKS:

1. Jon Kleinberg and ÉvaTardos,Algorithm Design, 1ST Edition, Pearson.
2. Michael T Goodrich and Roberto Tamassia,Algorithm Design: Foundations, Analysis, and Internet Examples, Second EditionWiley.
3. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.



DATABASE MANAGEMENT SYSTEMS (CST-011)

L:T:P:: 3:1:0

Credits-04

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.

Unit 4-Transaction processing: Transaction Concepts, ACID Properties, Two-Phase Commit, Save Points, Concurrency Control techniques: Locking Protocols, Two Phase Locking, timestamp-based protocol, Multi-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.



COMPILER DESIGN (CST-012)

L:T:P:: 3:1:0

Credits-04

OBJECTIVES: The objectives of this course are to:

1. Learn the various phases of compiler and various parsing techniques.
2. Understand intermediate code generation and run-time environment.
3. Learn to implement front-end of the compiler and code generator.

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

1. Understand the different phases of compiler.
2. Design a lexical analyser for a sample language using LEX tool.
3. Apply different parsing algorithms to develop the parsers for a given grammar using YACC tool.
4. Understand syntax-directed translation and run-time environment.
5. Learn to implement code optimization techniques and a simple code generator.

UNIT - I

INTRODUCTION TO COMPILERS: Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

UNIT- II

SYNTAX ANALYSIS: Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies, Recursive Descent Parser, Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT- III

SYNTAX-DIRECTED TRANSLATION: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.

INTERMEDIATE-CODE GENERATION: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

UNIT- IV

RUN-TIME ENVIRONMENTS: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.



CODE GENERATION: Issues in the Design of a Code Generator, The Target Language, addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.

UNIT- V

MACHINE-INDEPENDENT OPTIMIZATION: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs, peep-hole optimization.

TEXTBOOKS:

1. Compilers Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, PEA.
2. Introduction to Automata Theory Languages & Computation, 3rd Edition, Hopcroft, Ullman, PEA

REFERENCE BOOKS:

1. Theory of Computer Science, Automata Languages and Computation, 2nd Edition, Mishra, Chandra Shekaran, PHI.
2. Elements of Compiler Design, A.Meduna, Auerbach Publications, Taylor and Francis Group.



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.



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.



COMPUTER GRAPHICS (CST-014)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of this course are to

1. Provide a comprehensive introduction to computer graphics leading to understanding contemporary terminology, progress, issues, and trends.
2. Understand computer graphics techniques (2-D/3-D), focusing on 3D modelling, image synthesis, and rendering.
3. Introduce geometric transformations, geometric algorithms, software systems (OpenGL), 3D object models (surface, volume and implicit), visible surface algorithms, image synthesis, shading and mapping, ray tracing, radiosity, global illumination, photon mapping, and anti-aliasing.
4. Explore the interdisciplinary nature of computer graphics which is emphasized in the wide variety of examples and applications.

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

1. Develop the understanding of the fundamentals of Graphics concepts, and standards.
2. Understand the algorithms that form the foundation of computer graphics.
3. Provide 3D representation for their applications.
4. Understand various transformation techniques and their application.
5. Interpret parallel and oblique projections and their applications.

Unit 1- Introduction to computer graphics & graphics systems: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing, RGB color model, direct coding, lookup table, storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc., Active & Passive graphics devices, Computer graphics software.

Unit 2- Points & lines: Line drawing algorithms; DDA algorithm, Bresenhan's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Unit 3- 2D transformation & viewing Basic transformations: Translation, rotation, scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems, reflection shear, Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to viewport coordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

Unit 4- 3D transformations: Translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane, general parallel projection transformation, clipping, viewport



clipping, 3D viewing.

Unit 5- Curves representation: Surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color & shading models Light & color model, interpolative shading model and Texture

TEXTBOOKS:

1. Donald Hearn and Pauline Baker M, —Computer Graphics, Prentice Hall, New Delhi, 2007.
2. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Design, PHI, 2003.

REFERENCES:

1. Judith Jeffcoate, —Multimedia in practice: Technology and Applications, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, —Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan, 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics, CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, —Principles of Interactive Computer Graphics, Mc Graw Hill 1978.



SOFTWARE ENGINEERING (CST-015/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.



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, queueing systems and queueing 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, jointly 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/1 queueing 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.



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 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



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), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption 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.

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.



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, NiranjnG.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.



FUZZY LOGIC (CST-020)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of this course are to

1. Develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations.
2. Learn 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, α - 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.



DESIGN & ANALYSIS OF ALGORITHMS LAB (CSP-010)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Build a solid foundation in algorithms and their applications.
2. Implement various divide and conquer techniques examples, Greedy techniques examples, and Dynamic Programming techniques examples.
3. Provide a practical exposure of various algorithms.
4. Understand the importance of algorithm and its complexities.

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

1. Solve recurrence equations by considering time and space complexity.
2. Analyse the complexities of various problems in different domains.
3. Solve the problems that comprises of shortest route issue.
4. Solve the problems that address the issue of dynamic programming
5. Synthesize efficient algorithms in common engineering design situations.

LIST OF EXERCISES

1. Programming that uses recurrence relations to analyse recursive algorithms.
2. Computing best, average, and worst-case time complexity of various sorting techniques.
3. Performance analysis of different internal and external sorting algorithms with different type of data set.
4. Use of divide and conquer technique to solve some problem that uses two different algorithms for solving small problem.
5. Implementation of different basic computing algorithms like Hash tables, including collision-avoidance strategies, Search trees (AVL and B-trees).
6. Consider the problem of eight queens on an (8x8) chessboard. Two queens are said to attack each other if they are on the same row, column, or diagonal. Write a program that implements backtracking algorithm to solve the problem i.e. place eight non-attacking queens on the board.
7. Write a program to find the strongly connected components in a digraph.
8. Write a program to implement file compression (and un-compression) using Huffman's algorithm.
9. Write a program to implement dynamic programming algorithm to solve the all pairs shortest path problem.
10. Write a program to solve 0/1 knapsack problem using the following:
 - a) Greedy algorithm.
 - b) Dynamic programming algorithm.
 - c) Backtracking algorithm.
 - d) Branch and bound algorithm.



- 11.** Write a program that uses dynamic programming algorithm to solve the optimal binary search tree problem.
- 12.** Write a program for solving traveling salespersons problem using the following:
 - a) Dynamic programming algorithm.
 - b) The back tracking algorithm.
 - c) Branch and bound.



DATABASE MANAGEMENT SYSTEM LAB (CSP-011)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Understand data definitions and data manipulation commands.
2. Learn the use of nested and join queries.
3. Understand functions, procedures and procedural extensions of data bases.
4. Familiar with the use of a front-end tool and understand design and implementation of typical database applications

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

1. Understand, appreciate, and effectively explain the concepts of database Technologies.
2. Declare and enforce integrity constraints on a database using RDBMS.
3. Devise a complex query using SQL DML/DDL commands.
4. Create views and use in-built functions to query a database.
5. Write PL/SQL programs including stored procedures, stored functions and triggers.

LIST OF EXPERIMENTS

1. Build the following database schemas and perform the manipulation operations on these schemas using SQL DDL,DML,TCL and DCL commands.
(I) Database Schema for a customer-sale scenario
Customer(Custid : integer, cust_name: string)
Item(item_id: integer, item_name: string, price: integer)
Sale(bill_no: integer, bill_data: date, cust_id: integer, item_id: integer, qty_sold: integer)

For the above schema, perform the following:-

- a) Create the tables with the appropriate integrity constraint
- b) Insert around 10 records in each of the tables
- c) List all the bills for the current date with the customer names and item numbers
- d) List the total Bill details with the quantity sold price of the item and the final amount
- e) List the details of the customer who have bought a product which has a price > 200
- f) Give a count of how many products have been bought by each customer
- g) Give a list of products bought by a customer having cust_id as 5
- h) List the item details which are sold as of today
- i) Create a view which lists out the bill_no, bill_date, cust_id, item_id, price, qty_sold, amount
- j) Create a view which lists the date wise daily sales for the last one week
- k) Identify the normalization of this schema. Justify your answer.
- l) If the schema is not normalized, then normalize the schema.

(II) Database Schema for a Employee-pay scenario



Employee(emp_id : integer, emp_name: string)

Department (dept_id: integer, dept_name:string)

Paydetails(emp_id : integer, dept_id: integer, basic: integer,deductions: integer, additions: integer, DOJ: date)

payroll(emp_id : integer, pay_date: date)

For the above schema, perform the following:—

- a) Create the tables with the appropriate integrity constraints
 - b) Insert around 10 records in each of the tables
 - c) List the employee details department wise
 - d) List all the employee names who joined after particular date
 - e) List the details of employees whose basic salary is between 10,000 and 20,000
 - f) Give a count of how many employees are working in each department
 - g) Give a name of the employees whose netsalary>10,000
 - h) List the details for an employee_id=5
 - i) Create a view which lists out the emp_name, department, basic, deductions,netsalary
 - j) Create a view which lists the emp_name and his netsalary
 - k) Identify the normalization of this schema. Justify your answer
 - l) If the schema is not normalized then normalize the schema.
2. Construct a PL/SQL program to find largest number from the given three numbers.
 3. Build a PL/SQL program to generate all prime numbers below 100.
 4. Construct a PL/SQL program to demonstrate %type and %row type attributes.
 5. Develop a PL/SQL procedure to find reverse of a given number.
 6. Create a PL/SQL procedure to update the salaries of all employees by 10% in their basic pay.
 7. Execute a PL/SQL procedure to demonstrate IN, OUT and INOUT parameters.
 8. Design a PL/SQL trigger before/after update on employee table for each row/statement.
 9. Create a PL/SQL trigger before/after delete on employee table for each row/statement.
 10. Build a PL/SQL trigger before/after insert on employee table for each row/statement.
 11. Design and build the following applications using SQL and front end tool and generate report
 - Student information system for your college.
 - Hospital Management System.
 - A video library management system.
 - Inventory management system for a hardware / sanitary item shop.
 - Banking System.
 - Railway Reservation System
 - Car Insurance Company



COMPILER DESIGN LAB (CSP-012)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Understand the various phases in the design of a compiler.
2. Understand the design of top-down and bottom-up parsers.
3. Understand syntax directed translation schemes.
4. Introduce lex and yacc tools.

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

1. Understand the basic concepts; ability to apply automata theory and knowledge on formal languages.
2. Understand the basic concepts and application of Compiler Design
3. Apply their basic knowledge Data Structure to design Symbol Table, Lexical Analyser, Intermediate Code Generation, Parser (Top Down and Bottom-Up Design) and will able to understand strength of Grammar and Programming Language.
4. Understand various code optimization techniques and error recovery mechanisms.
5. Understand and Implement a Parser.

LIST OF PRACTICALS:

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language
2. Write a C program to identify whether a given line is a comment or not
3. Write a C program to test whether a given identifier is valid or not.
4. Write a C program to simulate lexical analyzer for validating operators.
5. To Study about Lexical Analyzer Generator(LEX) and Flex(Fast Lexical Analyzer)
6. Implement following programs using Lex:
 - a) Create a Lexer to take input from text file and count no of characters, no. of lines & no. of words.
 - b) Write a Lex program to count number of vowels and consonants in a given input string.
7. Implement following programs using Lex.
 - a) Write a Lex program to print out all numbers from the given file.
 - b) Write a Lex program to printout all HTML tags in file.
 - c) Write a Lex program which adds line numbers to the given file and display the same onto the standard output.
8. Write a Lex program to count the number of comment lines in a given C program. Also eliminate them and copy that program into separate file.
9. Write a C program for implementing the functionalities of predictive parser for the mini language.



10. Write a C program for constructing of LL (1) parsing.
11. Write a C program for constructing recursive descent parsing
12. Write a C program to implement LALR parsing.
13. Write a C program to implement operator precedence parsing.
14. To Study about Yet Another Compiler-Compiler(YACC).
15. Create Yacc and Lex specification files to recognizes arithmetic expressions involving +, -, * and / .
16. Create Yacc and Lex specification files are used to generate a calculator which accepts, integer and float type arguments.



