CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
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COMMITTED TO RESEARCH, INNOVATION AND EDUCATION 41 years

DEPARTMENT OF INFORMATION TECHNOLOGY

SCHEME AND SYLLABUS FOR

B.E. (IT) - V TO VI SEMESTERS

UNDER

AICTE MODEL CURRICULUM

R-18 REGULATION

DEPARTMENT OF INFORMATION TECHNOLOGY
CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
HYDERABAD-500 075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE Model Curriculum (with effect from 2020-21)
B.E. (Information Technology)

SEMESTER– V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	18IT C15	Operating Systems	3	-	3	30	70	3
2	18IT C16	Theory of Automata	3	-	3	30	70	3
3	18IT C17	Computer Networks	3	-	3	30	70	3
4	18IT C18	Software Engineering	3	-	3	30	70	3
5		Core Elective - 1	3	-	3	30	70	3
6		Core Elective - 2	3	-	3	30	70	3
PRACTICAL								
7	18IT C19	Operating Systems and Computer Networks Lab	-	2	2	15	35	1
8	18IT C20	Software Engineering Lab	-	2	2	15	35	1
9	18IT C21	Mini Project - III	-	2	-	50	-	1
TOTAL			18	6	-	260	490	21

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE-Continuous Internal Evaluation **SEE-Semester End Examination**

Core Elective-1		
S.No.	**Subject Code**	**Subject Name**
1.	18IT E01	Data Warehousing and Data Mining
2.	18IT E02	Computer Graphics
3.	18IT E03	Principles of Programming Languages
4.	18IT E04	UNIX and Shell Programming

Core Elective-2		
S.No.	**Subject Code**	**Subject Name**
1	18IT E05	Predictive Analytics with 'R'
2	18IT E06	Web Technologies
3	18IT E07	Information Retrieval Systems
4	18IT E08	Compiler Design

18IT C15 **OPERATING SYSTEMS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize students with various services provided by an operating system.
2. To introduce the concepts of process, process synchronization and process scheduling.
3. To deal with different approaches of memory management.
4. To facilitate understanding of the structure and organization of the file system.
5. To provide understanding of Protection and security aspects of operating systems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate operating system services, inter process communication and multithreaded Programming.
2. Apply suitable process scheduling, deadlocks handling algorithms and solve process-synchronization.
3. Make use of advanced techniques such as paging, segmentation and virtual memory for memory management.
4. Illustrate file system interfaces and its implementation.
5. Identify the Operating System Security problems and Threats

UNIT–I

Introduction: Definition of Operating System, Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Computing Environments, Open-Source Operating Systems.

Operating System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, System Boot.

Process: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication

Threads: Overview, Multicore Programming, Multithreading Models, Threading Issues.

UNIT–II

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling.

Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT–III

Memory Management Straegies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual Memory Management: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory.

UNIT–IV

File-System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing Protection.

Implementing File Systems: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance.

Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management.

UNIT–V

System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of the Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems

System Security: The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication.

Text Book:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Pvt Ltd, 2016.

Suggested Reading:

1. A.Tanenbaum, "Modern Operation Systems", 3rd Edition, Pearson Education, 2008.
2. William Stallings, "Operating Systems", 5th Edition, Pearson Education, 2005.
3. Ida M.Flynn, "Understanding Operating Systems", 6th Edition, Cengage, 2011.
4. D.M.Dhamdhere,"Operating systems a concept based approach", 2nd Edition, McGraw-Hill, 2007.

Web Resources:

1. http://nptel.ac.in/downloads/106108101/
2. http://www2.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
3. http://www.cs.kent.edu/~farrell/osf03/oldnotes/

18IT C16 **THEORY OF AUTOMATA**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To study abstract computing models namely Finite Automata, Pushdown Automata, and Turning Machines.
2. To introduce various grammars, formal languages and their relationships.
3. To impart the relation between various grammars and recognizers for different formal languages.
4. To aquiant with mathematical methods to prove properties of languages, grammars and automata.
5. To familiarize with decidability and undecidability of computational problems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Build Deterministic, Non deterministic Finite automata for Languages and show the acceptance of strings using Formal Machines.
2. Develop regular expressions and their equivalent finite automata for different languages.
3. Infer Context-free grammars for certain languages and Test for Closure Properties and Decision Properties of CFL's.
4. Construct pushdown automata for languages and Analyze Equivalence of PDA's, CFG's.
5. Identify Recursively Enumerable Languages, Undecidable problems using Turing Machines and Model Turing Machines for simple Computational Problems.

UNIT-I

Automata: Introduction to Finite Automata, the Central Concepts of Automata Theory: Alphabets, Strings and Languages.

Finite Automata: An Informal Picture Of Finite Automata: The Ground Rules, the Protocol, Enabling the Automata to Ignore Actions, the Entire System as an Automaton. Deterministic Finite Automata: Definition of a DFA, Simpler Notations for DFA's, Extending the Transition Function to Strings, The Language of a DFA, Nondeterministic Finite Automata: Definition of NFA, The Extended Transition Function, The Language of an NFA, Equivalence of NFA and DFA, An Application: Text Search, Finite Automata with Epsilon-Transitions: Use of €-transitions, The formal notation for an €- NFA, €-closure, Extended Transitions and Languages for €-NFA's, Eliminating €-transitions.

UNIT-II

Regular Expression and languages: Regular Expressions: The Operators of Regular Expressions, Building Regular Expressions. Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, Algebraic Laws for Regular Expressions.

Properties of Regular Languages: Proving Languages not to be Regular: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages: Testing Emptiness of Regular Languages, Testing Membership in a Regular Language. Equivalence and Minimization of Automata: Testing Equivalence of States, Testing Equivalence of Regular Languages, Minimization of DFA's.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars: Definition of Context Free Grammars, Derivations using a Grammar, Leftmost and Rightmost Derivation, The language of a Grammar, Parse Trees: Constructing Parse Trees, The Yield of a Parse Tree, Applications of CFGs, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity From Grammars, Leftmost Derivations as way to Express Ambiguity, Inherent Ambiguity.

Properties of Context Free Languages: Normal Forms for Context-Free Grammars: Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Productions, Eliminating Unit

Productions, Chomsky Normal Form, Pumping Lemma for CFL's: Statement of the Pumping Lemma, Applications of Pumping Lemma for CFL's, Closure Properties of CFL's, Decision Properties of CFL's: Testing Emptiness of CFL's, Testing Membership in a CFL's.

UNIT-IV

Pushdown Automata: Definition of pushdown automaton: The Formal Definition of PDA, Graphical Notation for PDA's, Instantaneous Description of a PDA, The Language of a PDA: Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack, Equivalence of PDA's and CFG's: From Grammars to PDA's, From PDA's to Grammars, Deterministic Pushdown Automata: Definition, Regular Languages and Deterministic PDA's.

UNIT-V

Introduction to Turing Machines: Problems that Computer Cannot Solve: The Turing Machine: Notation for the TM, Instantaneous Descriptions for TM's, Transitions Diagrams, The Language of a TM, Turing Machines and Halting, Programming Techniques for Turing Machines: Storage in the State, Multiple Tracks, Subroutines. Extensions to the Basic Turing machine, Restricted Turing machines, Turing Machine and Computers: Simulating a Computer by a TM.

Undecidability: A Language That Is Not Recursively Enumerable: Enumerating the Binary Strings, Codes for Turing Machines, The Diagonalization Language, An Undecidable problem that is RE: Recursive Languages, Compliments of Recursive and RE languages, The Universal Languages, Undecidablity of the Universal Language, Undecidable problems about Turing Machines: Reductions, TM's That Accept The Empty Language, Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP, Other Undecidable Problems.

Text Book:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", 3rd Edition, Pearson Education, 2007.

Suggested Reading:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rd Edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2nd Edition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd Edition, Prentice Hall of India 2008.
4. ShyamalendraKandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.

Web Resources:

1. http://nptel.ac.in/courses/106106049/
2. http://online.stanford.edu/course/automata-theory

18IT C17 **COMPUTER NETWORKS**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To present an overview of computer networking concepts and give an insight into the working principles of popular Internet Applications WWW, HTTP, Electronic Mail and Domain Name System.
2. To facilitate state-of-the-art knowledge on Network Layer issues including Routing and Addressing.
3. To introduce IP based transport protocols TCP and UDP.
4. To familiarize an understanding of various data link control protocols.
5. To provide main issues related to network security and relevant cryptographic techniques.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe the components, reference models, services and performance measures of Computer Networks and operating principles of WWW, HTTP, FTP, Electronic Mail and Domain Name System.
2. Identify transport layer services and infer UDP and TCP protocols.
3. Propose appropriate routing algorithm for Data routing.
4. Illustrate data link layer protocols for error detection, correction, channel partitioning and addressing.
5. Summarize various network security threats and cryptographic algorithms.

UNIT-I

Computer Networks and the Internet: Internet-A Nuts-and-Bolts Description, A Services Description, Protocol, The Network Edge - Access Networks, Physical Media, The Network Core, Packet Switching, Circuit Switching, A Network of Networks, Delay, Loss, and Throughput in Packet-Switched Networks- Overview of Delay in Packet-Switched Networks, Queuing Delay and Packet Loss, End-to-End Delay, Throughput in Computer Networks, Protocol Layers and Their Service Models-Layered Architecture, Encapsulation

Application Layer: Principles of Network Applications- Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols, The Web and HTTP - Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer- FTP- SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols Electronic Mail in the Internet DNS The Internet's Directory Service -Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages

UNIT-II

Transport Layer- Introduction and Transport-Layer Services- Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP-UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer- Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR), Connection-Oriented Transport: TCP- The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control- The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-Assisted Congestion-Control Example: ATM ABR Congestion Control

UNIT-III

Network Layer: Introduction- Forwarding and Routing Network Service Models Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Inside a Router- Input Processing, Switching, Output Processing, Queuing, The Internet Protocol (IP)-Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6, Routing Algorithms, The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet- Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP, Broadcast and Multicast Routing- Broadcast Routing Algorithms, Multicast

UNIT-IV

The Link Layer: Links, Access Networks, and LANs, Introduction to the Link Layer - The Services Provided by the Link Layer, Link Layer Implementation Error-Detection and -Correction Techniques- Parity Checks, Checksumming Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols- Channel Partitioning Protocols, Random Access Protocols Taking-Turns Protocols, Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs), Data Center Networking

UNIT-V

Security in Computer Networks: Network Security, Principles of Cryptography-Symmetric Key Cryptography, Public Key Encryption, Message Integrity and Digital Signatures-Cryptographic Hash Functions, Message Authentication Code, Digital Signatures, End-Point Authentication-Authentication Protocols, Securing E-Mail- Secure E-Mail, PGP, Network-Layer Security- IPsec and Virtual Private Networks (VPNs)

Text Book:

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

Suggested Reading:

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2013.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers, 2011.
3. Behrouz A. Forouzan, "Data communication and Networking", 4th Edition, Tata McGraw – Hill, 2011.
4. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.

