SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)

UG Programmes CE,CSE,ECE,EEE,IT & ME are Accredited by NBA

CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

Estd:1980

Regulation: R20		III / IV - B.Tech. I - Semester								
INFORMATION TECHNOLOGY										
SCHEME OF INSTRUCTION & EXAMINATION (With effect from 2020-21 admitted Batch onwards)										
Course Code	**Course Name**	**Category**	**Cr**	**L**	**T**	**P**	**Int. Marks**	**Ext. Marks**	**Total Marks**	
B20IT3101	Automata Theory and Compiler Design	PC	3	3	0	0	30	70	100	
B20IT3102	Data Mining Techniques	PC	3	3	0	0	30	70	100	
B20IT3103	Operating Systems	PC	3	3	0	0	30	70	100	
#PE-I	Professional Elective -I	PE	3	3	0	0	30	70	100	
#OE-I	Open Elective-I	OE	3	3	0	0	30	70	100	
B20IT3109	Data Mining Techniques with R Lab	PC	1.5	0	0	3	15	35	50	
B20IT3110	Operating Systems Lab	PC	1.5	0	0	3	15	35	50	
B20HS3102	Soft Skills **(Skill Oriented Course)**	SOC	2	1	0	2	--	50	50	
B20MC3102	Competitive Coding	MC	0	3	0	0	--	--	--	
B20IT3111	Summer Internship	PR	1.5	--	--	--	--	50	50	
		TOTAL	**21.5**	**19**	**0**	**8**	**180**	**520**	**700**	

	Course Code	Course
#PE-I	B20IT3104	Artificial Intelligence
	B20IT3105	Agile Software Process
	B20IT3106	Distributed Systems
	B20IT3107	Advanced Unix Programming
	B20IT3108	Computer Graphics
#OE-I	Student has to study one Open Elective offered by CE or ECE or EEE or ME or S&H from the list enclosed.	

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3101	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

AUTOMATA THEORY AND COMPILER DESIGN

(For IT)

Course Objectives:

1.	To learn fundamentals of Regular and Context Free Grammars and Languages
2.	To understand the relation between Contexts free Languages, PDA
3.	To study the various phases in the design of a compiler
4.	To understand the design of top-down and bottom-up parsers
5	To understand syntax directed translation schemes and approaches to generate code for a target machine

Course Outcomes: By the end of the course, the student will be able to

S.No	Outcome	Knowledge Level
1.	Design DFA, NFA for the given regular expressions	K3
2.	Design parse trees and parsers for the given grammar	K3
3.	Design algorithms to perform code optimization to improve the performance of a program in terms of space and time complexity	K3
4.	Design algorithms to generate machine code	K3

SYLLABUS

UNIT-I (10 Hrs)	**Formal Language and Regular Expressions**: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis
UNIT-II (10 Hrs)	**Context Free grammars and parsing**: Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL (1) parsing Bottom-up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.
UNIT-III (10 Hrs)	**Semantics**: Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow Statements **Context Sensitive features** – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.
UNIT-IV (8 Hrs)	**Run time storage**: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation. **Code optimization**: Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT-V **(12 Hrs)**	Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.	

Text Books:	
1.	1) Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008.
2.	Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.
Reference Books:	
1.	Louden: "Compiler Construction, Principles & Practice", 1st Edition, Thomson Press, 2006.
2.	Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2010.
3.	Theory of Computation, V. Kulkarni, Oxford University Press, 2013

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3102	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DATA MINING TECHNIQUES

(For IT)

Course Objectives: The main objective of the course is to

1.	Introduce basic concepts and techniques of data warehousing and data mining
2.	Examine the types of the data to be mined and apply pre-processing methods on raw data
3.	Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