INTERNSHIP-II / MINI PROJECT-II (CSP-013)

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 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 instill 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.



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



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.



COMPUTER NETWORKS (CST-021/CSO-051)

L:T:P:: 3:1:0

Credits-04

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.

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



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.

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, Pearson 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.



OPERATING SYSTEMS (CST-023)

L: T:P :: 3:1:0

Credits-04

COURSE OBJECTIVES: The objectives of this course are to

1. Learn and understand the Concepts of the operating systems.
2. Learn and understand operating system services.
3. The core structure, functions and design principles of operating system.
4. Interposes communications and basic concepts of virtualization.

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

1. Create processes and threads.
2. Develop process scheduling algorithms for a given CPU utilization specification, Throughput, Turnaround Time, Waiting Time, and Response Time.
3. Develop the techniques for optimally allocating memory to processes by increasing memory utilization and improving access time.
4. Design and implement a file management system.
5. Develop the I/O management functions in OS.

Unit 1- Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS -Layered, Microkernel Operating Systems, Concept of Virtual Machine.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multi threads

Unit 2- Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real-Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer-Consumer Problem, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.

Unit 3- Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation–Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation –Hardware support for paging, Protection and sharing, Disadvantages of paging.



Unit 4- Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

Unit 5- File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (Contiguous, linked, indexed).

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability.

TEXTBOOKS:

1. AviSilberschatz, Peter Galvin, Greg Gagne , Operating System Concepts Essentials, 9th Edition by, Wiley Asia Student Edition.
2. William Stallings , Operating Systems: Internals and Design Principles, 9th Edition (2022), Prentice Hall of India.

Reference Books:

1. RamazElmasri, A. Gil Carrick, David Levine, —Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. Achyut S.Godbole, Atul Kahate, —Operating Systems, McGraw Hill Education, 2016.
3. Andrew S. Tanenbaum, —Modern Operating Systems, Second Edition, Pearson Education, 2004.



INTERNET OF THINGS (IOT) (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 RASPBERRY 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, 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 Madiseti, —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.



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 programming 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 q-bit system of information representation: Bloch 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, RigettiPyQuil (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



AUGEMENTED REALITY (AR) (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



WEB TECHNOLOGY (CST-027)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of this course are to

1. Understand about client-server communication and protocols used during communication.
2. Design interactive web pages using Scripting languages.
3. Learn server-side programming using servlets and JSP.
4. Develop web pages using XML/XSLT.

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

1. Design simple web pages using mark-up languages like HTML and XHTML.
2. Create dynamic web pages using DHTML and java script that is easy to navigate and use.
3. Program server-side web pages that have to process request from client side web pages.
4. Represent web data using XML and develop web pages using JSP.
5. Understand various web services and how these web services interact.

UNIT-I Introduction to HTML: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;

Introduction to JavaScript: Scripts, Objects in Java Script, Dynamic HTML with Java Script

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX

UNIT-II Java Beans: Introduction to Java Beans, Advantages of Java Beans, JDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

UNIT-III Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Servlet, JSDK, The Servlet API, The javax.servelet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

UNIT-IV Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat

UNIT-V JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring



Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users
Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage
Considerations.

TEXT BOOK:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

REFERENCE BOOK:

1. Robert. W. Sebesta, "Programming the World Wide Web", 8thEdition(2022), Pearson Education, 2007.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown, Core Web Programming Second Edition, I I Volume I and II, Pearson Education, 2001.
4. Bates, —Developing Web ApplicationsI, Wiley, 2006



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: On 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.

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, Multi-tasking, 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.

**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- 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.	09



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.



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

Books and References

1. Kotler, P. and Keller, K.L. (2017) Marketing Management. 15^o 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.

**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 identify 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	Course Content	Lectures
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.	08
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.	08
III	Hazard Identification and Risk Assessment: The process of risk management, hazard identification, evaluation (risk assessment, risk matrix), risk control implementation, action and recommendation.	08
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.	08
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.	08

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 Butterworth London 1983.



COMPUTER NETWORKS LAB (CSP-014)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Equip the students with a general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

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

1. Learn about hardware component like RJ-45 connector, CAT-6 Cable etc.
2. Implement the various services of data link layer.
3. Configuration of router, hub, switch etc
4. Configuration of server in programming mode they will learn about socket programming, client server programming for deeply understanding TCP/ IP model and various protocols.
5. Configure their own Network management systems in simulation area, they will work on Cisco networking, NS-2 or NS-3 tools for more clear understanding about computer network.

LIST OF PRACTICALS

1. Installation and configuration of NS2 and Qual Net
2. Creating a network: nodes, links and queues, Creating connections, traffic and computing routers
Insertion of errors and analysis of trace file.
3. Study of basic network command and network configuration commands.
4. Simple project on NS2 – wired, wireless and combination of wired and wireless
5. Implementation of new protocols in NS2
6. Simulation study of pure ALOHA protocol;
7. Simulation study of slotted ALOHA protocol;
8. Simulation study of Token Bus LAN protocol;
9. Simulation study of Token Ring LAN protocol;
10. Simulation study of WAN protocol like Frame Relay, X. 25
11. Study of 802. 11 wireless LAN protocols.
12. Implement the Distance Vector Routing protocol for finding the shortest path.
13. Write a program to connect server with client and passes information from one system to another and vice versa that by creating / establishing connection.



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.



OPERATING SYSTEMS LAB (CSP-016)

L:T:P:: 0:0:2

Credits-01

COURSE OBJECTIVES: The objectives of this course are to

1. Learn Unix commands and shell programming.
2. Implement various CPU Scheduling Algorithms and Process Creation and Inter Process Communication.
3. Implement Deadlock Avoidance and Deadlock Detection Algorithms.
4. Implement Page Replacement Algorithms, File Organization and File Allocation Strategies.

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

1. Understand the system calls and I/O system calls in UNIX
2. Evaluate the process scheduling algorithms FCFS, SJF, Priority and Round robin
3. Simulate the process of communication through various techniques
4. Simulate memory management schemes
5. Simulate File Allocation Techniques

LIST OF EXPERIMENTS

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time (2 sessions)
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each scheduling policy, compute and print the average waiting and turnaround times (2 Sessions).
6. Developing Applications using Inter Process communication (using shared memory and pipes)
7. Simulate the Producer-Consumer problem using semaphores (using UNIX system calls).
8. Simulate First fit, best fit and Worst fit memory management algorithms.
9. Simulate Page Replacement Algorithms (FIFO, LRU and Optimal)
10. Simulate the Paging memory management scheme



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



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



VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

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SYLLABUS

For

B.TECH

(Computer Science and Engineering)

4TH Year

Effective From – Session 2025-26



SEMESTER-VII													
S. NO.	Subject Codes	Category	Subject	Periods			Evaluation Scheme					Subject Total	Credit
				L	T	P	Sessional Exam			ESE			
							CT	TA	Total	TE	PE		
1	AHT-015 /AHT-016	HSC	Rural Development Administration and Planning/ Project Management and Entrepreneurship	3	1	0	30	20	50	100		150	3
2	CST-0XX	DE	Departmental Elective-4	3	0	0	30	20	50	100		150	3
3	CST-0XX	DE	Departmental Elective-5	3	0	0	30	20	50	100		150	3
4	CSO-0XX	OE	Open Elective-2	3	0	0	30	20	50	100		150	3
5	CSP-017	DLC	Machine Learning Lab	0	0	2		25	25		25	50	1
6	CSP-018	DLC	Project Seminar	0	0	2			50			50	1
7	CSP-019	DLC	Design Project	0	0	4			100			100	2
8	CSP-020	DLC	Mini Project-III or Internship-III*	0	0	2			50			50	1
9	AHT-017	MC	Disaster Management	2	0	0		50	50		50	100	2
10	AHT-018	NC	Innovations and Problem Solving	2	1	0	15	10	25	50			
11	GP-007	NC	General Proficiency						50				
			Total	12	1	12						900	19
12			Minor Course (Optional)**	3	1	0	30	20	50	100			4
*The Internship-III (4-6weeks) will be conducted during summer break after the VI semester and will be assessed during VII semester.													
MOOCs course													

Departmental Elective-4		
S. No.	Subject Code	Subject Name
1	CST-029	Ad-hoc & Sensor Networks
2	CST-030	Machine Learning
3	CST-031	Mobile Computing
4	CST-032	Data Mining
5	CST-033	Block Chain

Departmental Elective-5		
S. No.	Subject Code	Subject Name
1	CST-034	Data Science
2	CST-035	Cryptography & Network Security
3	CST-036	DevOps
4	CST-037	Cloud Computing
5	CST-038	Natural Language Processing

Open Elective -2 (This course can be taken only by the students of branches other than CSE and specialized branches of CSE in VIIth semester. Students of CSE and specialized branches of CSE shall opt open electives floated by other departments)

Open Elective-2		
S. No.	Subject Code	Subject Name
1	CSO-051	Computer Network

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



SEMESTER-VIII													
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-015 / AHT-016	HSC	Rural Development Administration and Planning/ Project Management and Entrepreneurship	3	0	0	30	20	50	100		150	3
2	CST-0XX	DE	Departmental Elective-6	3	0	0	30	20	50	100		150	3
3	CSO-0XX	OE	Open Elective-3	3	0	0	30	20	50	100		150	3
4	CSO-0XX	OE	Open Elective-4	3	0	0	30	20	50	100		150	3
5	CSP-021	DLC	Project	0	0	12			100		200	300	6
6	GP-008	NC	General Proficiency						50				
			Total	12	0	12						900	18
7			Minor Course (Optional)**	3	1	0	30	20	50	100			4
	MOOCs course												

Departmental Elective-6		
S. No.	Subject Code	Subject Name
1	CST-039	Soft Computing
2	CST-040	Software Project Management
3	CST-041	Cyber and Digital Forensics
4	CST-042	Digital Image Processing
5	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 VIIIth semester. Students of CSE and specialized branches of CSE shall opt open electives floated by other departments)

Open Elective-3		
S. No.	Subject Code	Subject Name
1	CSO-052	Software Engineering

Open Elective-4		
S. No.	Subject Code	Subject Name
1	CSO-053	Object Oriented Programming

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



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:

(8 hours)

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:

(8 hours)

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.

UNIT-III:

(8 hours)

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: (8 hours)

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: (8 hours)

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.



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:

(8 hours)

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

UNIT-II

(8 hours)

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.

UNIT-III:

(8 hours)

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

(8 hours)

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:

(8 hours)

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.; Harper and Row.
2. Business, Entrepreneurship and Management: Rao, V.S.P.; Vikas
3. Entrepreneurship: Roy Rajeev.
4. Text Book of Project Management: Gopalkrishnan, 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.



ADHOC AND SENSOR NETWORK (CST-029)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Learn Ad hoc network and Sensor Network fundamentals.
2. Understand the different routing protocols
3. Have an in-depth knowledge on sensor network architecture and design issues
4. Understand the transport layer and security issues possible in Ad hoc and Sensor networks

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

1. Impart the trends in emerging field of wireless ad hoc and sensor networking.
2. Focus on layered communication modeling, such as the media access control and network layer.
3. Understand the basic concept of QoS and Multicast routing protocol.
4. Address quality of service issues and network reliability for transmission of real-time information.
5. Learn the various routing protocols of ad hoc and sensor networks

Unit 1- ADHOC NETWORKS INTRODUCTION: Introduction to Wireless Communication Technology, Characteristics of the Wireless Channel, IEEE 802.11a/b Standard, Origin of Ad-hoc Packet Radio Networks, Architecture of PRNETS, Introduction to Ad-hoc Wireless Networks, Heterogeneity in Mobile Devices.

Unit 2- ADHOC NETWORK ROUTING PROTOCOLS: Introduction -to designing a Routing Protocol, Classifications of Routing Protocols, Destination Sequenced Distance Vector (DSDV), Dynamic Source Routing (DSR), Zone Routing Protocol (ZRP), Wireless Routing Protocol (WRP), Source—Initiated On—Demand Approaches, Ad hoc On-Demand Distance Vector Routing , AODV.