Web Resources:

1. https://nptel.ac.in/courses/106105081/
2. http://www.redbooks.ibm.com/abstracts/gg243376.html
3. http://www.ietf.org/rfc.html

18IT C18 **SOFTWARE ENGINEERING**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To describe various software life cycle models and Agile software development concepts.
2. To introduce the Behavioural modeling concepts in UML.
3. To define the structural modeling concepts in UML.
4. To familiarize with Software Testing Techniques and tools.
5. To capacitate the students with Risk management and Product metrics concepts.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe the concepts of Software Engineering and build the Requirements model.
2. Develop basic and advanced behavioral models using the concepts of Unified Modelling Language.
3. Design various structural models such as Class, Objects and Packages for real world scenarios.
4. Acquire thorough knowledge of software testing strategies and testing tools.
5. Estimate the software productivity using product metrics and acquire knowledge of software risk Management.

UNIT-I

Software and Software Engineering: The Nature of Software, Software Engineering. The Software Process, Software Engineering Practice. **A Generic view of Process :** Software Engineering -A Layered Technology, A Process frame work, Process Models-Waterfall model, spiral model , The Unified Process, Product and Process, Process Assessment and Improvement, The CMMI, Introduction to Agile development-Extreme programming.
Understanding Requirements: Requirements Engineering, Establishing the Groundwork,Eliciting Requirements, Building the Requirements Model, Negotiating Requirements, Validating Requirements. **Requirements Modeling:** Requirements Analysis, Scenario-Based Modeling, Problem Analysis, Software Requirement and specifications.

UNIT-II

UML Introduction: Model, Introducing the UML, Elements of UML-Things Relationships and Diagrams.
Basic Behavioral Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams-Sequence diagrams-components of Sequence diagrams, Collaboration diagrams-Components of Collaboration diagrams, Activity diagrams-components of activity diagrams, Swimlane diagrams, Case studies on Use Case diagrams, Interaction diagrams.

UNIT-III

Basic Structural Modeling: Classes, Relationships, Class Diagrams, Advanced Structural Modeling: Advanced Classes, Advanced Relationships, Interfaces, Components, Collaborations and Deployment diagrams, Case studies on class diagrams.
Quality Concepts: Software Quality, Achieving Software Quality, Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, The ISO 9000 Quality Standards.

UNIT-IV

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Validation Testing, System Testing. Testing Tools–Rational functional tester, Selenium software testing tool.
Testing Conventional Applications: Software Testing Fundamentals, White-Box Testing, Basis Path Testing, Black–Box Testing, Alpha testing, Beta testing.

UNIT-V

Product Metrics: A Framework for Product Metrics, Size Metrics like LOC, Function points.
Risk Management: Software Risks, Reactive versus Proactive Risk Strategies, Risk Mitigation, Monitoring, and Management, The RMMM Plan.

Text Books:

1. Roger S.Pressman, "Software Engineering: A Practitioners Approach", 7th Edition, McGraw Hill, 2017.
2. Grady Booch, James Rumbaugh, Ivor Jacobson, "The Unified Modeling Language-User Guide (Covering UML 2.0)", 3rd Edition, Pearson Education, India, 2010.
3. Pankaj Jalote "An Integrated Approach to Software Engineering", 3rd Edition, Narosa Publishing house, 2008.

Suggested Reading:

1. Martin Fowler, Kendall Scott "UML Distilled**:** A Brief Guide to the Standard Object Modeling Language" Addison Wesley, 4th Edition, 2011.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2nd Edition.

Web Resources:

1. http://tuvalu.cs.flinders.edu.au/seweb/se-ed/
2. IBM Rational http://www-306.ibm.com/software/rational/uml/
3. http://www.togethersoft.com/services/practical_guides/umlonlinecourse/

18IT E01 **DATA WAREHOUSING AND DATA MINING**
(Core Elective–1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce the concepts of Data Warehouse and Data Mining.
2. To familiarize different kinds of data and various preprocessing techniques.
3. To present different frequent pattern discovery methods.
4. To describe various classification and clustering techniques.
5. To facilitate the learning of outlier analysis.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand the basic requirements of data mining and apply pre-process techniques.
2. Build Multidimensional data model and perform OLAP operations, generate Association rules from data.
3. Build and evaluate models for Classification and Prediction.
4. Evaluate the advanced classification and clustering techniques.
5. Understand outlier detection and real time applications of Data mining.

UNIT-I
Introduction: Data mining, Kinds of data, Kinds of pattern, Major issues in data mining. **Getting to know your data:** Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity. **Data Preprocessing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

UNIT-II
Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage: A Business Analysis Framework for Data Warehouse Design, Data Warehouse Design Process, Data Warehouse Usage for Information Processing, Data Warehouse Implementation. **Mining Frequent Patterns, Associations and correlations:** Basic Concepts, Frequent Item Set Mining Methods, Interesting patterns, Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining in Multilevel and Multidimensional Space.

UNIT-III
Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Introducing Ensemble Methods, Bagging, Boosting, Random Forests, Improving Classification Accuracy of Class-Imbalanced Data.

UNIT-IV
Classification: Advanced Methods: Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.
Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, DBSCAN, Evaluation of Clustering, Clustering graph and network data.

UNIT-V
Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches **Data Mining Trends and Research Frontiers:** Mining Complex Data Types: Mining Sequence Data: Mining Other Kinds of Data, Data Mining Applications, Data Mining and Society, Data Mining Trends.

Text Book:

1. Han J, Kamber M, Jian P "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2012.

Suggested Reading:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008.
2. M. Humphires, M.Hawkins, M.Dy,"Data Warehousing: Architecture and Implementation", Pearson Education, 2009.
3. Anahory, Murray, "Data Warehousing in the Real World", Pearson Education, 2008.
4. Kargupta, Joshi, etc., "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt. Ltd, 2007.

Web Resources:

1. https://hanj.cs.illinois.edu/bk3/
2. https://www.kdnuggets.com/
3. http://archive.ics.uci.edu/ml/index.php

18IT E02 **COMPUTER GRAPHICS**
(Core Elective-1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce the core concepts of computer graphics and output primitive algorithms.
2. To impart knowledge on Structures and Hierarchical Modeling, Attributes of output primitives.
3. To familiarize students with 2D transformation and Viewing techniques.
4. To provide knowledge on 3D object representations, transformations and various curve generation techniques.
5. To introduce the concepts of surface detection methods and computer animation techniques.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Explain the core concepts of computer graphics systems and analyze the output primitive algorithms.
2. Describe various types of attributes of output primitives, Structure concepts and Interactive Input methods.
3. Evaluate various techniques for performing 2D transformations and viewing techniques.
4. Analyze 3D Object representations, 3D transformations and curve generation methods.
5. Demonstrate visible surface detection methods and computer animation.

UNIT-I
Computer Graphics: Introduction, Application areas, Overview of graphics systems: Video-display devices, Raster-scan systems, Random scan systems, Graphics monitors and Work stations and input devices, Graphics software.
Output primitives: Points and lines, line drawing algorithms: DDA and Bresenham's line generation, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms, Fill-Area Functions, Cell Array, Character generation.

UNIT-II
Attributes of Output Primitives: Line Attributes, Curve Attributes, color and gray scale levels, Area Fill Attributes, Character Attributes, Bundled Attributes, Inquiry Functions.
Structures and Hierarchical Modeling: Structure concepts, Editing Structures, Hierarchical modeling with structures. Graphical User Interfaces and Interactive Input Methods: The User Dialogue, Logical Classification of Input Devices, Input Functions, Interactive Picture Construction Techniques.

UNIT-III
2-D Geometrical transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.
2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland – Hodgeman polygon clipping algorithm.

UNIT-IV
3-D Object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B- spline surfaces, CSG, Octrees, BSP Trees.
3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, projections, view volume and general projection transforms.

UNIT-V

Visible surface detection methods: Classification, back-face detection, depthbuffer, scan-line, depth sorting, BSP-tree methods, area sub-division and octree methods.

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications

Text Books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C version", 2nd Edition, Pearson Education
2. C, Foley, VanDam, Feiner and Hughes, "Computer Graphics Principles & practice", 2nd Edition, Pearson Education.

Suggested Reading:

1. Steven Harrington, "Computer Graphics- A Programming approach", 2nd Edition, Tata Mc Graw hill.
2. Zhigandxiang, Roy Plastock, Schaum's outlines, "Computer Graphics", 2nd Edition, Tata Mc- Graw Hill.
3. David F Rogers, "Procedural elements for Computer Graphics", 2nd Edition, Tata Mc Graw hill.

Web Resources:

1. https://www.scribd.com/presentation/324923136/Hearn-and-Baker
2. https://nptel.ac.in/courses/106106090/

18IT E03 **PRINCIPLES OF PROGRAMMING LANGUAGES**
(Core Elective-1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To briefly describe various programming paradigms.
2. To provide the Preliminary concepts of programming languages.
3. To familiarize with Syntax and Semantic Descriptions.
4. To acquire knowledge on ADT, Concurrency control, Exception handling Mechanisms
5. To provide conceptual understanding of High level language design and implementation.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand preliminaries of programming paradigms and formal notations of syntax.
2. Identify suitable data type and write optimal expressions.
3. Apply appropriate control structures and modularize the program.
4. Apply the concepts of encapsulation, concurrency and exception handling in programming.
5. Compare the features of functional, imperative and logical programming languages.

UNIT-I
Preliminary Concepts: Reasons for studying concepts of programming languages, Programming domains, Language Evaluation Criteria, Influences on Language design, Language categories.
Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, Programming Environments.
Syntax and Semantics: General Problem of describing Syntax and Semantics, Formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, Attribute grammars. Describing the Meanings of Programs: Dynamic Semantics**.**

UNIT-II
Data Types: Introduction, Primitive Data Types, Character String Types, Enumeration Types, Array Types, Associative Arrays, Record Types, Tuple Types, List Types, Union Types pointer and reference types, design and implementation uses related to these types. Names, Variables, Concept of Binding, Named Constants, Type checking, Strong Typing, Type compatibility.
Expressions and Assignment Statements: Arithmetic, Relational and Boolean expressions, Short-Circuit Evaluation, Assignment Statements, Mixed Mode Assignment.

UNIT-III
Statement Level-Control Structures: Selection, Iteration Statements, Unconditional Branching, Guarded commands.
Subprograms: Fundamentals of subprograms, Scope of life time of variables, static and dynamic scope, Design issues of subprograms and operations, Local Referencing Environments, Parameter Passing Methods, Parameters that are Subprogram, Design Issues for Functions, Overloaded Subprograms, Generic Subprograms, User Defined Overloaded Operators, Coroutines.

UNIT-IV
Abstract Data types and Encapsulation Constructs: Introductions to Data Abstraction, Design Issues, Language Examples, Parameterized ADT, Encapsulation Constructs, Object Oriented Programming in small talk, C++, Java, C#.
Concurrency: Subprogram Level Concurrency, Semaphores, Monitors, Message Passing, Java Threads, C# Threads.
Exception Handling: Exceptions, Exception Propagation, Exception handler in C++ and Java.