Course Outcomes: By the end of the course student will be able to

S.No	Outcome	Knowledge Level
1.	Illustrate the importance of Data Warehousing, Data Mining and its functionalities and Design schema for real time data warehousing applications.	K2
2.	Demonstrate on various Data Preprocessing Techniques viz. data cleaning, data integration, data transformation and data reduction and Process raw data to make it suitable for various data mining algorithms.	K3
3.	Choose appropriate classification technique to perform classification, model building and evaluation.	K3
4.	Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent itemsets generation.	K3
5.	Identify and apply various clustering algorithm (with open source tools), interpret, evaluate and report the result.	K3

SYLLABUS

UNIT-I (10Hrs)	**Data Warehousing and Online Analytical Processing:** Data Warehouse: Basic concepts, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Introduction: Why and What is data mining, What kinds of data need to be mined and patterns can be mined, Which technologies are used, Which kinds of applications are targeted.
UNIT-II (10 Hrs)	**Data Pre-processing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.
UNIT-III (10 Hrs)	**Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction.

UNIT-IV (10 Hrs)	**Association Analysis:** Problem Definition, Frequent Item set Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP Growth Algorithm.
UNIT-V (10 Hrs)	**Cluster Analysis:** Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means.

Textbooks:	
1.	Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier,2011.
2.	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson,2012.
Reference Books:	
1.	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2.	Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
3.	Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford.
4.	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc18_cs14/preview (NPTEL course by Prof.PabitraMitra)
2.	https://onlinecourses.nptel.ac.in/noc17_mg24/preview (NPTEL course by Dr. NandanSudarshanam& Dr. BalaramanRavindran)
3.	Data Mining Map (saedsayad.com)

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3103	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

OPERATING SYSTEMS

(For IT)

Course Objectives:

1.	Introduce to the internal operation of modern operating systems
2.	Define, explain, processes and threads, mutual exclusion, CPU scheduling, deadlock,memory management, and file systems
3.	Understand File Systems in Operating System like UNIX/Linux and Windows
4.	Understand Input Output Management and use of Device Driver and SecondaryStorage (Disk) Mechanism
5.	Analyze Security and Protection Mechanism in Operating System

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Describe various generations of Operating System and functions of Operating System	K2
2.	Describe the concept of program, process and thread and analyze various CPU Scheduling Algorithms and compare their performance	K2
3.	Solve Inter Process Communication problems using Mathematical Equations by various methods	K3
4.	Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques	K4
5.	Outline File Systems in Operating System like UNIX/Linux and Windows	K2

SYLLABUS

UNIT-I (10Hrs)	**Operating Systems Overview:** Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. **System Structures:** Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operatingsystem debugging, System Boot.
UNIT-II (10 Hrs)	**Process Concept:** Process scheduling, Operations on processes, Inter-process communication,Communication in client server systems. **Multithreaded Programming:** Multithreading models, Thread libraries, Threading issues. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multipleprocessor scheduling, Thread scheduling. **Inter-process Communication:** Race conditions, Critical Regions, Mutual exclusion with

	busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.
UNIT-III **(10 Hrs)**	**Memory-Management Strategies:** Introduction, Swapping, Contiguous memory allocation,Paging, Segmentation. **Virtual Memory Management:** Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.
UNIT-IV **(10 Hrs)**	**Deadlocks:** Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. **File Systems:** Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.
UNIT-V **(10 Hrs)**	**System Protection:** Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. **System Security:** Introduction, Program threats, System and network threats, Cryptography for security, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer security classification. **Case Studies:** Linux, Microsoft Windows.