Unit 3- QoS AND Multicast Routing Protocol in MANET: Issues and challenges in providing QoS in Adhoc Wiress Networks, Introduction to QoS in Ad hoc Wireless Networks, Classifications of QoS Solutions, Introduction to Multicast Routing Protocol, Classifications of Multicast Routing Protocols.

Unit 4- WSN INTRODUCTION: Characteristic requirements, Challenges of sensor networks Emerging technologies for wireless sensor networks, Advantages of sensor networks, Sensor network applications.

Unit 5- WSN PROTOCOLS: Communication protocols, MAC protoacaols, Namlng and Addressing-Routing protocols, Energy efficient routing.



TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, —Ad Hoc Wireless Networks Architectures and Protocols, Prentice Hall, PTR, 2004.
2. Holger Karl , Andreas willig, —Protocol and Architecture for Wireless Sensor Networks, John wiley publication, Jan 2006.

REFERENCE BOOKS:

1. Feng Zhao, Leonidas Guibas, —Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.
2. Charles E. Perkins, —Ad Hoc Networking, Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, —Wireless sensor networks: a survey, computer networks, Elsevier, 2002, 394 - 422.



MACHINE LEARNING (CST-030)

L:T:P:: 3:0:0

Credits-03

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

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. Ethem Alpaydin, —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.



MOBILE COMPUTING (CST-031)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Understand the basic concepts of mobile computing and basics of mobile telecommunication system.
2. Become familiar with the network layer protocols and Ad-Hoc networks.
3. Know the basis of transport and application layer protocols.
4. Gain the knowledge about different mobile platforms and application development

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

1. Impart knowledge of mobile and wireless computing systems and techniques.
2. Understand the knowledge of wireless network
3. Understand the concepts of security and failure detection and recovery strategies.
4. Understand the concepts routing protocols.
5. Understand the working of mobile tracking in wireless network

Unit 1- Introduction: Issues, Challenges, and benefits of Mobile Computing, IEEE 802.11 & Bluetooth, Wireless Multiple access protocols, spread spectrum, cellular wireless networks.

Unit 2- Data Management Issues: Wireless computing, nomadic computing, ubiquitous computing and tunneling, data replication for mobile computers, adaptive Clustering for Mobile Wireless networks, LEACH and TORA, mobile TCP (M-TCP) Spooning TCP, Frequency for radio transmission.

Unit 3- Distributed location Management: pointer forwarding strategies, Process communication techniques, Socket Programming, RPC, RMI, Mobile IP, TCP Over wireless. Hidden and exposed terminal problems.

Unit 4- Routing Protocols: Routing Protocol, Dynamic State Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), and Destination Sequenced Distance – Vector Routing (DSDV), Cluster Based Routing Protocol (CBRP).

Unit 5- Fault tolerance and security: Security and fault tolerance, transaction processing in Mobile computing environment. Mobile Agent Systems: Aglets, PMADE, Case Studies, agent failure scenarios, node failure detection and recovery.

TEXT BOOKS:

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt. Ltd, New Delhi – 2012



REFERENCE BOOKS:

1. Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems, Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computing, Springer, 2003.
3. William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition, TataMcGraw Hill Edition ,2006.
4. C.K.Toh, —AdHoc Mobile Wireless Networks, First Edition, Pearson Education, 2002.



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



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 toBlockchain, 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; 1st edition, 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 Smart 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.



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.

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 Steinbach, 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 Tector, "R Cookbook", O'Reilly, 2011.



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/MIME 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.



DEVOPS (CST-036)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. Implement automated system update and DevOps lifecycle.

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

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assess, collaborate, and adopt Devops in real-time projects

Unit 1-Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

Unit 2-Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.

DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

Unit 3-Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

Unit 4-Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

Unit 5-Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development



Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXTBOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN10: 1788392574.
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOK:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10.



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.

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, OpenNebula, 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.



NATURAL LANGUAGE PROCESSING (CST-038)

L:T:P:: 3:0:0

Credits-03

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.

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



COMPUTER NETWORKS (CST-021/CSO-051)

L:T:P:: 3:1:0

Credits-04

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.



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



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-S algorithm 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.



PROJECT SEMINAR (CSP-018)

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.



DESIGN PROJECT (CSP-019)

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.



Internship-III/Mini Project-III – (CSP-020)

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 instill 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.



DISASTER MANAGEMENT (AHT-017)

L:T:P:: 3:0:0

Credits-03

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)
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.



INNOVATIONS AND PROBLEM SOLVING(AHT-18)

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,
- 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 Genrich Altshuller
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.



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, Backpropagation learning, Fundamentals of Associative Memory, Associative memory models, Auto associative memory, Bi-directional hetero associative memory.

Unit 3- Competitive Networks: Introduction to Competitive Neural 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, snowflake 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.

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence – E Charniak and D McDermott, Pearson Education
2. Artificial Intelligence and Expert Systems – Dan W. Patterson, Prentice Hall of India.



SOFTWARE PROJECT MANAGEMENT (CST-040)

L:T:P:: 3:0:0

Credits-03

COURSE OBJECTIVES: The objectives of the course are to

1. Introduce the primary important concepts of project management related to managing software development projects.
2. Become familiar with the different activities involved in Software Project Management
3. Know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.

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

1. Identify the different project contexts and suggest an appropriate management strategy.
2. Practice the role of professional ethics in successful software development.
3. Identify and describe the key phases of project management.
4. Determine an appropriate project management approach through an evaluation of the business context and scope of the project
5. Manage the people and control the defects.

Unit 1- Basic Concepts: Product, Process and Project, Definition, Components of Software Project Management(SPM), Challenges and Opportunities, Tools and Techniques, Managing Human Resource and Technical Resource, Costing and pricing of projects, Training and development, Project management technique, Product Life Cycle , Project Life Cycle Models.

Unit 2- Format Process Models and Their Use: Definition and Format Model for a Process, ISO 9001 and CMM Models and their relevance to Project Management, Other Emerging Models like People CMM

Unit 3- Umbrella Activities In Projects: Metrics, Methods and Tools for Metrics, Issues of Metrics in multiple Projects, Configuration Management, Software Quality Assurance, Quality Standards and Certifications, Process and Issues in obtaining Certifications, Risk issues in Software Development and Implementation, Identification of Risks , Resolving and Avoiding risks, Tools and Methods for Identifying Risk Management.

Unit 4- Instream Activities In Project: Project Initiation, Project Planning, Execution and Tracking, Project Wind up, Concept of Process, Project Database.



Unit 5- Engineering And Issues In Project Management: Requirements, Design, Development, Testing, Maintenance, Deployment, Engineering Activities and Management Issues in Each Phase, Special Considerations in Project Management for India and Geographical Distribution Issues.

TEXT BOOK(S)

1. Royce and Walker, “Software Project Management”, 2nd Edition, Pearson Education, 2002.

REFERENCES

1. Bob Hughes and Mike Cotterell, “Software Project Management”, 5th Edition, Tata McGrawHill, 2011.
2. Kelker, S. A, “Software Project Management”, 2nd Edition, Prentice Hall, 2003.
3. Gopaldaswamy Ramesh, "Managing Global Projects", 1st Reprint Edition, Tata McGraw Hill,2006.
4. Robert K. Wysocki, “Executive's Guide to Project Management”, 2nd Edition, John Wiley & Sons, 2011.
5. Teresa and luckey, Joseph Phillips, “Software project Management for dummies”, 3rd Edition, Wiley publishing Inc., 2006.



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.



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.



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.

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.



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 in a 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 operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zookeeper - IBM Infosphere Big Insights and Streams.



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, Guoqing 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 Madiseti, “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.



SOFTWARE ENGINEERING (CST-015/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.
Tom Halt, —Handbook of Software Engineering, ClanyeInternational ISBN- 10: 1632402939



OBJECT ORIENTED PROGRAMMING (CST-004/CSO-053)

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 Multiple 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 I/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)



PROJECT (CSP-021)

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.



Minor Degree in “Cyber Security”

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme			End Semester		Total	Credit	Sem
			L	T	P	CT	TA	TOTAL	TE	PE			
1	CSET-001	Principles of Information Security	3	0	0	30	20	50	100		150	3s	III
2	CSET-002	Foundations of Cyber Security	3	0	0	30	20	50	100		150	3	IV
3	CSET-003	Ethical Hacking Fundamentals	3	0	0	30	20	50	100		150	3	V
4	CSET-004	Digital Forensics	3	0	0	30	20	50	100		150	3	VI
5	CSET-005	Security Incident & Response Management	3	0	0	30	20	50	100		150	3	VII
6	CSEP-001	Principles of Information Security Lab	0	0	2		25	25		25	50	1	III
7	CSEP-002	Ethical Hacking Fundamentals Lab	0	0	2		25	25		25	50	1	V
8	CSEP-003	Digital Forensics Lab	0	0	2		25	25		25	50	1	VI
9	CSEP-004	Capstone Project	0	0	4		50	50		50	100	2	VII
		GRAND TOTAL									1000	20	

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, TA: Teacher Assessment, TE: Theory End Semester Exam., PE: Practical End Semester Exam.



CSET-001: PRINCIPLES OF INFORMATION SECURITY

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of this course is to:

1. To understand computer networks, security attacks, services, and mechanisms.
2. To describe various cryptosystems- symmetric key cryptography and public key cryptography
3. To apply authentication services, mechanisms, and secure hash algorithms
4. To be familiar with the concepts of email security, IDS, SSL, TLS, viruses, and Firewalls.

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

1. Analyze the concepts of Computer Networks, Cryptography, Information security and its applications.
2. Build a security model to prevent and detect the attacks using various mechanisms.
3. Examine the authenticity of the messages, communicate securely, and investigate non-repudiation.
4. Apply the concepts of SSL, TLS, firewalls.
5. Implement intrusion detection and establish trusted systems.

Unit 1- Introduction to Computer Networks: Introduction to Computer Networks, Network hardware, Network software, OSI and TCP/IP Reference models, Security attacks, Security Services and Mechanisms.

Unit 2- Introduction to Cryptography: Integer Arithmetic, Modular Arithmetic, Traditional Symmetric Key Ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES). Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Asymmetric Cryptography: Introduction, RSA Cryptosystem, Elliptic Curve Cryptosystem.

Unit 3- Message Integrity and Message Authentication: Message Authentication Code (MAC), SHA-512 - Digital Signatures.

Unit 4- Security at the Application Layer: PGP and S/MIME. Security at Transport Layer: SSL and TLS. - Principles of IDS and Firewalls.

Unit 5- Applications of Information Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXTBOOKS:

1. Computer Networks, Andrew S Tanenbaum, David J. Wetherall, 5th Edition, Pearson Education/PHI.
2. Cryptography & Network Security, Behrouz A. Forouzan, Special Indian Edition, TMH.

REFERENCE BOOKS:



1. Network Security Essentials (Applications and Standards), William Stallings, Pearson Education.
2. Cryptography and Network Security – Principles and Practices, William Stallings, 4th Edition, Prentice Hall of India, 2005.
3. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, 3rd Edition, Pearson Education, 2003.



CSET-002: FOUNDATIONS OF CYBER SECURITY

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is:

1. To introduce security attacks and access management.
2. To get an exposure to malwares, social engineering and counter measures.
3. To gain knowledge on Intrusion detection & prevention systems.
4. To understand software security and human resources security issues.

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

1. Categorize security threats and able to implement access control strategies.
2. Understand different types of malicious software and threats.
3. Apply methods to protect from denial-of- service attacks.
4. Analyze intrusion detection systems and configure firewalls.
5. Develop secure coding, infrastructure security.

Unit 1- Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy.

Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks, Case Study: RBAC System for a Bank.

Unit 2- Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—Spam E-Mail, Trojans, Payload— System Corruption, Payload—Attack Agent— Zombie, Bots, Payload—Information Theft—Keyloggers, Phishing, Spyware, Payload—Stealth—Backdoors, Rootkits, Counter measures.

Unit 3- Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack. Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks.

Unit 4- Intrusion Detection: Intruders, Intrusion Detection, Analysis Approaches, Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed or Hybrid Intrusion Detection, Intrusion Detection



Exchange Format, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

Unit 5- Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program Output. Physical and Infrastructure Security: Overview, Physical Security Threats, Physical Security Prevention and Mitigation Measures, Recovery from Physical Security Breaches, Example: A Corporate Physical Security Policy, Integration of Physical and Logical Security.