UNIT-V

Functional Programming Languages: Introduction, Mathematical Functions, Fundamentals of Functional Programming Languages, The First Functional Programming Language: LISP, An Introduction to Scheme, Common Lisp, ML, Haskell, Support for Functional Programming in Primarily Imperative Languages, A Comparison of Functional and Imperative Languages

Logic Programming Language: Introduction and Overview of Logic Programming, Basic Elements of Prolog, Applications of Logic Programming.

Text Books:

1. Robert W. Sebesta, "Concepts of Programming Languages", 10th Edition, Pearson Education, 2012.
2. D. A. Watt, "Programming Language Design Concepts", Wiley Dreamtech, 2007.

Suggested Reading:

1. A. B. Tucker, R. E. Noonan, "Programming Languages", 2nd Edition, TMH.
2. K. C. Louden, "Programming Languages", 2nd Edition, Thomson, 2003.
3. Patric Henry Winston and Paul Horn, "LISP", 3rd Edition, Pearson Education.

Web Resources:

1. https://nptel.ac.in/courses/106102067/
2. https://web.cs.dal.ca/~nzeh/Teaching/3136/index.html

18IT E04 **UNIX AND SHELL PROGRAMMING**
(Core Elective-1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To familiarize students with the UNIX environment and basic UNIX utilities.
2. To introduce File systems and File structures.
3. To impart skills required for shell scripting and process handling.
4. To develop skills required to formulate regular expressions.
5. To familiarize students with the routine system administrative features and tools.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Describe the functional architecture, features and utilities of UNIX OS
2. Demonstrate various File handling operations
3. Understand the basic of the shell scripting and process handling mechanism using commands
4. Build regular expressions for pattern matching to design a task specific filter
5. Write application specific shell program and perform system administration

UNIT-I
Introduction to Unix: The UNIX Operating System, The UNIX Architecture, Features of UNIX, Internal and External Commands, Command Structure, **General-Purpose Utilities:**cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, sty. **The vi editor:** vi Basics, Input Mode, Saving Text and Quitting, Navigation, Editing Text, Undoing Last Editing Instructions, Repeating the Last Command, Searching for a Pattern, Substitution.

UNIT-II
Handling Files: The File System, Parent Child Relationship, The HOME variable, pwd,cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The UNIX File System cat, cp, rm, mv, more, file, ls, wc, cmp, comm, diff. **Compressing and Archiving files:**gzip and gunzip- Compressing and Decompressing files, tar-The Archival program, zip and unzip- Compressing and Archiving together.
File Attributes: ls options -l, -d,-lh,-la, File Ownership, File Permissions, chmod-Changing File permissions, Directory Permissions, Changing File ownership.

UNIT-III
The Shell: The Shells's interpretive Cycle, Shell Offerings, Pattern Matching, Escaping and quoting, Redirection, /dev/null and /dev/tty, Pipes, tee- Creating a tee, Command Substitution, Shell Variables.
The Process: Process Basics, ps- Process Status, System Processes (-e or –a), Mechanism of Process creation, Internal and External Commands, Process states and Zombies, Running jobs in Background, nice-Job Execution with low priority, Killing Processes with signals, Job Control, at and batch-Execute later, cron- Running jobs periodically, time-Timing Processes.

UNIT-IV
Simple Filters: pr-Paginating Files, head- Displaying the beginning of a File, tail-Displaying the end of a File, cut- Slitting a File vertically, paste-Pasting Files, sort-Ordering a File, uniq- Locate Repeated and Non-repeated Lines, tr- Translating Characters.
Filters using Regular Expressions: grep, Basic Regular Expressions, Extended Regular expressions, egrep, sed, Line Addressing, Using multiple instructions, Context Addressing, Writing Selected lines to a File, Text Editing, Substitution.

UNIT-V

Shell Programming: Shell scripts, read, Using Command Line Arguments, exit, The logical operators && and ||, Conditional execution- if, Using test and [ ] to evaluate expressions, case, expr, while, for, set and shift, trap, Debugging shell scripts with set–x.

System Administration: root, The administrator's privileges, Maintaining Security, User Management, Startup and Shutdown, Managing Disk Space, Device Files.

Text Book:

1. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2006.

Suggested Reading:

1. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and Shell Programming", 1st Edition, Cengage Learning India, 2003.
2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education, 2009.
3. YashwanthKanitkar, "Unix Shell programming", 1st Edition, BPB Publishers, 2010.
4. M.G. Venkateshmurthy, "Introduction to Unix and Shell Programming", Pearson Education, 2005.

Web Resources:

1. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=PracticalUnix
2. https://www.shellscript.sh/
3. www.bash.academy/
4. http://linuxcommand.org/

18IT E05 **PREDICTIVE ANALYTICS WITH 'R'**
(Core Elective-2)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To introduce Predictive Modeling.
2. To familiarize Regression and Classification Techniques.
3. To impart knowledge on the concepts of Neural Networks and various model Evaluation Techniques.
4. To introduce Topic Modeling.
5. To explore various case studies.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Perform predictive modelling and evaluate the performance
2. Understand regression techniques and Support Vector Machines
3. Evaluate different classifiers and build an efficient networking model
4. Analyze various ensemble methods, probabilistic Graphic models and understand topic modeling
5. Analyze time series models on real world data

Gearing Up for Predictive Modeling: Models**, Types of models :** Supervised, unsupervised, semi-supervised, and reinforcement learning models, Parametric and nonparametric models, Regression and classification models, Real-time and batch machine learning models, **The process of Predictive Modeling:** Defining the model's objective, Collecting the data, Picking a model, Preprocessing the data, Exploratory data analysis, Feature transformations, Encoding categorical features, Missing data, Outliers, Removing problematic features, Feature engineering and dimensionality reduction, Training and assessing the model, Repeating with different models and final model selection, Deploying the model, **Performance metrics:** Assessing regression models, Assessing classification models, Assessing binary classification models.

UNIT-II
Linear Regression: Introduction to linear regression, Simple linear regression, Multiple linear regression, Assessing linear regression models, Problems with linear regression, Feature selection, Regularization, Ridge regression**.**
Logistic Regression: Classifying with linear regression, Assessing logistic regression models, Regularization with the lasso, Classification metrics, Extensions of the binary and Multinomial logistic classifier
Support Vector Machines: Maximal margin classification, Support vector classification, Inner products**,** Kernels and support vector machines, Cross-validation.

UNIT-III
Neural Networks: Stochastic gradient descent**:** Gradient descent and local minima, The perceptron algorithm, Linear separation, The logistic neuron, **Multilayer perceptron networks:** Training multilayer perceptron networks.
Tree-based Methods: The intuition for tree models, Algorithms for training decision trees- Classification and regression trees, CART regression trees, Tree pruning, Missing data, Regression model trees CART classification trees, C5.0, Predicting complex skill learning, Variable importance in tree models,

UNIT-IV
Ensemble Methods: Bagging - Margins and out-of-bag observations, Predicting heart disease with bagging, Limitations of bagging, **Boosting –** AdaBoost, Limitations of boosting, **Random forests-** The importance of variables in random forests,
Probabilistic Graphical Models: A little graph theory, Bayes' Theorem, Conditional independence, Bayesian networks, The Naïve Bayes classifier. Hidden Markov models- Predicting letter patterns in English words.

Topic Modeling: An overview of topic modeling, Latent Dirichlet Allocation, The Dirichlet distribution, The generative process, Fitting an LDA model, Modeling the topics of online news stories, Model stability, Finding the number of topics, Topic distributions, Word distributions, LDA extensions

UNIT-V

Time Series Analysis: Fundamental concepts of time series, Time series summary functions, Some fundamental time series - White noise, Fitting a white noise time series, Random walk - Fitting a random walk, **Stationarity:** Stationary time series models, Moving average models, Autoregressive models - Autoregressive moving average models, **Non-stationary time series models:** Autoregressive integrated moving average models, Autoregressive conditional heteroscedasticity models, Generalized autoregressive heteroscedasticity models. Predicting foreign exchange rates, Other time series models. **Recommendation Systems:** Rating matrix, Measuring user similarity, Collaborative filtering, User-based collaborative filtering, Item-based collaborative filtering, Singular value decomposition, Other approaches to recommendation.

Text Books:

1. Rui Miguel Forte, "Mastering Predictive Analytics with R", Packt Publishing Ltd, 2015.
2. Roger D. Peng,"R Programming for Data Science", Lean Publishing, 2015.

Suggested Reading:

1. Lantz Brett, "Machine Learning with R", 2nd Edition, Packt Publishing Limited.
2. Sunila Gollapudi, "Practical Machine Learning", Packt Publishing Ltd.
3. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI, 2013.

Web Resources:

1. https://data-flair.training/blogs/r-predictive-and-descriptive-analytics/
2. https://www.littlemissdata.com/blog/predictive-analytics-tutorial-part-1
3. http://uc-r.github.io/mars

18IT E06 **WEB TECHNOLOGIES**
(Core Elective - 2)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To provide knowledge about web pages design and development.
2. To discuss the importance of XML and Web Services.
3. To impart knowledge on Java Servlets and JSP to build dynamic web pages.
4. To familiarize state of art frameworks.
5. To acquaint with Django framework that helps you to build a RESTful API.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Create web pages with good aesthetic sense of design using HTML, XHTML, CSS, JavaScript, DOM and JQuery.
2. Write well-formed and valid XML document and schema.
3. Implement java based dynamic web applications using Servlets, JSP and JDBC.
4. Build complex websites using MVC based STRUTS Framework.
5. Design and Develop full-stack web sites based on content stored in an RDBMS.

UNIT-I
Introduction: Web Fundamentals, **HTML 5.0:** basic tags, Images, Tables, Lists, Iframes, Forms, Layout, Graphics, span and div tags.
Introduction to Cascading Style Sheets: Types of CSS**,** CSS Selectors, CSS BOX Model, CSS Positioning, and CSS floating.
JQuery: Basics of JavaScript, JQuery syntax, Selectors, Events, JSON Fundamentals.

UNIT-II
Introduction to XML: The Syntax of XML, XML Document Structure, Document Type Definitions, Name Space, XML Schemas, Displaying XML Documents with CSS, XSLT Style Sheets and XML Processors.
Web Services: Web Service Architecture, structure and contents of SOAP message, structure of WSDL, Information in UDDI Registry, UDDI Registry API.

UNIT-III
Java Servlets: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Response methods, Approaches to Session tracking, Servlet Context, Servlet Collaboration.
JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Actions.
Databases: Connect servlet to MySQL, Connect JSP to MySQL.

UNIT-IV
Struts framework: MVC Design pattern, Introduction to the modern web application framework, Architecture and flow of execution, working with actions and interceptors, Building the view with Tags and Results in detail, OGNL and type conversion, exploring the validation framework, writing the custom validator and Struts application development.

UNIT-V
Django: Introduction, Django Framework Design Principles, Django Urls and Views, Django Templates Django Application Management, Django Form Structure and Workflow, Django Form Processing: Initialization, Field Access, Validation, and Error Handling Django Form Field Types: Widgets, Options, and Validations, Django Model Data Types, Django Model Database Tasks, Django Models and Multiple Databases CRUD Single Records in Django Models REST Services with Django.