Textbooks:	
1.	Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
2.	Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems.)
Reference Books:	
1.	Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, TataMcGraw-Hill, 2012.
2.	Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
3.	Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004.
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105214/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3104	**PE**	**3**	**-**	**--**	**3**	**30**	**70**	**3 Hrs.**

ARTIFICIAL INTELLIGENCE

(For IT)

Course Objectives:

| 1.	To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
2.	To understand the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution that play an important role in AI programs
3.	To have a basic understanding of some of the more advanced topics of AI

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

S.No	Outcome	Knowledge Level
1	Understand the basic applications of AI and problems that can be solved by AI	K3
2	Apply the problem-solving strategies to generate best AI solutions using state space search	K3
3	Apply AI languages to represent knowledge base	K3
4	Apply AI tools to represent knowledge base	K3
5	Apply uncertainty techniques to solve AI real time problems	K3

SYLLABUS

UNIT-I (10 Hrs)	Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.
UNIT-II (10 Hrs)	Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.
UNIT-III (10 Hrs)	Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.
UNIT-IV (8 Hrs)	Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge

	representation using frames Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web.
UNIT-V (12 Hrs)	Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-Shafer theory. Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

Text Books:	
1.	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning.
2.	Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA.
Reference Books:	
1.	Artificial Intelligence- Deepak Khemani, TMH, 2013.
2.	Introduction to Artificial Intelligence, Patterson, PHI.
3.	Artificial intelligence, structures and Strategies for Complex problem solving, George F Lugar, 5th ed, PEA.
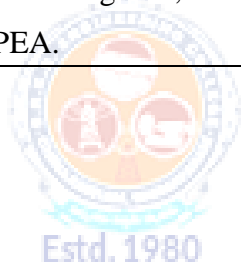
Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3105	PE	3	--	--	3	30	70	3 Hrs.

AGILE SOFTWARE PROCESS

(For IT)

Course Objectives:

|	
1.	Comprehend an iterative, incremental development process leads to faster delivery of more usefulsoftware.
2.	Apply the principles and practices of extreme programming.
3.	Analyze the essence of agile development methods.
4.	Develop prototyping in the software process.

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

S.No	Outcome	Knowledge Level
1.	Comprehend the common characteristics of an agile development process.	K2
2.	Identify and contrast state of the practice agile methodologies.	K2
3.	Analyze and contrast agile software development process models and plan driven process models.	K4
4.	Determine software project characteristics that would be suitable for an agile process	K3

SYLLABUS

UNIT-I (10Hrs)	The Agile Movement - A Five Minute Primer, What is Agile Development, The Agile Methodologies Agile Values, Agile Practices, Agile Principles Agile Characteristics-The Characteristics of an Agile Project, The Development Team Project Management, The Customer, Processes and Tools The Contract, What Projects Can Benefit from Agile Development.
UNIT-II (10 Hrs)	The Agile Methodologies: Common Themes, Methodology Descriptions, Extreme Programming, Scrum, Feature Driven Development, The Crystal Methodologies, Adaptive Software Development, Dynamic Systems Development Method, Lean Software Development, Starting Monday: Investigate Further Selecting an Approach that Fits: Choosing between an Agile or Traditional Approach, Selecting the Right Agile Approach
UNIT-III (10 Hrs)	Going Agile: Is the Team Ready? Announcing the Team's Intention to Go Agile, Encountering, Addressing and Overcoming Resistance, Start with the Bare Minimum, Altering the Project Environment, Iteration Zero, Discontinue a Process Once its Served its Purpose, False Agile, Practitioners and Projects, Starting Monday: Measuring The Team's Progress.

UNIT-IV (10 Hrs)	Agile Practices: Getting Started, Agile Practices Explained, Selecting the Next Practice, Rejecting a Practice, Adopt Practices before Tools Learn Programming Practices in Pairs, Agile Practices in this Book Agile Practices Explained, Why these Practices were Chosen
UNIT-V (10 Hrs)	Testing :An Agile Approach to Testing, The Good Enough Approach Testing as the Best Defense, Sharing a Code Base with another Project Team, Sharing Common Components with another Project Team, Depending upon Code or Components Produced by Another Project Team

Textbooks:

1.	Agile Software Development with Scrum, Ken Schawber, Mike Beedle, Pearson, 2015. ISBN-13:9780132074896.
2.	Integrating Agile Development In The Real World (Charles River Media Programming), Peter Schuh, ,2004, Cengage Learning, ISBN-13: 9781584503644