TEXTBOOKS:

1. Computer Security: Principles and Practice, William Stallings, Prentice Hall; 2014
2. Foundations of Security: What Every Programmer Needs to Know by Neil Daswani, Christoph Kern and Anitha Kesavan, Apress publisher, 2007.

REFERENCE BOOKS:

1. The ethical hacking guide to corporate security, Ankit Fadia, McMillan India.
2. Software Security: Building Security In, G. McGraw, Addison Wesley, 2006.



CSET-003: ETHICAL HACKING FUNDAMENTALS

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is:

1. To learn concepts, techniques, and tools they need to deal with Ethical Hacking.
2. To understand the basic concepts of enumerations in Ethical Hacking.
3. To identify the importance of advanced hacking techniques and their countermeasures.
4. To be familiar with the concepts of Exploitation and Deliverable.

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

1. Demonstrate the knowledge of Computer Networks, Cryptography, Information security concepts and its applications.
2. Apply the knowledge of tools available to support an ethical hacking.
3. Implement the knowledge of interpreting the results of a controlled attack.
4. Understand the role of politics, inherent & imposed limitations, and metrics for planning of a test.
5. Evaluate techniques related for the enumeration and exploitation.

Unit 1 Introduction: Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration.

Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture.

Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking.

Unit 2- The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

Unit 3- Preparing for a Hack: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance.

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase.

Unit 4- Exploitation: Intuitive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern.

Unit 5- Deliverable: The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion.



TEXTBOOKS:

1. The Ethical Hack: A Framework for Business Value Penetration Testing, James S. Tiller, Auerbach Publications, CRC Press.

REFERENCE BOOKS:

1. Ethical Hacking and Countermeasures Attack Phases, EC-Council, Cengage Learning
2. Hands-On Ethical Hacking and Network Defense, Michael Simpson, Kent Backman, James Corley, Cengage Learning.



CSET-004: DIGITAL FORENSICS

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is:

1. To learn the concepts of the rapidly changing and fascinating field of computer forensics.
2. To be familiar with the technical expertise and the knowledge required to investigate, detect, and prevent digital crimes.
3. To identify the approaches on digital forensics legislations, digital crime, forensics processes and procedures.
4. To understand perceptions of E-evidence collection, preservation, network forensics, art of steganography and mobile device forensics.

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

1. Understand relevant legislation and codes of ethics.
2. Apply the methods of computer forensics, digital detective, policies, and procedures.
3. Implement the approaches of E-evidence, tools, and environment.
4. Evaluate the methodologies of e-mail, web forensics and network forensics.
5. Apply the concepts of legal aspects of digital forensics.

Unit 1- Digital Forensics Science: Forensics science, computer forensics, and digital forensics.

Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics.

Unit 2- Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Unit 3- Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, explain what the normal case would look like, define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Unit 4- Computer Forensics: Prepare a case, begin an investigation, understand computer forensics, workstations and software, conduct an investigation, complete a case, Critique a case.

Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.



Unit 5- Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

TEXTBOOKS:

1. The Basics of Digital Forensics, John Sammons, Elsevier.
2. Computer Forensics: Computer Crime Scene Investigation, John Vacca, Laxmi Publications.

REFERENCE BOOKS:

1. Learn Computer Forensics: A Beginner's Guide to Searching, Analyzing, and Securing Digital Evidence, William Oettinger, 1st Edition, Packt Publishing, 2020, ISBN: 1838648178.
2. Cybercrime and Digital Forensics: An Introduction, Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Routledge.



CSET-005: SECURITY INCIDENT & RESPONSE MANAGEMENT

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. Provides Security incident & response management knowledge required to analyze problem encountered in engineering.
2. Covers network security, incidence, operations, dynamic malwares analysis, restoration, attacks, detection techniques, recovery process, backup with identification, policies, procedures and guidelines for handling incident.
3. Applied in many areas of engineering such as network security, networking, big data analytics and cryptography.

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

1. Understand network security, security incidence response and relation with security operations.
2. Evaluate about malwares, dynamic malware analysis and restoration of affected systems & attacks.
3. Analyze the malwares detection techniques using signatures and recovery process with response tools.
4. Apply techniques for information security Incident Management & data backup with identification and detection.
5. Remembers the policies, procedures and guidelines for handling incident and troubleshooting of network security..

Unit 1- Introduction: Definition of network security, Application of Security, Evaluation of network security, principles, Information Security Services, characteristics of network security, definitions of security incident response, IP addressing, relation of incident response to the rest of security operations, incident response phases - preparation, identification, recovery, follow-up, Identifying Unauthorized Devices.

Unit 2- Introduction to malware: OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis. Eradication: Actual removal and restoration of affected systems, removal of attack artifacts, scanning of other systems to ensure complete eradication, use of IOCs on other systems and local networks, understand the attack.

Unit 3- Malware Detection Techniques: Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature non-signature-based techniques: similarity-based techniques, machine-learning methods, invariant inferences. Recovery: Test and validate systems before putting back into production, monitoring of system behavior, ensuring that another incident will not be created by the recovery process, response Management, incident response tool, support investigations.



Unit 4- Information Security Incident Management & Data Backup: Information Security Incident Management overview- Handling-Response, Incident Response Roles and Responsibilities, Incident Response Process etc. Data Backup introduction, Types of Data Backup and its techniques, Developing an Effective Data Backup Strategy and Plan, Security Policy for Backup Procedures. Identification: Detection, incident triage, information gathering and reporting, incident classification.

Unit 5- Policies and procedures: incident workflows, guidelines, incident handling forms, principles of malware analysis, log analysis, threat intelligence, vulnerability management, penetration testing, Troubleshooting Network Devices and Services: Introduction & Methodology of Troubleshooting, Troubleshooting of Network security, Connectivity-Network Devices- Network Slowdowns-Systems-Modems.

TEXTBOOKS:

1. Managing Information Security Risks, The Octave Approach by Christopher Alberts, and Audrey Dorofee.
2. ‘Cryptography and Network Security (4th Edition) by (Author) William Stallings.
3. “Incident Response & Computer Forensics, Third Edition” by Jason T. Luttgens and Matthew Pepe.

REFERENCE BOOKS:

1. Blue Team Handbook: Incident Response Edition: A condensed field guide for the Cyber Security Incident Responder”, by Don Murdoch.
2. Practical malware analysis The Hands-On Guide to Dissecting Malicious Software by Michael Sikorski and Andrew Honig ISBN-10: 159327-290-1, ISBN-13: 978-1-59327- 290-6, 2012 2
3. Computer viruses: from theory to applications by Filiol, Eric Springer Science & Business Media, 2006.
4. <https://www.sans.org/reading-room/whitepapers/incident/security-incident-handling-small-organizations-32979>



CSEP-001: PRINCIPLES OF INFORMATION SECURITY LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is:

1. To apply algorithms used for data encryption and decryption.
2. To demonstrate IDS Tools.
3. To apply algorithms used for message Integrity and Authentication of data.
4. To understand various protocols for information security to protect against the threats in the networks.

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

1. Examine the authenticity of the messages, communicate securely, and investigate non-repudiation
2. Implement various encryption and decryption algorithms.
3. Identify the emerging areas in information security.
4. Interpret good security practices for information security.
5. Demonstrate the process of data protection from various threats.

The suggested list of Experiments:

1. Write a program to perform encryption and decryption using the following substitution ciphers.
 - a) Caesar cipher.
 - b) Play fair cipher.
 - c) Hill Cipher.
3. Write a program to implement the DES algorithm.
4. Write a program to implement RSA algorithm.
5. Calculate the message digest of a text using the SHA-1 algorithm.
6. Working with sniffers for monitoring network communication (Wireshark).
7. Configuring S/MIME for email communication.
8. Using Snort, perform real time traffic analysis and packet logging.



CSEP-002: ETHICAL HACKING FUNDAMENTALS LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To introduce the methodologies framework tools of ethical hacking to get awareness in enhancing the security.
2. To get knowledge on various attacks and their detection.
3. To understand various security tools.

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

1. Understand the basic concepts of enumerations in Ethical Hacking.
2. Identify the importance of advanced hacking techniques and their countermeasures.
3. Gain the knowledge of the use and availability of tools to support an ethical hack.
4. Gain the knowledge of interpreting the results of a controlled attack.
5. Apply various tools to provide security against attacks.

The suggested list of Experiments:

1. Set Up a honey pot and monitor the honey pot on network.
2. Write a script or code to demonstrate SQL injection attacks.
3. Create a social networking website login page using phishing techniques.
4. Write a code to demonstrate DoS attacks.
5. Install rootkits and study variety of options.
6. Study of Techniques uses for Web Based Password Capturing.
7. Install jcrypt tool (or any other equivalent) and demonstrate Asymmetric, Symmetric Crypto algorithm, Hash and Digital/PKI signatures studied in theory Network Security and Management
8. Implement Passive scanning, active scanning, session hijacking, cookies extraction using Burp suit tool.



CSEP-003: DIGITAL FORENSICS LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To provide a comprehensive overview of collecting, investigating, preserving, and presenting evidence of cybercrime left in digital storage devices, emails, browsers, mobile devices using different Forensics tools.
2. To understand file system basics and where hidden files may lie on the disk, as well as how to extract the data and preserve it for analysis.
3. To understand some of the tools of e-discovery
4. To understand the network analysis, Registry analysis and analyses attacks using different forensics tools.

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

1. Learn the importance of a systematic procedure for investigation of data found on digital storage media that might provide evidence of wrongdoing.
2. Learn the file system storage mechanisms and retrieve files in hidden format.
3. Learn the use of computer forensics tools used in data analysis.
4. Learn how to find data that may be clear or hidden on a computer disk, find the open ports for the attackers through network analysis, Registry analysis.
5. Evaluate the methodologies of e-mail, web forensics and network forensics.

The suggested list of Experiments:

1. Perform email analysis using the tools like Exchange EDB viewer, MBOX viewer and View user mailboxes and public folders, Filter the mailbox data based on various criteria, Search for particular items in user mailboxes and public folders.
2. Perform Browser history analysis and get the downloaded content, history saved logins, searches, websites visited etc using Foxton Forensics tool, Dumpzilla.
3. Perform mobile analysis in the form of retrieving call logs, SMS log, all contacts list using the forensics tool like SAFT.
4. Perform Registry analysis and get boot time logging using process monitor tool.
5. Perform Disk imaging and cloning the using the X-way Forensics tools.
6. Perform Data Analysis i.e History about open file and folder, and view folder actions using List view activity tool.
7. Perform Network analysis using the Network Miner tool.
8. Perform information for incident response using the crowd Response tool.
9. Perform File type detection using Autopsy tool.



10. Perform Memory capture and analysis using the Live RAM capture or any forensic tool.

CSEP-004: CAPSTONE PROJECT

L: T: P: : 0: 0: 4

Credits – 2

COURSE OBJECTIVES: The main objective of Capstone Project is to let the students apply the knowledge of theoretical concepts which they have learnt as a part of the curriculum of the minor degree using real time problems or situations.

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

1. Understand, plan, and execute a Capstone Project with team.
2. Acquired knowledge within the chosen area of technology for project development.
3. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
4. Communicate and report effectively project related activities and findings.
5. Expose the world of research, technology, and innovation.

COURSE GUIDELINES:

The Capstone project is desirable to be done in a group of 2 students. Each group has to prepare a title related to any engineering discipline, and the title must emulate any real world problem.

Submit an early proposal. This proposal is a 1-2page(s) report, describes what the project is about and the final product's output. The project proposal will be submitted to the respective guide.

Every individual student will be assigned a faculty to guide them. There will be three major reviews which will be carried out as listed below.