Text Books:

1. Robert W.Sebesta, "Programming with World Wide Web", 8th Edition, Pearson Education, 2014.
2. Subramanyam Allamraju, "Professional Java Server programming", J2EE 1.3 Edition, CeditBuest, Apress Publications, 2007.
3. Donald Brown, Chad Michael Davis, Scott Stanlick, "Struts 2 in Action", Manning Publications, 2008.
4. Daniel Rubio, "Beginning Django Web Application Development and Deployment with Python", 1st Edition, Apress 2017.

Suggested Reading:

1. Gustavo Alonso, "Web Services: Concepts, Architectures and Applications", Springer, 2010.

Web Resources:

1. https://msdn.microsoft.com/en-us/library/office/ aa218647(v=office.11).aspx
2. https://www.w3schools.Com

18IT E07 **INFORMATION RETRIEVAL SYSTEMS**
(Core Elective–2)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To familiarize different Information Retrieval models.
2. To introduce query languages for retrieving data.
3. To introduce various methods to improve the retrieval results.
4. To impart knowledge on text operations.
5. To introduce Parallel and Distributed IR models.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand different Information Retrieval models.
2. Apply query language to retrieve the data and evaluate performance.
3. Analyze various methods to improve the retrieval results.
4. Perform operations on text and build indices.
5. Analyze searching techniques and understand Parallel and Distributed IR models.

UNIT-I
Introduction: Basic concepts, Past present and Future of IRS, Retrieval Process.
Modeling: Introduction, A Taxonomy of IR Models. **Retrieval:** Adhoc and Filtering, A formal characterization of IR Models, Classic IR, Set Theoretic Models, Algebraic Models, Probabilistic Models.

UNIT-II
Structured Text Retrieval Models, Models for Browsing.
Retrieval Evaluation: Introduction, Retrieval Performance Evaluation, Reference Collections.
Query languages: Introduction, Keyword-based querying, pattern Matching, Structural Queries, Query Protocols.

UNIT-III
Query operations: Introduction, User Relevance Feedback, Automatic Local Analysis, Automatic Global Analysis.
Text and Multimedia Languages and Properties: Introduction, Meta Data, Text, Markup Languages, Multimedia.

UNIT-IV
Text Operations: Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing Text Compression Techniques. **Indexing:** Introduction, Inverted Files, Other Indices for Text Searching, Boolean Queries.

UNIT-V
Searching: Sequential Searching, Pattern Matching, Structural Queries, Compression.
Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

Text Book:
1. Ricardo, Baeza-yates, BerthierRibeiro-Neto, "Modern Information Retrieval", Pearson Education, 2008.

Suggested Reading:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2009.
2. David A. Grossman, OphirFrieder, "Information Retrieval - Algorithms and Heuristics", Springer, 2nd Edition, 2004.
3. Gerald Kowalski, "Information Retrieval Systems: Theory and Implementation", Springer.
4. William B. Frakes, Ricardo Baeza- Yates, "Information Retrieval – Data Structures & Algorithms", Pearson Education, 2008.

Web Resources:

1. https://class.coursera.org/nlp/lecture
2. http://www.dcs.gla.ac.uk/Keith/Preface.html

18IT E08 **COMPILER DESIGN**

(Core Elective – 2)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce various phases of Compiler Design.
2. To familarizse scanner concept.
3. To Comprehemd Parser algorithms.
4. To impart knowledge in generation of Intermediate code.
5. To familiarize with machine dependent and machine independent optimization techniques.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Summarize the phases in Compiler Design and develop Lexical-Analyzer for Source Language.
2. Build Top-down parsers using Recursive, Predictive Parsers and Compare Top-down verses Bottom-up parsers.
3. Construct Bottom-up parsers using LR Parsers and Infer Syntax Directed Translation scheme for the Context Free Grammars.
4. Develop Intermediate code for Annotated Parse Tree and Relate runtime environments.
5. Translate Intermediate code into Target code and Apply Machine Independent Optimizations.

UNIT-I

Introduction: Programs related to compilers, Translation process, Major data structures, other issues in compiler structure, Boot strapping and porting.

Lexical analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.

UNIT-II

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing.

UNIT-III

More powerful LR parsers, Using Ambiguous Grammars, Parser Generators.

Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation.

UNIT-IV

Intermediate code generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.

Runtime Environments: Storage Organization, Stack Allocation of Space, Access to Non local Data on the Stack, Heap Management, Introduction to Garbage Collection.

UNIT-V

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, Peephole Optimization, Register Allocation and Assignment, The Principal Sources of Optimizations.

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers: Principles, Techniques &Tools", 2nd Edition, Pearson Education, 2014.
2. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning.

Suggested Reading:

1. Keith D Cooper & Linda Torczon, "Engineering a Compiler", 2nd Edition, Morgan Kaufman.
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, "Modern Compiler Design", 2nd Edition, Springer.
3. John R Levine, Tony Mason, Doug Brown, "Lex and Yacc", 2nd Edition, O'Reilly.

Web Resources:

1. http://nptel.ac.in/courses/106108113
2. http://nptel.ac.in/courses/106108052

18IT C19 OPERATING SYSTEMS AND COMPUTER NETWORKS LAB

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To familiarize with various system calls of LINUX and network commands.
2. To introduce Inter process communication Methods and CPU scheduling algorithms.
3. To facilitate knowledge required to handle deadlocks and use semaphores.
4. To presenr Client/Server applications based on TCP and UDP using Java Socket API.
5. To provide knowledge required to implement error detection, network routing algorithms and encryption algorithms.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate starting of a new process, replacing a process and execute basic System Calls.
2. Implement Inter-process communication and CPU scheduling Algorithms.
3. Apply the appropriate method to handle deadlocks and synchronize processes to solve critical section problems.
4. Show client-server communication using TCP and UDP.
5. Examine Error detection using CRC, encryption and routing algorithms.

List of Programs

Operating System Programs:

1. a) Demonstrate the system calls. a) fork b) execvp c) stat d) setenv & getenv
   b) Basic networking Commands: - ping, tracert, netstat, ipconfig, traceroute
2. Implement Inter process communication between a server and multiple clients
3. Implement CPU scheduling algorithms
4. Implement Banker's algorithm for Deadlock Avoidance.
5. Implement Producer-Consumer Problem using semaphores.

Computer Network Programs:

6. Implementation of TCP (Server and client) and UDP (Server and client)
7. Capture and analyze IP packets by executing trace route.
8. Implement Dijkstra's and Distance Vector routing algorithms
9. Implement CRC Error detection technique.
10. Implement RSA asymmetric Encryption Algorithm.

Text Books:

1. W. Richard Stevens, "Unix Network Programming", Volume 2, 2nd Edition, Pearson Education, 2015.
2. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

Suggested Reading:

1. A.Tanenbaum, "Modern Operation Systems", 3rd Edition, Pearson Education, 2008.
2. Silberschatz, Galvin, and Gagne," Operating System Concepts", 8th Edition,Wiley Publication.
3. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2013.

Web Resources:

1. https://www.cse.iitb.ac.in/~mythili/teaching/cs347_autumn2016/index.html
2. https://www.nsnam.org/docs/tutorial/html/

18IT C20 **SOFTWARE ENGINEERING LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To discuss use case models that capture requirements of a software system.
2. To illustrate dynamic models of a software system.
3. To build class diagrams that models a software system.
4. To acquaint with activity and swimlane models.
5. To familiarize with analysis and design models.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Interpret user requirements using the UML notation.
2. Illustrate Dynamic models of a software system.
3. Design class diagrams that model a software system.
4. Develop Activity and swim lane models.
5. Implement Analysis and Design models for various real world scenarios.

List of Experiments

1. Construct Use case diagrams for the following
    a. Diagram editor.
    b. Library information system.
    c. Banking system.
2. Construct Sequence diagrams for the following.
    a. Mobile phone.
    b. Use case student register for a course.
    c. Diagram editor.
3. Construct Collaboration diagrams for the following
    a. Use case librarian issues books to student.
    b. Mobile phone.
    c. Diagram editor.
4. Construct Activity diagrams for the following
    a. ATM transaction.
    b. Ticket machine.
    c. Sales order processing.
5. Construct Swim lane diagrams for the following
    a. Account.
    b. CD player.
    c. ATM machine.

Case Studies:

Develop analysis and design models for

6. Passport automation system
7. Credit card processing
8. BPO management system
9. E-book management system
10. Recruitment system

Text Books:

1. G. Booch, J. Rumbaugh, and I. Jacobson, "The Unified Modeling Language User Guide", Addison-Wesley, 1st Edition, 1998. (Chapters 17 to 27).
2. Grady Booch, RobertA.Maksimchuk, "Object - Oriented Analysis and Design with Applications", Addision-Wesley, 3rd Edition, 2007. (Chapters 8 to 12).

Suggested Reading:

1. Martin Fowler, Kendall Scott, "UML Distilled**:** A Brief Guide to the Standard Object Modeling Language" Addison Wesley, 4th Edition, 2011.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", PHI, 2nd Edition.

Web Resources:

1. SEweb - Software Engineering Education Home Page: http://tuvalu.cs.flinders.edu.au/seweb/se-ed/
2. IBM Rational http://www-306.ibm.com/software/rational/uml/
3. Practical UML - A Hands-On Introduction for Developers http://www.togethersoft.com/services/practical_guides/umlonlinecourse

18IT C21 **MINI PROJECT – III**

Instruction	2 Hours per week
Duration of Semester End Examination	-
Semester End Examination	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To enable students to learn by doing.
2. To develop capability to analyse and solve real world problems.
3. To develop innovative ideas among the students

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Interpret Literature with the purpose of Formulating a project proposal.
2. Planning, analyzing, Designing and implement a software project using SDLC model.
3. Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios.
4. Plan to work as a team and to focus on getting a working project done and submit a report with in a stipulated period of time.
5. Final Seminar, as oral Presentation before departmental Committee.

The Students are required to implement a project from opted subject in the core elective-2. During the implementation of the project, Personnel Software Process (PSP) has to be followed.

Report of the project work is to be submitted at the end of the Semester for evaluation.