Reference Books:

1.	Agile Testing: A Practical Guide for Testers and Agile Teams, Lisa Crispin, Janet Gregory, Publisher:Addison Wesley
2.	Agile Software Development, Principles, Patterns and Practices, Alistair Cockburn, Pearson Education,2015. ISBN-13: 9780321482754
3.	Agile Software Development: The Cooperative Game, By Alistair Cockburn Publisher: Addison Wesley
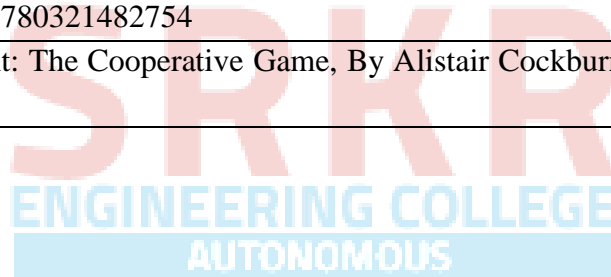
Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3106	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DISTRIBUTED SYSTEMS

(For IT)

Course Objectives:

1.	To understand the foundations of distributed systems.
2.	To learn issues related to clock Synchronization and the need for global state in distributed systems.
3.	To learn distributed mutual exclusion and deadlock detection algorithms.
4.	To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems
5.	To learn the characteristics of peer-to-peer and distributed shared memory systems

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

S.No	Outcome	Knowledge Level
1.	Enumerate the foundations and issues of distributed systems	K2
2.	Illustrate the various synchronization issues and global state for distributed systems	K2
3.	Demonstrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems	K2
4.	Describe the agreement protocols and fault tolerance mechanisms in distributed systems	K2
5.	Describe the features of peer-to-peer and distributed shared memory systems	K2

SYLLABUS

UNIT-I (10 Hrs)	**Introduction:** Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues and challenges. A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Models of process communications. **Logical Time:** A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP.
UNIT-II (10 Hrs)	**Message ordering and group communication:** Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. **Global state and snapshot recording algorithms**: Introduction, System model and definitions, Snapshot algorithms for FIFO channels.

UNIT-III **(10 Hrs)**	**Distributed mutual exclusion algorithms**: Introduction – Preliminaries – Lamport's algorithm – RicartAgrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. **Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model
UNIT-IV **(8 Hrs)**	**Check pointing and rollback recovery**: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated check pointing algorithm – Algorithm for asynchronous check pointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure-free system – Agreement in synchronous systems with failures.
UNIT-V **(12 Hrs)**	**Peer-to-peer computing and overlay graphs:** Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. **Distributed shared memory:** Abstraction and advantages – Memory consistency models – Shared memory Mutual Exclusion

Text Books:	
1.	Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012.
2.	Distributed computing: Principles, algorithms, and systems, Ajay D Kshemkalyani and Mukesh Singhal, Cambridge University Press, 2011.

Reference Books:	
1.	Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
2.	Advanced concepts in operating systems. Mukesh Singhal and Niranjan G. Shivaratri, McGrawHill, 1994.
3.	Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,Pearson Education, 2007.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3107	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

ADVANCED UNIX PROGRAMMING

(For IT)

Course Objectives:

Understating the shell commands, shell programming, system calls of files and processes, signals, inter-process communication concepts and programming, TCP and UDP.

Course Outcomes: After finishing this course student will be able to

S.No	Outcome	Knowledge Level
1.	Explore Unix commands and awareness of shell programming	K3
2.	Describe about different system calls for files and directories	K3
3.	Understand the working of processes and signals	K2
4.	Apply client server program for IPC	K3
5.	Explain about socket programming	K3