Review #	Requirement	Mark Weightage	
		Internal	External
0	Area / Title selection	-	-
1	Literature review / Proposal for the Project	10%	-
2	Mathematical Modelling/Circuit Design	20%	-
3	Final simulation / Hardware presentation	20%	-
End Semester Exam	Final Viva-Voce and project demonstration	-	50%

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment
2. Performing the experiments in the laboratory



3. Oral examination conducted on the syllabus and term work mentioned above.

List of Minor Courses offered by Computer Sc. & Engineering Department to B.Tech. Programme

Sl. No.	Award of Degree	Eligible Major B.Tech. Degree programmes (Discipline / Branch of Study as Prescribed by the University from time to time) For minor Degree	Offering Department	Minor Degree (After successfully passing the subjects worth 20 Credits as available against each Minor)																											
1	B. Tech. in branch name with Minor in “ <i>Artificial Intelligence & Machine Learning</i> ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	Artificial Intelligence & Machine Learning <table border="1"> <tbody> <tr> <td>1</td> <td>AIML-001</td> <td>Introduction to AI & Machine Learning</td> </tr> <tr> <td>2</td> <td>AIML-002</td> <td>Introduction to Data Analytics</td> </tr> <tr> <td>3</td> <td>AIML-003</td> <td>Deep Learning and Neural Network</td> </tr> <tr> <td>4</td> <td>AIML-004</td> <td>Specific topics in Artificial Intelligence</td> </tr> <tr> <td>5</td> <td>AIML-005</td> <td>Applications of AI</td> </tr> <tr> <td>6</td> <td>AIMLP-001</td> <td>Introduction to AI & Machine Learning Lab</td> </tr> <tr> <td>7</td> <td>AIMLP-002</td> <td>Introduction to Data Analytics Lab</td> </tr> <tr> <td>8</td> <td>AIMLP-003</td> <td>Deep Learning and Neural Network Lab</td> </tr> <tr> <td>9</td> <td>AIMLP-004</td> <td>Capstone Project</td> </tr> </tbody> </table>	1	AIML-001	Introduction to AI & Machine Learning	2	AIML-002	Introduction to Data Analytics	3	AIML-003	Deep Learning and Neural Network	4	AIML-004	Specific topics in Artificial Intelligence	5	AIML-005	Applications of AI	6	AIMLP-001	Introduction to AI & Machine Learning Lab	7	AIMLP-002	Introduction to Data Analytics Lab	8	AIMLP-003	Deep Learning and Neural Network Lab	9	AIMLP-004	Capstone Project
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9	AIMLP-004	Capstone Project																													

2	B. Tech. in branch name with Minor in “ <i>Cyber Security</i> ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	<table border="1"> <thead> <tr> <th colspan="3">Cyber Security</th> </tr> </thead> <tbody> <tr> <td data-bbox="1430 107 1507 217">1</td> <td data-bbox="1507 107 1619 217">CSET-001</td> <td data-bbox="1619 107 1919 217">Principles of Information Security</td> </tr> <tr> <td data-bbox="1430 217 1507 298">2</td> <td data-bbox="1507 217 1619 298">CSET-002</td> <td data-bbox="1619 217 1919 298">Foundations of Cyber Security</td> </tr> <tr> <td data-bbox="1430 298 1507 380">3</td> <td data-bbox="1507 298 1619 380">CSET-003</td> <td data-bbox="1619 298 1919 380">Ethical Hacking Fundamentals</td> </tr> <tr> <td data-bbox="1430 380 1507 461">4</td> <td data-bbox="1507 380 1619 461">CSET-004</td> <td data-bbox="1619 380 1919 461">Digital Forensics</td> </tr> <tr> <td data-bbox="1430 461 1507 542">5</td> <td data-bbox="1507 461 1619 542">CSET-005</td> <td data-bbox="1619 461 1919 542">Security Incident & Response Management</td> </tr> <tr> <td data-bbox="1430 542 1507 623">6</td> <td data-bbox="1507 542 1619 623">CSEP-001</td> <td data-bbox="1619 542 1919 623">Principles of Information Security Lab</td> </tr> <tr> <td data-bbox="1430 623 1507 704">7</td> <td data-bbox="1507 623 1619 704">CSEP-002</td> <td data-bbox="1619 623 1919 704">Ethical Hacking Fundamentals Lab</td> </tr> <tr> <td data-bbox="1430 704 1507 786">8</td> <td data-bbox="1507 704 1619 786">CSEP-003</td> <td data-bbox="1619 704 1919 786">Digital Forensics Lab</td> </tr> <tr> <td data-bbox="1430 786 1507 867">9</td> <td data-bbox="1507 786 1619 867">CSEP-004</td> <td data-bbox="1619 786 1919 867">Capstone Project</td> </tr> </tbody> </table>	Cyber Security			1	CSET-001	Principles of Information Security	2	CSET-002	Foundations of Cyber Security	3	CSET-003	Ethical Hacking Fundamentals	4	CSET-004	Digital Forensics	5	CSET-005	Security Incident & Response Management	6	CSEP-001	Principles of Information Security Lab	7	CSEP-002	Ethical Hacking Fundamentals Lab	8	CSEP-003	Digital Forensics Lab	9	CSEP-004	Capstone Project
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4	B. Tech. in branch name with Minor in “ <i>Internet of Things</i> ” ”	Biotechnology Bio Chemical Engineering Chemical Engineering Civil Engineering Electrical Engineering Electrical & Electronics Engineering Electronics & Communication Engineering Mechanical Engineering Mechanical Engineering (Manufacturing Engineering) Production Engineering Manufacturing Engineering Power Plant Engineering	CSE	Internet of Things		
				1	IoTT-001	Internet of Things Architectures, Protocols and Systems Programming
				2	IoTT-002	Embedded Systems and Internet of Things
				3	IoTT-003	IoT Applications and Web development
				4	IoTT-004	Machine Learning for Internet of Things
				5	IoTT-005	Internet of Things Security
				6	IoTP-001	Embedded Systems and Internet of Things Lab
				7	IoTP-002	IoT Applications and Web development Lab
				8	IoTP-003	Machine Learning for Internet of Things Lab
				9	IoTP-004	Capstone Project

***If required the student may opt requisite fundamental course/s for a minor specialization as audit course.**



Minor Degree in “Data Science”

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme			End Semester		Total	Credit	Sem
			L	T	P	CT	TA	TOTAL	TE	PE			
1	DST001	Introduction To Data Science	3	0	0	30	20	50	100		150	3	III
2	DST002	Artificial Intelligence & Machine Learning	3	0	0	30	20	50	100		150	3	IV
3	DST003	Analyzing, Visualizing, And Applying Data Science with Python	3	0	0	30	20	50	100		150	3	V
4	DST004	Web Data Mining	3	0	0	30	20	50	100		150	3	VI
5	DST005	Business Intelligence and Data Visualization	3	0	0	30	20	50	100		150	3	VII
6	DSP001	Introduction To Data Science Lab	0	0	2		25	25		25	50	1	III
7	DSP002	Artificial Intelligence & Machine Learning Lab	0	0	2		25	25		25	50	1	IV
8	DSP003	Analyzing, Visualizing, And Applying Data Science with Python Lab	0	0	2		25	25		25	50	1	V
9	DSP004	Capstone Project	0	0	4		50	50		50	100	2	VII
		GRAND TOTAL									1000	20	

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, TA: Teacher Assessment, TE: Theory End Semester Exam., PE: Practical End Semester Exam.



DST-001: INTRODUCTION TO DATA SCIENCE

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To Provide the knowledge and expertise to become a proficient data scientist.
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
3. Produce Python code to statistically analyze a dataset.

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

1. Understand the purpose and components of Data Science.
2. Understand the techniques used in EDA.
3. Apply various processes to extract features of data.
4. Understand the key techniques and theory behind data visualization.
5. Understand key applications of data science that are commonly linked to ethical issues.

Unit 1- Introduction: Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.

Unit 2- Data Analytics and Techniques: Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.

Unit 3- Data Extraction and Feature Generation: Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms.

Unit 4- Data Visualization: Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a dataset.

Unit 5- Applications & Ethics of Data Science: Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.

TEXTBOOKS:

1. Business Analytics: The Science of Data-Driven Decision Making, U Dinesh Kumar, John Wiley & Sons.
2. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, John Wiley & Sons.
3. Joe I Grus, Data Science from Scratch, Shroff Publisher/ O'Reilly Publisher Media
4. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher.



REFERENCE BOOKS:

1. Cathy O'Neil and Rachel Schutt Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
3. Jake Vander Plas, Python Data Science Handbook, Shroff Publisher/O'Reilly Publisher Media.
4. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher/ O'Reilly Publisher Media.



DST-002: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To understand basics of machine learning in data science.
2. To understand various basic machine learning algorithm that can be used with various type of data.

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

1. Understand various types of machine learning approaches.
2. Demonstrate logistic regression to predict class of a dataset.
3. Understand the role of clustering in real life dataset.
4. Classify dataset using Support Vector Machine
5. Understand the model selection and advance regression process.

Unit 1- Introduction to Machine Learning & Linear Regression: INTRODUCTION – Learning, Types of Learning, well-defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches, Underfitting and Overfitting, Bias and Variance.

Linear Regression: Basic facts of linear regression, implementation of linear regression, and case studies of linear regression using the data set.

Unit 2- Logistic Regression: Logistic Regression: Basic facts and implementation of logistic regression, solve a case study to predict output using an existing data set.

Unit 3- Clustering: Clustering and Principal Component Analysis: Introduction, Types of clustering, Correlations and distances, K means and hierarchical clustering, and how to make market strategies using clustering.

Unit 4- Support Vector Machine: Support Vector Machine: basics of SVM and its application to detect spam emails and recognize alphabets, SVM for classification and regression problems.

Unit 5- Advance regression: Model Selection and advanced regression: use of Lasso and Ridge.

TEXTBOOKS:

1. Machine Learning using Python , U Dinesh Kumar and Manaranjan Pradhan, John Wiley & Sons.
2. Advanced Data Analytics Using Python: With Machine Learning , Deep Learning by By Sayan Mukhopadhyay
3. Practical Data Mining" by Monte F. Hancock , Auerbach Publication.



REFERENCE BOOKS:

1. "Machine Learning for Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald.
2. Practical Data Science with R, Nina Zumel, John Wiley & Sons.
3. Python for Data Science for Dummies, John Paul Mueller, Luca Massaron, John Wiley & Sons.
4. Big Data and Analytics, Seema Acharya and Subhashini Chellappan, Wiley Publication.



DST-003: ANALYZING, VISUALIZING, AND APPLYING DATA SCIENCE WITH PYTHON

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To learn how to use tools and libraries of python for data science, and way to import, clean and prepare data for analysis.
2. To familiarize with Pandas Data Frames, and SciKit libraries to work with various datasets and Load, manipulate, analyze, and visualize datasets with pandas.

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

1. Understand basic data analysis python libraries.
2. Apply the various techniques used in pandas' library.
3. Apply machine learning models using scikit-learn.
4. Understand the role of ANOVA in prediction and analysis of data.
5. Identify the importance of model evaluation and data model refinement techniques.

Unit 1- INTRODUCTION TO LIBRARIES IN PYTHON: Data Analysis libraries: will learn to use Pandas Data Frames, Numpy multi-dimensional arrays, and SciPy libraries to work with a various dataset.

Unit 2- PANDAS: Pandas, an open-source library: load, manipulate, analyze, and visualize various datasets. Series and Data Frames, Grouping, aggregation, Merge Data Frames, Generate summary tables, Group data into logical pieces, Manipulation of data.

Unit 3- SCIKIT: Scikit- learn : build smart models and make predictions, various parameters that can be used to compare various parameters, Data Representation, Estimator API, Conventions, Linear Modelling, extended Linear Modeling. Anomaly Detection, KNN Learning.

Unit 4- DATA ANALYSIS & PREDICTION: Descriptive Statistics, Basic of Grouping, ANOVA, Correlation, Polynomial Regression and Pipelines, R- squared and MSE for In-Sample Evaluation, Prediction and Decision Making.

Unit 5- MODEL EVALUATION: Grid Search, Model Refinement, Binning, Indicator variables, Model Evaluation, Over-fitting, Under- fitting and Model Selection, Ridge Regression.

TEXTBOOKS:

1. Data Visualization with Python and JavaScript, Kyran Dale, Shro ff Publisher/ O'ReillyPublisher Publication.
2. Data Science Using Python and R by Chanta l D. Larose and Daniel T. Larose , Wiley Publication.