Schedule

S.No	Programming concepts are to be taught related to the courses choosen from core elective – 2	4 weeks
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	5 weeks
4.	Documentation & Project Presentation	2 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling Mini Project for that class.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE Model Curriculum (with effect from 2020-21)
B.E. (Information Technology)

SEMESTER– VI

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	18IT C22	Artificial Intelligence	3	-	3	30	70	3
2	18IT C23	Information Security	2	-	2	20	50	2
3		Core Elective – 3	3	-	3	30	70	3
4		Core Elective – 4	3	-	3	30	70	3
5	18MB C01	Engineering Economics and Accountancy	3	-	3	30	70	3
6		Open Elective - 1	3	-	3	30	70	3
7	18EE M01	Indian Traditional Knowledge	2	-	2	-	50	Non - Credit
7	18IT C24	Artificial Intelligence Lab	-	2	2	15	35	1
8	18IT C25	Information Security Lab	-	2	2	15	35	1
9	18IT C26	Mini Project - IV	-	2	-	50	-	1
		TOTAL	19	6	-	250	520	20

L: Lecture **T: Tutorial** **D: Drawing** **P: Practical**
CIE-Continuous Internal Evaluation **SEE-Semester End Examination**

Core Elective-3		
S.No.	**Subject Code**	**Subject Name**
1.	18IT E09	Social Media Analytics
2.	18IT E10	Virtual Reality
3.	18IT E11	Soft Computing
4.	18IT E12	Mobile Commerce

Core Elective-4		
S.No.	**Subject Code**	**Subject Name**
1.	18IT E13	Data Science with Python
2.	18IT E14	Digital Image Processing and Analysis
3.	18IT E15	Artificial Neural Networks and Deep Learning
4.	18IT E16	Cyber Security

Open Elective-1		
S.No.	**Subject Code**	**Subject Name**
1.	18BT O01	Basics of Biology
2.	18EG O02	Gender Sensitization
3.	18ME O04	Research Methodologies
4.	18MT O02	Graph Theory

18IT C22 **ARTIFICIAL INTELLIGENCE**

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Learn problem solving through search techniques.
2. Familiarize with knowledge representation and logical reasoning techniques in AI.
3. Learn probabilistic reasoning models on uncertain data.
4. Acquaint with supervised and reinforcement learning.
5. Learn syntax and semantic analysis of the natural language.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the basics of AI and analyze various Exhaustive and Heuristic Search Techniques.
2. Apply logical concepts and representation techniques to infer knowledge.
3. Understand quantification of uncertainty and evaluate data using probabilistic reasoning models.
4. Apply the techniques of supervised and reinforcement learning on data.
5. Process Natural Language and perform syntax & semantic analysis.

UNIT-I

Introduction: The Foundations of AI, History of AI. Intelligent agents – Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Solving problems by searching: Problem Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions.

Adversarial search: Games, Optimal decisions in games, Alpha-Beta Pruning. Constraint Satisfaction Problems- Defining constraint satisfaction Problems.

UNIT-II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III

Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use.

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks.

Probabilistic Reasoning over Time: Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models, Kalman Filters.

UNIT-IV

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines.

Learning Probabilistic Models: Statistical Learning, Learning with Complete Data.

Learning with Hidden Variables: The EM Algorithm

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning-Q learning.

UNIT–V

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

Natural Language for Communication: Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Interpretation.

Text Books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach" , Prentice Hall, 3rd Edition.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

Suggested Reading:

1. Nilsson, N., "Artificial Intelligence: A New Synthesis", San Francisco, Morgan Kaufmann, 1998.
2. Rich, Knight, Nair: "Artificial intelligence", Tata McGraw Hill, Third Edition, 2009.
3. Tom M. Mitchell, "Machine Learning", McGraw Hill, 1997.
4. Kulkarni, Parag, Joshi, Prachi ,"Artificial Intelligence : Building Intelligent Systems", PHI, 2015.
5. Peter Jackson, "Introduction to Expert Systems", Third Edition, Pearson Addison Wesley, 1998.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs19/
2. https://www.coursera.org/learn/ai-for-everyone

18IT C23 **INFORMATION SECURITY**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Course Objectives:

1. To provide basic concepts of Information security and threats its associated attacks.
2. To explore the role of risk management and security technology like firewalls and Intrusion systems.
3. To familiarize with the concepts Cryptographic algorithms and Transport level Security.
4. To acquire knowledge of Electronic mail,IP Security and User Authentication.
5. To introduce how security policy affects the ongoing technical and administrative evaluation.

Course Outcomes:

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

1. Describe the components of information security and identify threats, attacks that cause harm to organizational assets.
2. Examine the control measures to maintain the level of risk and make use of firewalls and intrusion detection systems to protect the networks.
3. Demonstrate cryptographic algorithms and implement secure communications between web browser and a web server.
4. Inspect on three functional areas like authentication, confidentiality and key management.
5. Compare information security technical and non-technical aspects and aware of employment policies and practices.

UNIT-I

Introduction to Information Security: History of Information Security, What Is Security, CNSS security model, Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, Security in the Systems Life Cycle, Security Professionals and the Organization.

Need for Security: Business needs, Threats and Attacks, Compromises to Intellectual Property, Deviations in Quality of Service, Espionage or Trespass, Forces of Nature, Human Error or Failure, Information Extortion, Sabotage or Vandalism, Software Attacks, Technical Hardware Failure or Errors, Technical Software Failure or Errors, Technological Obsolescence, Theft.

UNIT-II

Risk management: An Overview of Risk Management, Risk Identification, Risk assessment, Risk Control, Quantatitive versus Qualitative Risk Management Practices, Recommended Risk Control Practices.

Security Technology: Introduction,Access Control, Firewalls, Intrusion detection and prevention systems, Honeypots,Honeynets, Padded Cell Systems, Scanning and Analysis Tools.

UNIT-III

Cryptography: Introduction, Foundations of Cryptology, Cipher methods, cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications.

Transport Level Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, HTTTPS, Secure Shell.

UNIT-IV

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail.

IPSecurity: IPSecurity Overview, IPSecurity Policy, Encapsulating Security Payload, Combining Security Associations, Internet key exchange.

User Authentication: kerberos, Federated Identity Management.

UNIT-V

Implementing Information Security: Introduction, Information Security Project Management, Technical Aspects of Implementation, Non technical Aspects of Implementation, Information Systems Security Certification and Accreditation.

Security and Personnel: Introduction ,Positioning and Staffing Security Function, Employment Policies and Practices, Security Considerations for Temporary Employees, Consultants and Other Workers, Internal Control Strategies, Privacy and the Security of Personnel Data.

Information security Maintenance: Introduction, Security Management Maintenance Models, Digital Forensics.

Text Books:

1. Michael E. Whitman, Hebert J Mattord, "Principles of Information Security", 5th Edition, Cengage Learning, 2014.
2. Thomas R Peltier, Justing Peltier, JohnBlackley, "Information Security Fundamentals", Auerbacj Publications, 2010.
3. William Stallings "Cryptography and Network Security Principles and Practice", 6th Edition, Pearson, 2014.

Suggested Reading:

1. Dr.V.K.Jain,"Cryptography and Network Security", 1st Edition, Khanna Book publishing, 2013.
2. Marks Merkow, Jim Breithaupt, "Information Security: Principle and Practices", 2nd Edition, Pearson Education, 2014.

Web Resources:

1. https://www.sans.org/security-resources/
2. https://nptel.ac.in/courses/106106129/

18IT E09 **SOCIAL MEDIA ANALYTICS**

(Core Elective - 3)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce Social Media Mining, Graph Essentials and Network Models.
2. To familiarize various algorithms for the study of Communities.
3. Impart knowledge about Mining, Influence and Homophily.
4. To familiarize Recommendation Systems and Behavioral Analytics.
5. To explore various Prediction Systems.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Describe graph essentials and various network measures and models.
2. Understand community behavior and information diffusion in social media.
3. Comprehend data mining algorithms and measure influence and homophily.
4. Understand the challenges and evaluate the recommendation systems.
5. Apply prediction algorithms for real world problems.

UNIT-I

Introduction: Social Media Mining, New Challenges for Mining.

Graph Essentials: Graph Basics, Graph Representation, Types of Graphs, Connectivity in Graphs, Special Graphs, Graph Algorithms.

Network Measures: Centrality, Transitivity and Reciprocity, Balance and Status, Similarity, Network Models: Properties of Real-World Networks, Random Graphs, Small-World Model, Preferential Attachment Model.

UNIT-II

Community Analysis: Community Detection, Community Evolution, Community Evaluation, Information. **Diffusion in Social Media:** Herd Behaviour, Information Cascades, Diffusion of Innovations, Epidemics.

UNIT-III

Data Mining Essentials: Data, Data Preprocessing, Data Mining Algorithms, Supervised Learning, Unsupervised Learning.

Influence and Homophily: Measuring Assortativity, Influence, Homophily, Distinguishing Influence and Homophily.

UNIT-IV

Recommendation in Social Media: Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations.

Behavior Analytics: Individual Behavior, Collective Behavior.

UNIT-V

Prediction: Predicting the future, Prediction of learning, Predicting elections, Predicting Box offices, Predicting Stock market, Closing predictions.

Text Books:

1. Zafarani R., Abbasi M.A., Liu H, "Social Media Mining: An Introduction", Cambridge University Press, 2014.
2. Lutz Finger, Soumitra Dutta, "Ask, Measure, Learn: Using Social Media Analytics to Understand and Influence Customer Behavior", O'Reilly Media, 2014.

Suggested Reading:

1. David Easley and Jon Kleinberg, "Networks, Crowds and Markets", Cambridge University Press, 2010
2. Bing Liu, "Sentiment Analysis: mining opinions, sentiments, and emotions", Cambridge University Press, 2015.
3. Matthew A. Russell, "Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites", O'Reilly Media 2011.

Web Resources:

1. http://www.kdd.org/kdd2015/tutorial.html
2. http://thinktostart.com/category/social-media/
3. http://blogs.iit.edu/iit_web/social-media-2/social-media-whats-your-strategy/4

18IT E10 **VIRTUAL REALITY**
(Core Elective – 3)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To familiarize the students with the fundamentals of Virtual Reality.
2. To impart the knowledge of 2D and 3D orientation for understanding the behavior of VR system with the environment.
3. To introduce the dynamics of the objects.
4. To deal with the factors involved to create virtual environment.
5. To introduce the applications of Virtual Reality Systems.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Explain the basic concepts of Virtual Reality and 3D Computer Graphics.
2. Demonstrate geometric modeling, transformations and model of interaction of the virtual environment with the system.
3. Apply the dynamics of Virtual Environment and Physical simulation for real time applications.
4. Evaluate the human factors involved in Virtual Hardware and Virtual Software.
5. Develop a Virtual Reality application.

UNIT-I
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-II
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-III
Virtual Environment: Animating the Virtual Environment: Introduction. The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system.
Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

UNIT-IV
VR Hardware and Software: Human factors: Introduction, the eye, the car, 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-V

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

Text Books:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Suggested Reading:

1. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
2. Grigore C. Burdea, Philippe Coiffe, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
3. Kelly S. Hale, Kay M. Stanney, "Handbook of Virtual Environments: Design, Implementation, and Applications", CRC Press, 2nd Edition, 2014.

Web Resource:

1. https://nptel.ac.in/courses/106106138/

18IT E11 **SOFT COMPUTING**
(Core Elective – 3)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To familiarize with Artificial neural networks and supervised learning.
2. To introduce Memory networks, unsupervised learning and special networks.
3. To present Fuzzy sets, fuzzy relations and membership functions.
4. To familiarize with defuzzification, fuzzy measures and reasoning.
5. To facilitate the learning concepts of Genetic Algorithm and its applications.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand ANN and various supervised learning networks.
2. Understand and compare architectures and training of associative memory networks, unsupervised learning networks and special networks.
3. Comprehend fuzzy sets, relations and membership functions.
4. Understand the process of defuzzification, apply fuzzy arithmetic and fuzzy rules for approximate reasoning.
5. Understand fuzzy decision making and apply various genetic algorithms.

UNIT-I
Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, basic model of Artificial neural networks, Important terminology of ANNs, McCulloch-pitts neuron model, Linear separability, Hebb Network **Supervised Learning Network:** Perceptron networks, adaptive linear neuron (Adaline), Multiple adaptive linear neuron, Back propagation network, Radial basis Function network.