SYLLABUS

UNIT-I (10Hrs)	Introduction, Architecture of Unix, Responsibilities of shell, Unix file system, vi editor. **Unix commands**: Some Basic Commands, file utilities, process utilities, text processing utilities, network utilities, disk utilities, backup utilities, Security by file permissions.
UNIT-II (10 Hrs)	**Shell Programming**: shell variables, The Export command, The Profile File a Script Run During starting, The First Shell Script, The read command, Positional Parameters, The $? Variable, Knowing the exit Status- More about the Set Command, The Exit command, Branching Control Structures, Loop Control Structures, The Continue and Break Statement- The Expr Command, Performing Integer Arithmetic- Real Arithmetic in Shell Programs- The here Document(<<), The Sleep Command, Debugging Scripts, The Script command, The Eval command, The Exec Command, Sample programs. **Files** - Introduction, file descriptors, open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, links-soft and hard links-symlink, link, unlink.
UNIT-III (10 Hrs)	**Directories-**Creating, removing and changing Directories-mkdir, rmdir, chdir, obtaining current working directory-getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions. **Process Control**: process identifiers, fork function, vfork function, exit function, wait and waitpid functions, exec functions, user identification. **Signals**: signal handling using signal function, kill and raise, alarm, pause, abort and sleep functions.

UNIT-IV **(10 Hrs)**	**IPC**: introduction, pipes, FIFO's, client –server examples for pipes and FIFO's **message queues:** message queue structure in kernel, system calls of message queue, client-server example for message queue. **Semaphores:** definition, system calls of semaphores, semaphores structure in kernel, file locking using semaphores
UNIT-V **(10 Hrs)**	**Shared memory**-system calls of shared memory, semaphore structure in kernel, client server example. **Sockets:** Introduction, overview, elementary socket system calls, TCP Echo program, UDP Echo program
	.

Textbooks:	
1.	Unix the ultimate guide, 3rd edition, Sumitabha Das, TMH.
2.	Advanced programming in the Unix environment by W. Richard Stevens.
3.	Unix network programming by W. Richard Stevens.
Reference Books:	
1.	Introduction to Unix and shell programming, Venkateshmurhty
2.	Unix and shell programming by B.M. Harwani, OXFORD university press.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3108	PE	3	--	--	3	30	70	3 Hrs.

COMPUTER GRAPHICS

(For IT)

Course Objectives:

1.	Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.
2.	A thorough introduction to computer graphics techniques.
3.	To give the basics of Geometric Transformations and projections.
4	To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes: After finishing this course student will be able to

S.No	Outcome	Knowledge Level
1.	Understand graphics principles and graphics hardware.	K2
2.	Demonstrate geometrical transformations.	K3
3.	Develop interactive graphics applications and Demonstrate computer graphics animation.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Overview of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Workstations, Input Devices, Hard Copy Devices, Interactive Input Methods, Windows and Icons, Virtual Reality Environments, Graphics Software.
UNIT-II (10 Hrs)	**Output primitives:** Points and Lines, , Line and Curve Attributes, Color and Gray scale levels, Ant aliasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.
UNIT-III (10 Hrs)	**Two Dimensional Transformations:** Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations.

UNIT-IV (10 Hrs)	**Three Dimensional Transformations & Projections**: Translation, Rotation, Scaling, Other Transformations, Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.
UNIT-V (10 Hrs)	**Viewing Pipeline and Clipping operations :** Viewing Pipeline ,Viewing Coordinates &Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, , Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping operations- Point Clipping, Line Clipping, Polygon Clipping,, Curve Clipping,, Text and Exterior Clipping. **Three Dimensional Concepts and Object representations:** 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, Spline Representations, Bézier Curves and Surfaces, BSpline Curves and Surfaces,

Textbooks:	
1.	Computer Graphics, Donald Hearn & M.Pauline Baker, Pearson Education ,New Delhi.