REFERENCE BOOKS:

1. Python for Data Science and Visualization -Beginners to Pro, Udemy.



DST-004: WEB DATA MINING

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. Search the web and other sources of unstructured text from a human-centered standpoint. These include document indexing, crawling, HITS algorithm; distance metrics; analyzing streaming data, such as social media; link analysis; and system evaluation.
2. To learn how to extract data from the Web and to understand how to analyze collected data to derive the most information.

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

1. Explain data reduction and data compression of Web Text data.
2. Extract and analyze data and information from the webpages.
3. Understand the concepts of web spamming.
4. Understand a crawler application to collect and index documents from the web.
5. Understand the classification of web text data using various techniques.

Unit 1- INTRODUCTION TO DATA MINING: Introduction to internet and WWW, Data Mining Foundations, Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.

Unit 2- ASSOCIATION RULES: Mining Class Association Rules, Basic Concepts of Sequential Patterns, Mining Sequential Patterns on GSP, Mining Sequential Patterns on Prefix Span, Generating Rules from Sequential Patterns', Apriori Algorithm.

Unit 3- WEB SPAMMING: Concepts of Information Retrieval, IR Methods, Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-processing, stop word Removal , Stemming, Duplicate Detection, Inverted Index and Its Compression, Index Compression, Latent Semantic Indexing , Singular Value Decomposition , Query and Retrieval, Web Search, Meta Search, Web Spamming.

Unit 4- CRAWLERS: Link Analysis, Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank Algorithm, HITS Algorithm, CommModuley Discovery, Problem Definition, Bipartite Core CommModuleies, Web Craw ling, A Basic Crawler Algorithm - Breadth First Crawlers , Preferential Crawlers , Implementation Issues - Fetching, Parsing, Link Extraction, Spider Traps, Page Repository, Universal Crawlers , Focused Crawlers, Topical Crawlers , Crawler Ethics and Conflicts.

Unit 5- CLASSIFICATION: Opinion Mining, Sentiment Classification, Classification based on Sentiment Phrases, Classification Using Text Classification Methods, Feature based Opinion Mining and Summarization,



Problem Definition, Object feature extraction, Comparative Sentence and Relation Mining, Opinion Search and Opinion Spam.

TEXTBOOKS:

1. Mining the Web: Discovering Knowledge from Hypertext Data , Soumen Chakrabarti, Morgan Kaufmann Publishers.
2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents , and Usage Data, Springer Publications, 2011.

REFERENCE BOOKS:

1. Anthony Scime, Web Mining: Applications and Techniques, 2005.
2. Kowalski , Gerald , Mark T Maybury: Information Retrieval Systems: Theory and Implementation.
3. Mathew Russell , Mining the Social Web 2nd Edition , Shroff Publisher/O'Reilly Publisher Publication.
4. Data Mining and Data Warehousing Principles and Practical Techniques , Parteek Bhatia , Cambridge University Press.



DST-005: BUSINESS INTELLIGENCE AND DATA VISUALIZATION

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. Covers fundamental concepts of Business Intelligence tools, techniques, components and its future.
2. Understand of data visualization concepts and techniques. The underlying theme in the course is feature of Tableau, its capabilities.

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

1. Apply quantitative modelling and data analysis techniques to the solution of real-world business problems.
2. Understand the importance of data visualization and the design and use of many visual components.
3. Understand as products integrate defining various analytical process flow.
4. Learn the basics of troubleshooting and creating charts using various formatting tools.
5. Learn basics of structuring data and creating dashboard stories adding interactivity dashboard stories.

Unit 1- INTRODUCTION TO BUSINESS INTELLIGENCE: Business Intelligence (BI), Scope of BI solutions and their fitting into existing infrastructure, BI Components and architecture, BI Components, Future of Business Intelligence, Functional areas of BI tools, End user assumptions, setting up data for BI, Data warehouse, OLAP and advanced analytics, Supporting the requirements of senior executives including performance management, Glossary of terms and their definitions specific to the field of BI and BI systems.

Unit 2- ELEMENTS OF BUSINESS INTELLIGENCE SOLUTIONS: Business Query and Reporting, Reporting, Dashboards and Scorecards Development, Development, Scorecards, Metadata models, Automated Tasks and Events, Mobile Business Intelligence, Software development kit (SDK). Stages of Business Intelligence Projects, Project Tasks, Risk Management and Mitigation, Cost justifying BI solutions and measuring success, BI Design and Development, Building Reports, Building a Report, Drill-up, Drill-down Capabilities.

Unit 3- TABLEAU: Introductions and overview: What Tableau can and cannot do well, Debug and troubleshoot installation and configuration of the software.

Creating Your First visualization: Getting started with Tableau Software, Using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps), Using the Show me panel

Tableau Calculations: Overview of SUM, AVR, and Aggregate features Creating custom calculations and fields, Applying new data calculations to your visualization.

Formatting Visualizations: Formatting Tools and Menus, formatting specific parts of the view, Editing and Formatting Axes.

Unit 4- DATA VISUALIZATION: Manipulating Data in Tableau: Cleaning-up the data with the Data Interpreter, structuring your data, Sorting, and filtering Tableau data, Pivoting Tableau data.



Advanced Visualization Tools: Using Filters, Using the Detail panel Using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colours.

Creating Dashboards & Stories: Using Storytelling, creating your first dashboard and Story, Design for different displays, Adding interactivity to your Dashboard

Distributing & Publishing Your Visualization: Tableau file types, Publishing to Tableau Online, sharing your visualization, Printing, and exporting.

Given a case study: Perform Interactive Data Visualization with Tableau.

Unit 5- INTRODUCTION TO POWER BI: Describe the Power BI ecosystem, Define Power BI and its relationship with Excel, Discuss the Power BI suite of products, Describe how the Power BI products integrate, Explain the typical analytics process flow, Differentiate between the various data sources, Connect Power BI to a data source, Clean and transform data to ensure data quality, Load the data to the Power BI Data Model, Describe the Power BI ecosystem, Define Power BI and its relationship with Excel, Discuss the Power BI suite of products, Describe how the Power BI products integrate, Explain the typical analytics process flow.

TEXTBOOKS:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.
2. Learning Tableau 10 - Second Edition: Business Intelligence and data visualization that brings your business into focus” by Joshua N. Milligan
3. Tableau Your Data! - “Daniel G. Murray and the Inter Works BI Team”-Wiley.

REFERENCE BOOKS:

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager’s Guide”, Second Edition, 2012.



DSP-001: INTRODUCTION TO DATA SCIENCE LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. Produce Python code to statistically analyze a dataset.
2. Critically evaluate data visualizations based on their design and use for communicating stories from data.

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

1. To explain how data is collected, managed, and stored for data science.
2. To understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
3. Implement basic statistics functions in python and a variety of plots using matplotlib.
4. Apply the fundamentals of the Pandas and Scipy library in Python.
5. To implement data collection and management scripts using python libraries.

The suggested list of Experiments:

1. Python Environment installation/setup and Essentials.
2. Implement Basic statistics functions (mean, mode, average, etc.) using NumPy library.
3. Print multiplication table of a given number.
4. Python Program to Find the Sum of Natural Numbers.
5. Python Program to Convert Celsius to Fahrenheit.
6. Given a list, iterate it, and display numbers divisible by five, and if you find a number greater than 150, stop the loop iteration. **list1** = [12, 15, 32, 42, 55, 75, 122, 132, 150, 180, 200].
7. Write a Pandas program to split the following data frame into groups based on all columns and calculate Group by value counts on the data frame.

Test Data:

Id	type	book
1	10	Math
2	15	English
1	11	Physics
1	20	Math
2	21	English
1	12	Physics
2	14	English

8. Write a Pandas program to partition each of the passengers into four categories based on their age Note: Age categories (0, 10), (10, 30), (30,60), (60, 80).



9. Write a Python program to plot two or more lines on same plot with suitable legends of each line.
10. Write a Python program to plot two or more lines with legends, different widths, and colors.
11. Write a NumPy program to create a 3x3 matrix with values ranging from 2 to 10.
12. Write a NumPy program to get help on the add function.
13. Write a Python program to create a 2-D array with ones on the diagonal and zeros elsewhere. Now convert the NumPy array to a SciPy sparse matrix in CSR format.



DSP-002: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To understand basics of machine learning in data science.
2. To understand various basic machine learning algorithm that can be used with various type of data.

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

1. Understand the role of clustering in real life dataset.
2. Classify dataset using Support Vector Machine
3. Demonstrate logistic and linear regression to predict class of a dataset.
4. Understand the model selection and advance regression process.
5. Apply Machine Learning algorithms to solve real world problems.

The suggested list of Experiments:

1. Use python to predict employee attrition in a firm and help them plan their manpower. (Take data set from Kaggle).
2. Create customer clusters using different market strategies on a data set.
3. Make a movie recommendation system.
4. Develop a prediction mechanism to predict which employee can go on leave in a company in near future.
5. Recognizing alphabets using SVM.
6. Write a program to perform various types of regression (Linear & Logistic).
7. Write a program to implement k-Nearest Neighbor algorithm to classify the iris dataset. Print both correct and wrong predictions. Python ML library classes can be used for this problem.



DSP-003: ANALYSING, VISUALIZING AND APPLYING DATA SCIENCE WITH PYTHON LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To learn how to use python for data science.
2. To understand and use all the tools and libraries of python for data science.

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

1. Understand the basic libraries in python and its implementation.
2. Apply predictive analytics on dataset and make predictions.
3. Design applications applying various operations for data cleansing and transformation.
4. To learn the strategies adopted to analyze the data in various companies for better decision making.
5. Design visualizations to extract useful insights from data.

The suggested list of Experiments:

1. Apply basic statistics function of python on New York City- 311 Complaints and Housing datasets.
2. Visualize Iris dataset using matplotlib library.(bar, histogram, pie chart, boxplot, etc.)
3. Write a program to predict the class of a flower based on various features of iris dataset.
4. Write a Python program to add, subtract, multiple and divide two Pandas Series.
5. Write a Pandas program to split the following dataframe into groups based on all columns and calculate Groupby value counts on the dataframe.

Test Data:

Id	type	book
1	10	Math
2	15	English
1	11	Physics
1	20	Math
2	21	English
1	12	Physics
2	14	English

6. Write a Pandas program to partition each of the passengers into four categories based on their age Note: Age categories (0, 10), (10, 30), (30, 60), (60, 80).
7. Write a Pandas program to create.
 - a) Date time object for Jan 15, 2012.
 - b) Specific date and time of 9:20 pm.
 - c) Local date and time.
 - d) A date without time.



- e) Current date.
 - f) Time from a date time.
 - g) Current local time.
8. Write a Pandas program to create a date from a given year, month, day and another date from a given string formats.
 9. Write a Pandas program to print the day after and before a specified date. Also print the days between two given dates.
 10. Write a Pandas program to create a time series using three months frequency.
 11. Write a Pandas program to create a sequence of durations increasing by an hour.
 12. Write a Pandas program to check if a day is a business day (weekday) or not.
 13. Write a Pandas program to create a Pivot table with multiple indexes from a given excel sheet.
 14. Write a Pandas program to create a Pivot table and find the total sale amount region wise, manager wise.
 15. Write a Pandas program to create a Pivot table and count the manager wise sale and mean value of sale amount.
 16. Write a Pandas program to create a Pivot table and find the maximum and minimum sale value of the items.
 17. Write a Python program using Scikit-learn to print the keys, number of rows-columns, feature names and the description of the Iris data.



DSP-004: CAPSTONE PROJECT

L: T: P: : 0: 0: 4

Credits – 2

COURSE OBJECTIVES: The main objective of Capstone Project is to let the students apply the knowledge of theoretical concepts which they have learnt as a part of the curriculum of the minor degree using real time problems or situations.

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

1. Understand, plan, and execute a Capstone Project with team.
2. Acquired knowledge within the chosen area of technology for project development.
3. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
4. Communicate and report effectively project related activities and findings.
5. Expose the world of research, technology, and innovation.

COURSE GUIDELINES:

The Capstone project is desirable to be done in a group of 2 students. Each group has to prepare a title related to any engineering discipline, and the title must emulate any real world problem.