UNIT-II
Associative Memory Networks: Training algorithms for pattern Association, Associative memory network, Heteroassociative memory network: theory, architecture, Bidirectional Associative Memory: architecture, Discrete Bidirectional associative memory, Continuous BAM, Analysis of hamming distance, Energy function and storage capacity, Hopfield networks: Discrete Hopfield network, continuous Hopfield network. **Unsupervised Learning Networks:** Fixed Weight Competitive Nets, Kohonen Self-Organizing Feature Maps: architecture, training algorithm, Learning Vector Quantization: architecture, training algorithm, Adaptive Resonance Theory Network: theory, ART 1. **Special networks:** Simulated Annealing Networks, Boltzmann machine, Gaussian machine.

UNIT-III
Introduction to Fuzzy Logic, classical sets and fuzzy sets: Introduction to Fuzzy logic, Classical sets: Operations on classical sets, properties, Fuzzy sets: Operations, Properties. **Classical relations and Fuzzy Relations:** Fuzzy relations, Tolerance and Equivalence relations, **Membership functions:** Fuzzification, Membership value assignments: Inference, rank ordering, angular fuzzy sets.

UNIT-IV
Defuzzification: Lamda Cuts for fuzzy sets and fuzzy relations, defuzzification methods, **Fuzzy arithmetic and Fuzzy measures:** Fuzzy arithmetic, Extension principle, Fuzzy measures, Measures of fuzziness, Fuzzy integrals, **Fuzzy rule base and Approximate Reasoning:** Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Decomposition of compound rules, Aggregation of fuzzy rules, Fuzzy reasoning, Fuzzy inference system, Overview of fuzzy expert system.

UNIT-V
Fuzzy decision making: Individual Decision Making, Multiperson, multi objective, multi attribute, Fuzzy Bayesian decision making, **Genetic Algorithm:** Introduction, basic terminology, Genetic algorithm vs

Traditional algorithm, simple GA, general genetic algorithm, Operators in GA, Stopping condition, Constraints, Schema theorem, Classification of genetic algorithm, Holland classifier systems, genetic programming, applications of genetic algorithm.

Text Book:

1. S. N. Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley India, 2008.

Suggested Reading:

1. Limin Fu, "Neural Networks in Computer Intelligence", McGraw Hill, 1995.
2. Timoty J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 1997.
3. N.P. Padhy, S.P. Simon, "Soft Computing: With Matlab Programming", Oxford University Press, Academic 2015.
4. J.S.R. Jang, C.T. Sun, E.Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Prentice Hall India, 1997.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview
2. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_neural_networks.htm

18IT E12 **MOBILE COMMERCE**
(Core Elective – 3)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce fundamentals of E-Commerce.
2. To examine strategies used by businesses used to improve purchasing, logistics, and other supporting activities.
3. To impart knowledge on technical infrastructure and security needed for M-Commerce.
4. To facilitate different e-payment options.
5. To acquaint with various security issues in E-Commerce.

Course Outcomes:

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

1. Understand electronic commerce and the stakeholders and their capabilities and limitations in the strategic convergence of technology and business.
2. Assess e-commerce strategies and applications, including online marketing, e-government, e-learning and global e-commerce.
3. Describe the concepts of M-Commerce and its applications.
4. Categorize advantages and disadvantages of different online payment options and choose an appropriate E-commerce Solution.
5. Identify the importance of security, privacy, and ethical issues as they relate to E-Commerce.

UNIT-I

Introduction: Definition, Objectives, Advantages and disadvantages, Forces driving E-Commerce, Traditional commerce Vs. E-Commerce, E-Commerce opportunities for industries, Growth of E-Commerce. E-Commerce Models: Business to consumer, Business to Business, Consumer to Consumer, other models – Brokerage Model, Aggregator Model, Info-mediary Model, Community Model and value chain Model.

UNIT-II

Introduction: The Fundamental Functional Platform of M-Commerce – Applications - The Value Chain Supporting M-Commerce Transactions. Services and Applications in Horizontal and Vertical Markets: Personal Organizers-Location Based Services and Applications - M-Commerce Portals- Communication and Messaging-M-Commerce Data Synchronization - Education-Gaming Services.

UNIT-III

A Framework for the study of Mobile Commerce, NTT DoCoMo's I-Mode, Wireless Devices For Mobile Commerce, Towards A Classification Framework For Mobile Location Based Services, Wireless Personal And Local Area Networks, The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

UNIT -IV

Electronic Payment Systems: Special features required in payment systems, Types of E-payment systems, E-Cash, E-cheque, credit card, Smart Card, Electronic Purses.
E-Marketing, E-Customer Relationship Management, E-Supply Chain Management.

UNIT-V

Security Issues in E-Commerce: Security risk of E-Commerce, Types of threats, Security tools and risk management approach, Cyber laws, Business Ethics, IT Acts.

Text Books:

1. Ravi Kalakota & A.B. Winston, "Frontiers of Electronic Commerce", 1st Edition, Pearson Education, 2005.
2. E.BrianMennecke, J.TroyStrader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.

Suggested Reading:

1. Bharat Bhaskar, "Electronic Commerce – Framework Technologies and Applications", 3rd Edition, Tata McGraw Hill, 2008.
2. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 2001.
3. Dr.Pandey, Saurabh Shukla, "E-commerce and Mobile commerce Technologies", Sultan chand, 2011.

Web Resources:

1. Mobile Commerce World (www.mobilecommerceworld.com) Industry news.
2. Clarke, R. (1998) Electronic Data Interchange (EDI): An Introduction. www.anu.edu.au/ people/Roger.Clarke/EC/EDIIntro.htm
3. The worldwide Mobile Marketing Association (www.mmaglobal.com) has case studies and statistics of adoption.

18IT E13 **DATA SCIENCE WITH PYTHON**
(Core Elective – 4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To facilitate learning fundamentals of Numpy, Pandas and various file formats.
2. To familiarise with data pre-processing operations.
3. To introduce time series data and inferential statistics.
4. To acquire knowledge about visualisation and prediction.
5. To explore various case studies.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand the usage of Numpy, Pandas libraries and various file formats.
2. Apply data pre-processing and visualization techniques on the data.
3. Perform time series data analysis and apply inferential statistics.
4. Visualize the data and apply prediction techniques.
5. Understand Collaborative filtering, clustering and ensemble models.

UNIT-I
NumPy Basics: Arrays and Vectorized Computation, Getting Started with pandas, Data Loading, Storage, and File Formats.

UNIT-II
Data Cleaning and Preparation, Data Wrangling: Join, Combine, and Reshape, Plotting and Visualization, Data Aggregation and Group Operations.

UNIT-III
Time Series, Advanced Pandas, Introduction to Modeling Libraries in Python, Data Analysis Examples, Inferential Statistics.

UNIT-IV
Finding a Needle in a Haystack, Making Sense of Data through Advanced Visualization, Performing Predictions with a Linear Regression, Estimating the Likelihood of Events.

UNIT-V
Generating Recommendations with Collaborative Filtering, Pushing Boundaries with Ensemble Models, Applying Segmentation with k-means Clustering, Analyzing Unstructured Data with Text Mining.

Text Books:
1. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", 2nd Edition, O'Reilly Media, 2017.
2. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Suggested Reading:
1. Joel Grus, "Data Science from Scratch", O'Reilly Media, 2015.
2. John V. Guttag, "Introduction to Computation and Programming Using Python– with Application to Understanding Data", The MIT Press, 2nd Edition, 2016.
3. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials: A practitioner's guide covering essential data science principles, tools, and techniques", 3rd Edition, 2018.

Web Resources:

1. https://www.analyticsvidhya.com/
2. https://www.kaggle.com
3. https://www.dataschool.io/

18IT E14 **DIGITAL IMAGE PROCESSING AND ANALYSIS**
(Core Elective-4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the fundamental concepts and applications of digital image processing.
2. To impart knowledge on the image processing concepts: intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction.
3. To familiarize the image analysis concepts: morphological image processing, image segmentation, image representation and description, and object recognition.
4. To introduce colour image processing techniques.
5. To deal with various image compression methods.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Explain the fundamental concepts and applications of digital image processing techniques.
2. Demonstrate intensity transformations, spatial filtering, smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction.
3. Develop an object recognition system using morphological image processing, image segmentation, image representation and description, and object recognition techniques.
4. Illustrate the varios colour image processing techniques with applications.
5. Evaluate various image compression methods for compression ratio.

UNIT-I

Basics: **Introduction:** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of visual perception, Image Sampling and Quantization - Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Intensity Resolution.

Some Basic Relationships between Pixels - Neighbours of a Pixel; Adjacency, Connectivity, Regions, and Boundaries, Distance Measures.

Intensity Transformations: Some Basic Intensity Transformation Functions - Image Negatives, Log Transformations, Power-Law (Gamma) Transformations, Piecewise-Linear Transformation Functions, Histogram Processing - Histogram Equalization, Histogram Matching (Specification), Local Histogram Processing.

UNIT- II

Spatial Filtering: Fundamentals of Spatial Filtering - The Mechanics of Spatial Filtering, Spatial Correlation and Convolution; Smoothing Spatial Filters - Smoothing Linear Filters, Order-Statistic (Nonlinear) Filters; Sharpening Spatial Filters – Foundation, Using the Second Derivative for Image Sharpening—The Laplacian, Unsharp Masking and Highboost Filtering.

Filtering in the Frequency Domain: The 2-D Discrete Fourier Transform and its inverse; Some Properties of the 2-D Discrete Fourier Transform - Relationships between Spatial and Frequency Intervals, Translation and Rotation, Periodicity, Symmetry Properties, Fourier Spectrum and Phase Angle, The 2-D Convolution Theorem; The Basics of Filtering in the Frequency Domain - Frequency Domain Filtering Fundamentals, Correspondence between Filtering in the Spatial and Frequency Domains; Image Smoothing Using Frequency Domain Filters - Ideal Low pass Filters, Butterworth Low pass Filters, Gaussian Low pass Filters; Image Sharpening Using Frequency Domain Filters - Ideal High pass Filters, Butterworth High pass Filters, Gaussian High pass Filters, Unsharp Masking, Highboost Filtering.

UNIT- III

Image Restoration and Reconstruction: A Model of the Image Degradation/Restoration Process, Noise Models - Spatial and Frequency Properties of Noise, Some Important Noise Probability Density Functions, Periodic Noise, Estimation of Noise Parameters; Restoration in the Presence of Noise Only—Spatial Filtering –

Mean Filters, Order-Statistic Filters, Adaptive Filters; Periodic Noise Reduction by Frequency Domain Filtering – Band reject Filters, Band pass Filters; Linear, Position-Invariant degradradaton; Estimating the Degradation Function - Estimation by Image Observation, Estimation by Experimentation, Estimation by Modelling; Inverse Filtering; Minimum Mean Square Error (Wiener) Filtering; Morphological Image Processing: Preliminaries; Erosion and Dilation;Opening and Closing.

UNIT- IV

Image Segmentation: Fundamentals; Points, Line and Edge Detection - Detection of Isolated Points, basic edge detection, edge linking and boundary detection; Thresholding – foundation, basic global thresholding, optimum global thresholding using otsu's method; Region-based Segmentation - region growing, region splitting and merging; Segmentation using Morphological Watersheds - background, dam construction, watershed segmentation algorithm.

Representation and Description: Representation - Boundary (Border) Following, Chain Codes, Polygonal Approximations Using Minimum-Perimeter Polygons, Signatures, Boundary Descriptors - Some Simple Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments, Regional Descriptors - Some Simple Descriptors, Topological Descriptors, Texture.

Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods – Matching, Optimum Statistical Classifiers, Neural Networks.

UNIT-V

Colour Image Processing: Colour Fundamentals; Colour Models - RGB Colour Model, CMY and CMYK Colour Models, The HSI Colour Model; Pseudo Colour Image Processing - Intensity Slicing, Intensity to Colour Transformations; Basics of Full-Colour Image Processing; Smoothing and Sharpening.

Image Compression: Fundamentals-Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Measuring Image Information, Fidelity Criteria, Image Compression Models; Some Basic Compression Methods - Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding.

Text Book:

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education, 3rd Edition.

Suggested Reading:

1. Vipula Singh, "Digital Image Processing with MatLab and lab View", Elsevier.
2. Thomas B. Moeslund, "Introduction to Video and Image Processing: Building Real Systems and Applications", Springer, 2012.
3. Milan Sonka, Vaclav Halvac and Roger Boyle, "Image Processing, Analysis, and Machine Vision", 2nd Edition, Thomson Learning Publishers.
4. Kenneth R.Castleman, "Digital Image Processing", Pearson Education, 2006.

Web Resources:

1. www.imageprocessingplace.com
2. https://in.mathworks.com/discovery/digital-image-processing.html
3. https://imagemagick.org/
4. https://nptel.ac.in/courses/117105079/

18IT E15 **ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING**
(Core Elective-4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To familiarize with Artificial Neural Networks and the process of learning.
2. To introduce the concept of perceptron.
3. To give insights into Back propagation and Self organising maps.
4. To present the basics of Neuro dynamics and neuro dynamical models.
5. To introduce the concepts of Convolutional neural networks and Recurrent Neural Networks.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Understand Neural Networks and various learning processes.
2. Apply single and multilayer perceptrons for problem solving.
3. Understand the process of learning in Back propagation and Self Organizing maps.
4. Comprehend neuro dynamical models.
5. Build Convolutional neural networks and work on recurrent neural networks.

UNIT – I
Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Feedback, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks **Learning Process:** Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive learning, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

UNIT – II
Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Optimization Techniques, Linear Least-Square Filters, Least-Mean-Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron, Perceptron Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment.
Multilayer Perceptrons: Back Propagation Algorithm, XOR Problem, Heuristics for making the back-propagation algorithm perform better, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT – III
Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence of Back propagation learning.
Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, summary of the SOM Algorithm, Properties of the Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification.

UNIT – IV
Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, Computer Experiment-I.

UNIT – V
Convolutional Neural Networks: Neurons in Human Vision, The Shortcomings of Feature Selection, Filters and Feature Maps, Full Description of the Convolutional Layer, Max Pooling, Full Architectural Description of Convolution Networks, Building a Convolutional Network, Visualizing Learning in Convolutional Networks, Learning Convolutional Filters for Other Problem Domains.

Recurrent Neural Networks: Long Short-Term Memory (LSTM) Units, TensorFlow Primitives for RNN Models, Solving seq2seq Tasks with Recurrent Neural Networks, Augmenting Recurrent Networks with Attention, Dissecting a Neural Translation Network.

Text Books:

1. Simon Haykin, "Neural Networks a Comprehensive Foundation", 2nd Edition, PHI, 1999.
2. Nikhil Buduma, Nicholas Lacascio "Fundamentals of Deep Learning", 1st Edition, O'Reilly Media Inc., 2017.

Suggested Reading:

1. Li Min Fu, "Neural Networks in Computer Intelligence", TMH, 2003.
2. Yoshua Bengio, Ian Goodfellow, Aaron Courville, "Deep Learning", MIT Press, 2016.
3. C.M.Bishop, "Neural Networks and Pattern Recognition", Oxford University Press (Indian Edition), 2003.

Web Resources:

1. https://nptel.ac.in/courses/117105084/
2. http://deeplearning.net/
3. https://adeshpande3.github.io/A-Beginner%27s-Guide-To-Understanding-Convolutional-Neural-Networks/

18IT E16 **CYBER SECURITY**
(Core Elective – 4)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To present basic concepts of Cybercrime and Cyberattacks.
2. To introduce security challenges presented by mobile devices.
3. To impart knowledge on Tools and Methods used in Cybercrime.
4. To present fundamentals concepts in Cyber Forensics.
5. To familiarize about regulatory framework for Cybersecurity.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Describe legal and global perspectives of Cybercrimes and inspect how criminals plan the attacks.
2. Identify attacks, security policies and credit card frauds in mobile and wireless computing Era.
3. Examine phishing techniques, keyloggers, spywares, password cracking methods and types of thefts used in cybercrimes.
4. Demonstrate the need for computer forensics, relevance of OSI layer model and implications for evidential aspects.
5. Evaluate the cost of cybercrimes, web threats, IPR issues, organizational guidelines for Internet usage and safe computing.

UNIT-I
Introduction to Cybercrime: Definition and origins of the word, Cybercrime and Information security, who are cybercriminals, Classification of Cybercrimes, Legal Perspectives, Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era.
Cyberoffenses: Introduction, How Criminals plan the attacks, Social Engineering, CyberStalking, Cybercafe and Cybercrimes, Botnets, Attack vector, Cloud computing.

UNIT-II
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, Attack on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations,Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational security policies and measures in Mobile Computing Era, Laptops.

UNIT-III
Tools and Methods Used in Cybercrime: Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms,Trojan Horses and Backdoors, Steganography, DoS and DDos Attacks, SQL Injection, Buffer Overflow, Attacks on wireless Networks.
Phishing and Identity Theft: Introduction, Phishing, Identity Theft.

UNIT-IV
Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-mail, Digital Forensics Life cycle, Chain of Custody Concept, Network Forensics, Approaches a computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer model to computer Forensics, Forensics and social Networking Sites, Computer Forensics from Compliance perspective, Chanllenges in Computer Forensics, Special tools and Techniques, Forensics Auditing, Antiforensics.

UNIT-V

Cybersecurity Organizational Implications: Introduction, Cost of Cybercrimes and IPR Issues, Web Threats for Organizations, Security and Privacy Implications from Cloud Computing, Social Media Marketing, Social Computing and the Associated challenges for Organizations, Protecting People's Privacy in the Organization, Organizational Guidelines for Internet Usage, Safe Computing Guidelines and Computer Usage Policy, Incident Handling, Forensics Best practices for Organizations.

Text Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security understanding Cyber Crimes, Computer forensics and Legal Perspectives", Wiley India Pvt.Ltd., 2013.
2. Harsh Bothra, "Hacking Be A Hacker with Ethics", Khanna Publishers 2017.

Suggested Reading:

1. William Stallings "Cryptography and Network Security Principles and Practice, 6th Edition, Pearson 2014.
2. Dr.V.K.Jain,"Cryptography and Network Security", 1st Edition, Khanna Book publishing New Delhi 2013.
3. Nina Godbole,"Information Systems Security Security Management, Metrics, Frameworks and Best Practices", Wiley, 2nd Edition, 2012.

Web Resources:

1. https://www.nist.gov/
2. https://www.sans.org/
3. https://www.udemy.com/the-complete-cyber-security-course-end-point-protection/

18MB C01 ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
The Objectives of the course are:
1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand production and cost relationships to make best use of resources available.
4. Apply accountancy concepts and conventions and preparation of final accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

Unit-I
Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II
Demand and Supply Analysis: Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III
Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.
Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV
Accountancy: Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V
Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:
1. MehtaP.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.
3. PandayI.M. "Financial Management", 11th edition, VikasPublishing House, 2015.

Suggested Reading:

1. Varshney and KL Maheswari, Managerial Economics, Sultan Chand, 2014.
2. M.Kasi Reddy and S.Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
3. A.R.Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2013.

18BT O01 **BASICS OF BIOLOGY**
(Open Elective – 1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Impart knowledge of origin and evolution of biological organisms.
2. Understand the structure and functions of human organ systems.
3. Understand the principles behind medical devices for diagnosis of human health and environment protection.
4. Give an insight of biological information, relationship and genome sequencing of various organisms.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Explain the theories of origin and evolution of life.
2. Describe the anatomical structure and physiological functions of the human organ systems.
3. Outline the principle and applications of medical devises.
4. Discuss the technology advancements in improving human health and environment
5. Explain the biological information, sequencing and evolutionary relationship among organisms.

UNIT-I

Introduction to Biology: Classical Vs Modern Biology; Importance of Biological Science and Historical developments; Origin of Life, Urey Miller Experiment, Spontaneous Generation Theory; Three Domains of Life; Principle and Applications of Microscope (Light and Electron Microscope), Prokaryotic and Eukaryotic Cell- Structure and their differences.

UNIT-II

Human organ systems and their functions -I: Introduction to various organ systems of human body and their functions; Skeletal System-Bones, Tendon, Ligaments, principle and applications in knee replacement; Nervous System - Structure of Brain, Spinal Cord, Neuron, Neurotransmitters, Synapse, Alzheimer's - a case study, principle and applications of Imaging Techniques (CT & MRI scans); Circulatory System - Heart structure and functions, principle and applications of cardiac devices (Stent and Pacemaker), Artificial heart, blood components and typing, haemocytometer.

UNIT-III

Human Anatomy and Functions-II: Respiratory Systems - Lung structure and function, principle and applications of Peak Flow Meter, ECMO (Extra Corporeal Membrane Oxygenation); Excretory Systems-Kidney structure and function, principle and applications of Dialysis; Prenatal diagnosis; Assisted reproductive techniques- IVF, Surrogacy.

UNIT-IV

Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

UNIT-V

Bioinformatics: Nucleic acid composition, Genetic Code, Amino acid, Polypeptide, Levels of protein structure, Homolog, Ortholog and Paralog, Phylogenetics, Genome Sequencing, Human Genome Project, Next generation sequencing.

Text Books:

1. Campbell, N.A., Reece, J.B., Urry, Lisa, Cain, M,L., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. "Biology: A Global Approach", 11th Edition, Pearson Education Ltd. 2017
2. Shier, David, Butler, Jackie, Lewis, Ricki., "Hole's Human Anatomy & Physiology", 13th Edition, McGraw Hill 2017.
3. Dubey RC " A Text book of Biotechnology" 5th Edition, S Chand and Company limited, 2014.
4. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, "Medical Biotechnology", 1st Edition, ASM Press, 2014.

18EG O02 **GENDER SENSITIZATION**
(Open Elective – 1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives
This course will introduce the students to:
1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Course Outcomes
Upon successful completion of this course, students will be able to:
1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

UNIT – I
Understanding Gender:
Gender: Why Should We Study It? *(Towards a World of Equals: Unit -1)*
Socialization: Making Women, Making Men *(Towards a World of Equals: Unit -2)*
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II
Gender And Biology:
Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals: Unit -4)*
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary *(Towards a World of Equals: Unit -10)*
Two or Many? Struggles with Discrimination.