Submit an early proposal. This proposal is a 1-2page(s) report, describes what the project is about and the final product's output. The project proposal will be submitted to the respective guide.

Every individual student will be assigned a faculty to guide them. There will be three major reviews which will be carried out as listed below.

Review #	Requirement	Mark Weightage	
		Internal	External
0	Area / Title selection	-	-
1	Literature review / Proposal for the Project	10%	-
2	Mathematical Modelling/Circuit Design	20%	-
3	Final simulation / Hardware presentation	20%	-
End Semester Exam	Final Viva-Voce and project demonstration	-	50%

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment
2. Performing the experiments in the laboratory
3. Oral examination conducted on the syllabus and term work mentioned above.



Minor Degree in “Internet of Things”

Sl. No.	Subject Codes	Subject Name	Periods			Evaluation Scheme			End Semester		Total	Credit	Sem
			L	T	P	CT	TA	TOTAL	TE	PE			
1	IoTT-001	Internet of Things Architectures, Protocols and Systems Programming	3	0	0	30	20	50	100		150	3	III
2	IoTT-002	Embedded Systems and Internet of Things	3	0	0	30	20	50	100		150	3	IV
3	IoTT-003	IoT Applications and Web development	3	0	0	30	20	50	100		150	3	V
4	IoTT-004	Machine Learning for Internet of Things	3	0	0	30	20	50	100		150	3	VI
5	IoTT-005	Internet of Things Security	3	0	0	30	20	50	100		150	3	VII
6	IoTP-001	Embedded Systems and Internet of Things Lab	0	0	2		25	25		25	50	1	III
7	IoTP-002	IoT Applications and Web development Lab	0	0	2		25	25		25	50	1	V
8	IoTP-003	Machine Learning for Internet of Things Lab	0	0	2		25	25		25	50	1	VI
9	IoTP-004	Capstone Project	0	0	4		50	50		50	100	2	VII
		GRAND TOTAL									1000	20	

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, TA: Teacher Assessment, TE: Theory End Semester Exam., PE: Practical End Semester Exam.



**IoT-001: INTERNET OF THINGS ARCHITECTURES, PROTOCOLS AND SYSTEMS
PROGRAMMING**

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. The knowledge and understanding of Internet of Things.
2. Provide a strong foundation of fundamentals of Internet of Things and need of IoT Security.
3. Get acquainted with various communication protocols of Internet of Things.
4. Detailed understanding of present scope of Internet of Things with case studies.

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

1. Model Internet of Things using various protocols of standard communication layers
2. Represent and analyze various communication models, carry out the comparative analysis in terms of specified parameters.
3. Choose an appropriate communication model for given design criteria.
4. Understand essentials of IoT Security.
5. Provide most optimum model of connectivity solution to various things in different application areas.

Unit 1- Introduction: Enabling Technologies of IoT, Logical Design of IoT, IoT communication Models, IoT Communication API's

Cloud Services: IAAS, PAAS, SAAS, IoT Specific Cloud Services.

RFID: Introduction to RFID and its Applications in IoT.

Unit 2- PHY/MAC Layer: Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy

Network Layer: IPv4, IPv6, 6LoWPAN, ICMP, RPL, COAP.

Unit 3- Transport Layer: (TCP, UDP, DCCP, SCTP)-(TLS, DTLS)

Session Layer: HTTP, CoAP, XMPP, AMQP, MQTT.

Unit 4- IoT Security: Vulnerabilities Security Requirements and Threat Analysis, Misuse Cases, IoT Security Tomography, and Layered Attacker Model, Identity Management and Establishment, Access Control, and Secure Message Communication, Security Models, IoT Security Protocols.

Unit 5- System Software for IoT: Software for IoT Development Boards like Arduino, Raspberry Pi, Beagle Bone, Intel Galileo: IDE, Simulator, Emulator, Debugger, OS , Software Libraries for Internet connectivity Devices, Gateways, Internet, and Web/Cloud Services Software Development Prototyping Online Component API and Web APIs.

IoT Case Studies: Smart Cities, Agriculture, Health and Lifestyle, Industry, Home Automation, Telecom/5G



TEXTBOOKS:

1. Vijay Madiseti and ArshdeepBahga, “Internet of Things (A Hands-on Approach)”, University Press 1st Edition, 2014
2. Jeeva Jose, “Internet of Things”, ISBN-10 : 938617359X, Khanna Book Publishing, 2018
3. Raj Kamal, Internet of Things: Architecture and Design Principle” , ISBN-13: 978-93-5260- 522-4, McGraw Hill Education (India) 2017.

REFERENCE BOOKS:

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
2. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
3. HakimaChouchi, “The Internet of Things Connecting Objects to the Web”, ISBN 078 -1- 84821-140-7, Wiley Publications
4. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010.
5. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
6. Data and Computer Communications; By: Stallings, William; Pearson Education Pte.Ltd., Delhi, 6th Edition.



IoT-002: EMBEDDED SYSTEMS AND INTERNET OF THINGS

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To learn and understand the basics of Embedded systems.
2. To be acquainted with interfacing of sensors and actuators with microprocessor.
3. To design embedded systems applications.
4. To understand Internet of Things and its usefulness for society.

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

1. Identify and understand the unique characteristics and components of embedded systems.
2. Compare various development boards Arduino, Raspberry pi, Beagle bone.
3. Implement interfacing of various sensors, actuators to the development boards.
4. Design, implement and test an embedded system application.
5. Compare various IoT communication technologies and Design various IoT applications.

Unit 1- Embedded Systems: Architecture & Characteristics of ES, Types of Embedded systems, Examples of Embedded Systems. Embedded System on Chip (SOC).

Components of ES: Hardware and software, Hardware components of ES: Power supply: types, characteristics, selection criteria, Processing Unit, Input devices, Output Devices.

Unit 2- Introduction to Embedded operating Systems: Operating Systems Concepts, Real time operating systems, and, Task Scheduling, Different OS tasks, Introduction to Real-Time Operating Systems, characteristics, selection criteria, bootloader: U-boot.

Unit 3- Sensors : Roles of Sensors & Actuators, Types of sensors ,Active and passive, analog and digital, Contact and no-contact, Absolute and relative.

Working of Sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.

Development boards: Types of boards - Arduino, Raspberry pi, Beagle bone, ESP8266, selection criteria. Interfacing of sensors with development boards.

Unit 4- Embedded System - Application Development: Integrated Development Platforms for Application Development in ES environment, SDLC- Requirements, Architecture, Design, Components, Coding, Testing and Deployment. Study of any two Open source IDE for ES application development with respect to any of the two indicated Case studies.

Unit 5- Introduction of IoT: Definition and characteristics of IoT, Technical Building blocks of IoT, Device, Communication Technologies, Data, Physical design of IoT, IoT enabling technologies, IoT Issues and Challenges- Planning, Costs and Quality ,Security and Privacy, Risks.



IoT Protocols: MQTT, CoAP, XMPP and AMQT, IoT communication models, IoT Communication technologies: Bluetooth, BLE, Zigbee, Zwave, NFC, RFID, LiFi, Wi-Fi, Interfacing of wifi, RFID, Zigbee, NFC with development board

TEXTBOOKS:

1. Arshdeep Bahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.
2. Lyla B. Das, “Embedded Systems: An Integrated Approach” Pearson , ISBN: 9332511675, 9789332511675.

REFERENCE BOOKS:

1. Sriram V. Iyer, Pankaj Gupta, “Embedded Real-time Systems Programming”, Tata McGraw-Hill, ISBN: 13: 9780070482845
2. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
3. Raj Kamal, “Embedded Systems: Architecture, programming and Design”, 2nd Edition, McGraw- Hill, ISBN: 13: 9780070151253
4. Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to the Smart Grid and Building Automation”, Wiley, 2012, 9781119958345 3.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012, ISBN:978-1-119-99435-0.



IoT-003: IOT APPLICATIONS AND WEB DEVELOPMENT

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To acquire specific scripting knowledge to develop interactive applications.
2. To understand the basics of android application development.
3. To apply the programming skills in developing application pertaining to Industrial, medical, agricultural, etc.

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

1. Design dynamic web forms to acquire and process user & sensor data.
2. Implement mobile application using android SDK.
3. Solve the need for smart systems in a distributed environment.
4. Understand the IoT architecture and building blocks for various domains.
5. Devise multidisciplinary case to case modelling and execute wide range of application.

Unit 1- Markup Language: Introduction to Markup language, HTML document structure, HTML forms, Style (CSS), Multiple CSS stylesheets, DHTML, Tools for image creation and manipulation, User experience design, IoT development using charts.

Scripting Language: Introduction to JavaScript, Functions, DOM, Forms, and Event Handlers, Object Handlers, Input validation, J2ME, application design using J2ME , IoT development using Real time rules, platforms, alerts

Unit 2- Android Programing Framework: Mobile app development: Android Development environment, Simple UI Layouts and layout properties, GUI objects, Event Driven Programming, opening and closing a Database.

Unit 3- Industrial Internet Application: IoT Fundamentals and Components, Industrial Manufacturing, Monitoring, Control, Optimization and Autonomy, Introduction to Hadoop and big data analytics.

Unit 4- Applications in IoT enabled Smart Cities: Energy Consumption Monitoring, Smart Energy Meters, Home automation, Smart Grid and Solar Energy Harvesting, Intelligent Parking, Data lake services scenarios.

Applications in agriculture: Smart Farming: Weather monitoring, Precision farming, Smart Greenhouse, Drones for pesticides

Unit 5- Healthcare applications: Architecture of IoT for Healthcare, Multiple views coalescence, SBC-ADL to construct the system architecture. Use Cases : Wearable devices for Remote monitoring of Physiological parameter, ECG, EEG, Diabetes and Blood Pressure.



TEXTBOOKS:

1. John Dean, Web Programming with HTML5, CSS and JavaScript, 2018, Jones and Bartlett Publishers Inc., ISBN-10: 9781284091793
2. DiMarzio J. F., Beginning Android Programming with Android Studio, 2016, 4th ed., Wiley, ISBN-10: 9788126565580.

REFERENCE BOOKS:

1. Fadi Al-Turjman, Intelligence in IoT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 2018, Packt Publishing.
3. Subhas Chandra Mukhopadhyay, Smart Sensing Technology for Agriculture and Environmental Monitoring, 2012, Springer, ISBN-10: 3642276377.



IoT-004: MACHINE LEARNING FOR INTERNET OF THINGS

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To learn and understand the basics of Machine Learning and IoT
2. To get acquainted with machine learning for IOT Data Analysis.
3. To learn and understand Machine learning and deep learning methods for IoT applications.
4. To design IoT applications using ML , DL methods
5. To understand the Internet of Things and its benefits for society.

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

1. Identify and understand the machine learning elements and techniques.
2. Implement data preprocessing methods for IoT using python.
3. Identify and understand Machine Learning accelerators for IoT Devices.
4. Design & implement deep learning model for sensor data.
5. Design various IoT applications using ML and DL techniques.

Unit 1- Introduction to Machine Learning: Introduction to ML, Introduction to Statistical Learning Methods, Classic and adaptive machines, Machine-Learning Problem, Machine-Learning Techniques and Paradigms, Machine Intelligence, Elements of Machine Learning, Introduction to Advanced ML - Deep Learning, Reinforcement Learning.

Unit 2- IOT Data Pre-processing: Data Preparation for Predictive Maintenance Modeling, Cleaning and Standardizing IoT Data, Applying Advanced Data Exploration Techniques.

Feature Engineering: Exploring Feature Engineering, Applying Feature Selection Techniques, Feature set selection using ML, Machine learning for Internet of Things data analysis.

Unit 3- Machine learning (ML) methods for IoT Applications : Decision Trees (DTs), Support Vector Machines (SVMs), Bayesian theorem-based algorithms, k- Nearest neighbour (KNN), Random forest (RF), Association Rule (AR) algorithms, Ensemble learning (EL), k-Means clustering, Principal component analysis (PCA)

Deep learning (DL) methods for IoT Applications : Convolutional neural networks (CNNs), Recurrent neural networks (RNNs), Deep autoencoders (AEs), Restricted Boltzmann machines (RBMs), Deep belief networks (DBNs), Generative adversarial networks (GANs), Ensemble of DL networks (EDLNs).