UNIT – III
Gender and Labour:
Housework: the Invisible Labour *(Towards a World of Equals: Unit -3)*
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics *(Towards a World of Equals: Unit -7)*
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV
Issues Of Violence
Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*
Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)
Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)
Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V
Gender: Co - Existence
Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)
Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.
Additional Reading: Rosa Parks-The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender" published by Telugu Akademi, Hyderabad, Telangana State, 2015.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

18ME O03 **RESEARCH METHODOLOGIES**

(Open Elective – 1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design.
4. To equip the students with good methods to analyze the collected data.
5. To explain how to interpret the results and report writing.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Define research problem.
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
5. Improve the style and format of writing a report for technical paper/ Journal report.

UNIT–I

Research methodology: Objectives and motivation of research, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs. empirical, research approaches, significance of research, research methods vs. methodology, research process, criteria of good research, problems encountered by researchers in India, technique involved in defining a problem

UNIT–II

Literature survey: Importance of literature survey, sources of information-primary, secondary, tertiary, assessment of quality of journals and articles, information through internet.

UNIT–III

Research design: Meaning of research design, need of research design, feature of a good design important concepts related to research design, different research designs, basic principles of experimental design, steps in sample design.

UNIT–IV

Data collection: Collection of primary data, Secondary data, measures of central tendency-mean, mode, median, measures of dispersion- range, mean deviation, standard deviation, measures of asymmetry (skewness), important parametric tests -z, t, F, Chi-Square, ANOVA significance.

UNIT–V

Research report formulation and presentation: Synopsis, dissertation, technical paper and journal paper, writing research grant proposal, making presentation with the use of visual aids, writing a proposal for research grant.

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011.
3. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.

Suggested Reading:

1. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
2. Naval Bajjai, "Business Research Methods", Pearson Education,2011.

18MT O02 **GRAPH THEORY**
(Open Elective – 1)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To discuss the basic and core concepts in Graph, Euler Graph and its path.
2. To explain the Matching and Covering in Bipartite Graph.
3. To demonstrate how Matching are used in Principles, Models underlying theory.
4. To explain One-Way Traffic, Rankings in a tournament.
5. To discuss Algorithmic approach to solve Network flow problems.

Course Outcomes:
Upon successful completion of this course, students will be able to:
1. Identify the concepts of the Graph Theory in related problems.
2. Determine the solutions in Matching and Covers, Maximum Matching in Bipartite Graph.
3. Calculate the solutions for Matching and Faster Bipartite Matching, Matching in general graphs and related Algorithms.
4. Apply the Knowledge of Job sequencing, One-Way Traffic, Rankings to solve real time problems.
5. Solve combinatorial optimization problems pertaining to Network flow.
6. Construct solutions to real world problems.

UNIT-I
Introduction to Graphs & its Applications: Basics of Paths, Cycles, and Trails, Connection, Bipartite Graphs, Eulerian Circuits, Vertex Degrees and Counting, Degree-sum formula, The Chinese –Postman- Problem and Graphic Sequences.

UNIT-II
Matchings: Matchings and Covers, Hall's Condition, Min-Max Theorem, Independent Sets, Covers and Maximum Bipartite Matching, Augmenting Path Algorithm.

UNIT-III
Matchings & its Applications: Weighted Bipartite Matching, Hungarian Algorithm, Stable Matchings and Faster Bipartite Matching, Factors & Perfect Matching in General Graphs, Matching in General Graphs: Edmonds' Blossom Algorithm.

UNIT-IV
Directed graphs & its Applications: Directed Graphs, Directed Paths, Directed Cycles, Applications - A Job Sequencing Problem, Designing an Efficient Computer Drum, Making a Road System One-way, Ranking the Participants in a Tournament.

UNIT-V
Networks & its Applications: Flows, cuts, Ford-Fulkerson labelling algorithm, the max-flow min-cut theorem, Applications-Menger's theorems, Feasible flows.

Text Books:
1. J.A. Bondy and U.S.R.Murty, "Graph Theory with Applications, Springer", 2008.
2. D.B.West, "Introduction to Graph Theory", Prentice-Hall of India/Pearson, 2009.
3. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI publication, 3rd Edition, 2009.

Suggested Reading:
1. R.Diestel, "Graph Theory", Springer, 2000.
2. F.Harary, "Graph Theory", Narosa, print 2013.

3. C.L. Liu, “Elements of Discrete Mathematics”, Tata McGraw Hill, 2nd Edition, 2000.

18EE M01 **INDIAN TRADITIONAL KNOWELDGE**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
Credits	0

Course Objectives:

1. To get a knowledge in Indian Culture.
2. To Know Indian Languages and Literature and the fine arts in India.
3. To explore the Science and Scientists of Medieval and Modern India.

Course Outcomes:

After completion of this course, students will be able to:

1. Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
2. Distinguish various Languages and Literature existing in India.
3. Discuss and Compare Philosophy and Religion in Indian since ancient times.
4. Explore various Fine arts in Indian History, and Illustrate the development of Science and Technology in India.
5. Describe the Indian Education System, and recognize the efforts of scientist to the development of India.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature.

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only).

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition, ISBN: 81246033375, 2005.
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007.
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993.
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989.
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978 8120810990, 2014.

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.

2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

18IT C24 **ARTIFICIAL INTELLIGENCE LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To familiarize with search and game playing strategies.
2. To introduce logic programming concepts through Prolog.
3. To learn probabilistic reasoning on uncertain data.
4. To familiarize with supervised learning algorithms.
5. To introduce Natural Language Processing

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Build intelligent agent for search.
2. Implement logic programming.
3. Apply probabilistic reasoning on data.
4. Apply the techniques of supervised and reinforcement learning on data.
5. Perform NLP operations with and without NLTK.

List of Programs

1. Implementation of uninformed and informed search techniques.
2. Implementation of game search.
3. Installation of prolog and demonstration of basic operations.
4. Design of a Bayesian network from given data.
5. Demonstration of supervised learning algorithms.
6. Demonstration of reinforcement learning.
7. Design an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
8. Implementation of simple chatbot.
9. Demonstration of the following operations on text data.
   a. Removal of punctuations in the given string.
   b. Generation of string tokens.
10. Demonstration of the following operations using NLTK.
    a. Removal of stop words for a given passage from a text file.
    b. Stemming for a given sentence.
    c. POS tagging for a given sentence to classify text data.

Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.
2. Russell, Norvig, “Artificial intelligence - A Modern Approach”, Pearson Education, 3rd Edition, 2015.

Suggested Reading:

1. Rich, Knight, Nair: “Artificial intelligence”, Tata McGraw Hill, 3rd Edition, 2009.
2. Nicole Bauerle, Ulrich Rieder, “Markov Decision Process with Applications to Finance”, Springer, 2011.
3. Nilsson, N., “Artificial Intelligence: A New Synthesis”, Morgan Kaufmann, 1st Edition, 1998.

Web Resources:

1. https://ai.berkeley.edu/project_overview.html
2. http://aima.cs.berkeley.edu/

18IT C25 **INFORMATION SECURITY LAB**

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To provide basic cryptography techniques for securing the data.
2. To impart knowledge on symmetric and Asymmetric encryption techniques.
3. To facilitate understanding of digital signatures and key management.
4. To deal with the configuration and use of technologies designed to segregate the organization's systems from the insecure Network.
5. To familiarize with various security threats that modern organizations face.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Demonstrate encryption and decryption methods using substitution, transposition and product ciphers.
2. Develop the code using symmetric and asymmetric encryption algorithms like AES, Blowfish and Diffie Hellman key exchange.
3. Build the program to calculate the message digest of a text using Hash algorithms like MD5 and SHA1.
4. Construct the code using digital signature algorithm to solve data integrity problems.
5. Experiment with rootkits,wireshark,Nmap to troubleshoot network problems and to develop and test software.

List of Programs

1. Program to implement encryption and decryption using the following:
   a) Substitution cipher b) Transposition Cipher c) Product Cipher
2. Program to implement AES Algorithm.
3. Program to implement Blowfish algorithm.
4. Program to implement the Diffie-Hellman Key exchange algorithm.
5. Program to calculate the message digest of a text using the SHA-1 algorithm.
6. Program to calculate the message digest of a text using the MD5 algorithm.
7. Program to implement Digital Signature algorithm.
8. Demonstrate intrusion detection system using SNORT tool or any other sofware.
9. Installation of rootkits and study about the variety of options.
10. Implement Wireshark to capture the packets and interfaces.
11. Setup a honey pot and monitor the honeypot on network using KF sensor.
12. Demonstrate how to managing securing policies using tcpdump, dumpcap using Wireshark.
13. Demonstration of pentest tools using Nmap, Wireshark.

Text Books:

1. Michael Gregg, "Build Your Own Security Lab" ,Wiley Publishing, Inc.,2008.
2. Michael E.whitman, Herbert J.Mattord,Andrew Green ,"Hands on Information Security lab manual", Cengage Learning, Fourth edition, December 27, 2013.

Suggested Readings:

1. Alfred Basta, Wolf Halton, "Computer Security, concepts, issues and implementation", Cengage Learning India Pvt Ltd, 2008.
2. William Stallings, "Cryptography and Network Security principles and practice", 5th Edition, Pearson Education, Inc., publishing as Prentice Hall 2011.

Web Resources:

1. https://www.sans.org/security-resources/blogs
2. http://opensecuritytraining.info/HTID.html
3. http://cyber.gatech.edu/research
4. https://www.udemy.com/topic/penetration-testing/
5. https://nmap.org/
6. https://www.bornfortech.net/best-rootkit-remover/
7. https://www.snort.org/
8. https://www.wireshark.org/

18IT C26 **MINI PROJECT – IV**

Instruction	2 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Course Objectives:

1. To enable students to learn by doing.
2. To develop capability to analyse and solve real world problems.
3. To develop innovative ideas among the students

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Interpret Literature with the purpose of formulating a project proposal.
2. Planning, analyzing, Designing and implement a software project using SDLC model.
3. Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios.
4. Plan to work as a team and to focus on getting a working project done and submit a report with in a stipulated period of time.
5. Final Seminar, as oral Presentation before departmental Committee.

The Students are required to implement a project from opted subject in the core elective - 4. During the implementation of the project, Personnel Software Process (PSP) has to be followed. Report of the project work is to be submitted at the end of the Semester for evaluation.

Schedule

S.No	Programming concepts are to be taught related to the courses choosen from core elective – 4	4 weeks
1.	Problem Identification / Selection	2 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	5 weeks
4.	Documentation & Project Presentation	2 weeks

Guidelines for the Award of marks

S.No.	Description	Max. Marks
1.	Weekly Assesment	20
2.	PPT Preparation	05
3.	Presentation	10
4.	Question and Answers	05
5.	Report Preparation	10

Final Mini Project demonstration and PPT presentation is to be evaluated for the entire class together by all the faculty handling Mini Project for that class.