Unit 4- Compact fast Machine Learning Accelerators for IOT devices: Edge Computing on IOT Devices, IOT Based Smart Buildings, Distributed Machine Learning, Machine Learning Accelerator, Machine Learning Model Optimization,

Least-Squares-Solver for Shallow Neural Network: Introduction, Algorithm Optimization, Hardware Implementation.



Unit 5- Deep Learning for IOT: Deep Learning Models For Sensor Data, Embedded Deep Learning, Real Time IOT Imaging with Deep Neural Network.

Applications of ML and IOT: IOT for Agriculture, Remote Patient Monitoring, Smart City, Smart Transportation, IOT Security using ML.

TEXTBOOKS:

1. Ethem ALPAYDIN, “Introduction to Machine Learning” ,The MIT Press, October 2004, ISBN 0-262-01211-1.
2. Hantao Huang, Hao Yu, “Compact and Fast Machine Learning Accelerator for IoT Devices,”Edition: 1st ed. Publisher: Springer Singapore Year: 2019ISBN: 978-981-13-3323-1.

REFERENCE BOOKS:

1. Trevor Hastie Robert Tibshirani Jerome Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Second Edition, Springer Series in Statistics, Feb 2009
2. Tom M. Mitchell , “ Machine Learning”, McGraw-Hill Science/Engineering/Math; (March 1, 1997)ISBN: 0070428077
3. Neeraj Kumar, Aaisha Makkar, “ MACHINE LEARNING IN COGNITIVE IOT”, <https://www.routledge.com/Machine-Learning-in-Cognitive-IoT/Kumar-Makkar/p/book/9780367359164> ISBN 9780367359164 Published June 1, 2020 by CRC Press
4. Puneet Mathur, “ IoT Machine Learning Applications in Telecom, Energy, and Agriculture, With Raspberry Pi and Arduino Using Python”, ISBN 978-1-4842-5549-0
5. Nicolas Modrzyk, “ Real-Time IoT Imaging with Deep Neural Networks - Using Java on the Raspberry Pi 4” , Apress Publication , Year: 2020, ISBN: 9781484257210, 978148425722.



IoT-005: INTERNET OF THINGS SECURITY

L: T: P: : 3: 0: 0

Credits – 3

COURSE OBJECTIVES: The objective of the course is to:

1. To understand IoT security issues and concerns.
2. To understand the main threats and attacks in IoT Environment.
3. To ensure user authentication.
4. To understand Security Requirements in IoT Architecture.
5. To create awareness of IoT security.
6. To apply Security concepts/techniques for IoT applications.

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

1. Describe IoT security issues and concerns.
2. Discuss the main threats and attacks in IoT Environment.
3. Discuss Security Requirements in IoT Architecture.
4. Develop awareness of IoT security.
5. Use security concepts/techniques for IoT applications.

Unit 1- Introduction: Securing the Internet of Things & Security Architecture: Introduction, Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications, Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability , Attacks Specific to IoT.

Unit 2- Security and Vulnerability in the Internet of Things: Fundamentals of cryptography, Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Secure Cloud/Web Interface, Secure Software/Firmware, Physical Layer Security.

Unit 3- IoT Node Authentication : Security Goals in IoT, Public-Key-Based Authentication, Identity-Based Authentication, Trust models & privacy preservation, Encryption and Digital Signature, IP Connectivity, Lightweight Cryptography, Existing Security Schemes for IoT.

Unit 4- Data Protection & Security Requirements in IoT Architecture: Data Protection in IoT: Data lifecycle in IoT, Protecting Data in IoT Security Requirements in IoT Architecture: Introduction, Network Layer, Service Layer, Application-Interface Layer, Cross-Layer Threats, Threats Caused in Maintenance of IoT, cloud security for IoT, IoT Security for machine learning applications.

Unit 5- Security in Enabling Technologies & Existing Security Scheme for IoT: Security in Identification and Tracking Technologies, Security in Integration of Wireless Sensor Network and RFID, Security in Communications, Security Protocols and Privacy Issues into 6LoWPAN Stack, Security in Service Management, Data Security and Privacy, Data Confidentiality and Key Management Contents, Security Concerns in Social IoT,



Confidentiality and Security for IoT Based Healthcare.

TEXTBOOKS:

1. Orchestrating and Automating Security for the Internet of Things: Delivering Advanced Security Capabilities from Edge to Cloud for IoT, by Anthony Sabella, Rik Irons- Mclean, Marcelo Yannuzzi, Publisher: Cisco Press, Release Date: June 2018,ISBN: 9780134756936
2. Securing the Internet of Things, Shancang Li Li Da Xu, Syngress, 2017, Elsevier, ISBN: 978-0-12-804458-2
3. Internet of Things for Smart Cities Technologies, Big Data and Security, Waleed Ejaz Alagan Anpalagan, Springer, ISBN 978-3-319-95036-5 ISBN 978-3-319-95037-2.

REFERENCE BOOKS:

1. Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations ", ISBN: 9781498723183, CRC Press, 2016. 6.
2. Aditya Gupta, "The IoT Hacker"s Handbook: A Practical Guide to Hacking the Internet of Things", ISBN: 1484242998, Apress publisher, 2019



IoT-001: EMBEDDED SYSTEM AND INTERNET OF THINGS LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To understand the fundamentals and functionality of various embedded board platforms.
2. To design and implement interconnection and integration of sensors to embedded board platform.
3. To design and implement application of IoT using various sensors.

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

1. Understand the different hardware/software co-design techniques for microcontroller-based embedded systems, apply techniques in IoT applications.
2. Design and implement interconnection and integration of sensors to embedded board platform.
3. Understand the working of embedded boards.
4. Apply the knowledge to interface various sensors with IoT development board.
5. Design and implement IoT system for real time applications.

The suggested list of Experiments:

1. Study of Raspberry Pi 4, Arduino board and Operating systems for the same. Understand the process of OS installation on the Raspberry Pi.
2. Study of different sensors:- temperature sensor, biosensor, IR sensor, chemical sensor(PH), gauge sensor, ultrasonic sensor etc.
3. Understand the connection and configuration of GPIO and its use in programming. Write an application of the use of push switch and LEDs.
4. Write an application to read temperature from the environment. If temperature crosses threshold value, then it notifies with buzzer.
5. Interface IR sensor to Raspberry Pi/ Arduino. Write a program to detect obstacle using IR sensor and notify it using LED.
6. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee to on and off remote led.
7. Interface stepper motor and seven segment display with Raspberry Pi/Arduino and write a program to control the motion of motor and display number of rotations made by motor on 7 segment display.
8. Write an application using Raspberry Pi/Arduino for streetlight control system. System consists of smart streetlights that have external light sensing that automatically turns on at desired intensity based on amount of lighting needed.
9. Write an application using Raspberry Pi/Arduino for traffic signal monitoring and control system.
10. Write an application using Raspberry Pi/Arduino for smart health monitoring system which records heartbeat rate and temperature and also sends SMS alerts if readings are beyond critical values.



- 11.** Implement a weather monitoring system using humidity, temperature and raindrop sensor and Raspberry Pi/Arduino board.
- 12.** Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.
- 13.** Internet of things enabled real time water quality monitoring system.
- 14.** Implement smart home automation system. The system automates home appliances and control them over internet from anywhere.
- 15.** Develop a Real time application like a smart home security.

Description: When anyone comes at door the camera module automatically captures his image and sends a notification to the owner of the house on his mobile phone using GSM modem.



IoT-002: IOT APPLICATIONS AND WEB DEVELOPMENT LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To acquire specific scripting knowledge to develop interactive applications.
2. To understand the basics of android application development.
3. To apply the programming skills in developing application pertaining to Industrial, medical, agricultural, etc.

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

1. Understand the IoT architecture and building blocks for various domains.
2. Design solutions for smart systems in a distributed environment.
3. Implement mobile application using android SDK.
4. Design dynamic web forms to acquire and process user & sensor data.
5. Devise multidisciplinary case to case modelling and execute wide range of application.

The suggested list of Experiments:

1. Design and development of wireless video surveillance robot.
2. Design and implementation of wearable glove to enable sign to speech conversation.
3. IoT based home automation with security features.
4. Smart farming : IoT based system for smart agriculture.
5. IoT application to improvise industrial automation.
6. Smart Energy meters to minimize power consumptions with a statistical approach.
7. Bringing intelligence body area network – Smart Healthcare systems.



IoT-003: MACHINE LEARNING FOR INTERNET OF THINGS LAB

L: T: P: : 0: 0: 2

Credits – 1

COURSE OBJECTIVES: The objective of the course is to:

1. To learn and understand the basics of Machine Learning and IoT.
2. To get acquainted with machine learning for IOT Data Analysis.
3. To learn and understand Machine learning and deep learning methods for IoT applications.
4. To design IoT applications using ML , DL methods.
5. To understand the Internet of Things and its benefits for society.

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

1. Identify and understand the machine learning elements and techniques.
2. Implement data preprocessing methods for IoT using python.
3. Compare Machine Learning and Deep Learning.
4. Design & implement deep learning model for sensor data
5. Design various IoT applications using ML and DL techniques.

The suggested list of Experiments:

Operating System recommended :- 64-bit Open source Linux or its derivative.

Programming tools recommended: - Data Mining Tool like WEKA , R Studio for R Programming, Anaconda for Python programming, Arduino IDE

Hardware Requirement: Various sensors as per selected application(Temperature Sensor, Humidity Sensor, for Air Quality) Arduino board , Raspberry Pi 3 or above Version, Py Camera)

1. Programming for IOT : R- programming, Python Libraries, Azure Cloud platform Examining Machine Learning for IoT

Develop an Application on Arduino/Raspberry-Pi to capture the values of temperature sensor after every 15 sec of time interval, store these values in .csv format and predict the temperature at particular time t using linear regression analysis.

Hint:

Create the dataset of at least 20-25 instances, use any data analysis tool (WEKA/R).

2. Getting Started with Azure Machine Learning

Deploy your first Azure/Think Speak IoT Edge module to a virtual Linux or Windows device

Reference

- i) Deploy your first IoT Edge module to a Linux device
- ii) Deploy your first IoT Edge module to a Windows device
- iii) Things Speak for IoT
- iv) Collect the sensor data on private cloud using Things Speak.

3. Exploring Code-First Machine Learning with Python



- i) Download the Dataset of your choice
- ii) Divide the dataset into Training data and Testing data.
- iii) Perform the classification of the instances using any machine learning algorithm like KNN Algorithm, Naïve Bayes, Decision Tree or any.
- iv) Evaluate the machine learning model by considering the parameter (TPR, TNR, FPR, FNR, accuracy, precision, recall, error rate etc.)



IoT-004: CAPSTONE PROJECT

L: T: P: : 0: 0: 2

Credits – 2

COURSE OBJECTIVES: The main objective of Capstone Project is to let the students apply the knowledge of theoretical concepts which they have learnt as a part of the curriculum of the minor degree using real time problems or situations.

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

1. Understand, plan, and execute a Capstone Project with team.
2. Acquired knowledge within the chosen area of technology for project development.
3. Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
4. Communicate and report effectively project related activities and findings.
5. Expose the world of research, technology, and innovation.

COURSE GUIDELINES:

The Capstone project is desirable to be done in a group of 2 students. Each group has to prepare a title related to any engineering discipline, and the title must emulate any real world problem.

Submit an early proposal. This proposal is a 1-2page(s) report, describes what the project is about and the final product's output. The project proposal will be submitted to the respective guide.

Every individual student will be assigned a faculty to guide them. There will be three major reviews which will be carried out as listed below.

Review #	Requirement	Mark Weightage	
		Internal	External
0	Area / Title selection	-	-
1	Literature review / Proposal for the Project	10%	-
2	Mathematical Modelling/Circuit Design	20%	-
3	Final simulation / Hardware presentation	20%	-
End Semester Exam	Final Viva-Voce and project demonstration	-	50%

The assessment of term work shall be done on the basis of the following.

1. Continuous assessment
2. Performing the experiments in the laboratory
3. Oral examination conducted on the syllabus and term work mentioned above.