Reference Books:	
1.	Procedural Elements for Computer Graphics, David F.Rogers, Tata McGraw Hill Book Company, New Delhi, 2003.
2.	Computer Graphics: Principles & Practice in C,J.D.Foley, S.KFeiner, AVan Dam F.H John Pearson Education ,2004**.**
3.	Computer Graphics using Open GL,Franscis S Hill Jr,Pearson Education,2004.
4.	Computer Vision and Image Processing: A Practical Approach using CVIP tools, S. E.Umbaugh, Prentice Hall, 1998

e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc20_cs90/preview
2.	https://www.javatpoint.com/computer-graphics-tutorial

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3109	**PC**	**-**	**--**	**3**	**1.5**	**15**	**35**	**3 Hrs.**

DATA MINING TECHNIQUES WITH R LAB

(For IT)

Course Objectives:

1	To understand the mathematical basics quickly and covers each and every condition of data mining in order to prepare for real-world problems.
2	The various classes of algorithms will be covered to give a foundation to further apply knowledge to dive deeper into the different flavors of algorithms.
3	Students should be aware of packages and libraries of R and also familiar with functions used in R for visualization.
4	To enable students to use R to conduct analytics on large real life datasets.
5	To familiarize students with how various statistics like mean median etc. can be collected for data exploration in R.

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

S.No	Outcome	Knowledge Level
1	Extend the functionality of R by using add-on packages	K2
2	Extract data from files and other sources and perform various data manipulation tasks on them.	K3
3	Code statistical functions in R	K3
4	Use R Graphics and Tables to visualize results of various statistical operations on data.	K3
5	Apply the knowledge of R gained to data Analytics for real life applications.	K3

SYLLABUS

1	Implement all basic R commands.
2	Interact data through .csv files (Import from and export to .csv files).
3	Get and Clean data using swirl excercises.(Use 'swirl' package, library and install that topic from swirl).
4	Visualize all Statistical measures (Mean,Mode, Median, Range, Inter Quartile Range etc., using Histograms, Boxplots and Scatter Plots).

	Create a data frame with the following structure.			
	EMP ID	**EMP NAME**	**SALARY**	**START DATE**
	1	Satish	5000	01-11-2013
5	2	Vani	7500	05-06-2011
	3	Ramesh	10000	21-09-1999
	4	Praveen	9500	13-09-2005
	5	Pallavi	4500	23-10-2000

a. Extract two column names using column name.
b. Extract the first two rows and then all columns.
c. Extract 3 rd and 5th row with 2nd and 4th column

6	Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into i. 0 to 1 range with min-max normalization. ii. a value around 0 with z-score normalization.
7	Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.
8	Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best $R2$ and plot the original values in 'green' and predicted values in 'red'.
9	Write R Programs to implement k-means clustering.
10	Write R Programs to implement k-medoids clustering.
11	Write R Programs to implement density based clustering on iris dataset.
12	Write a R Program to implement decision trees using 'readingSkills' dataset.
13	Implement decision trees using 'iris' dataset using package party and 'rpart'.
14	Use a Corpus() function to create a data corpus then Build a term Matrix and Reveal word frequencies.

Reference Books:

1	Online Tutorials Library (tutorialspoint.com)
2	An R Introduction to Statistics | R Tutorial (r-tutor.com)
3	R and Data Mining: Examples and Case Studies, 1st ed, Yanchang Zhao, Sprnger, 2012.
4	Towards Data Science

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3110	PC	-	--	3	1.5	15	35	3 Hrs.

OPERATING SYSTEMS LAB

(For IT)

Course Objectives:

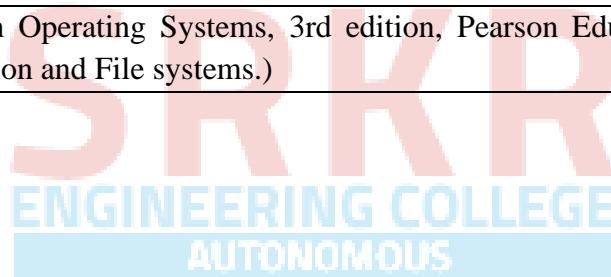|	
1	To understand the design aspects of operating system
2	To study the process management concepts & Techniques
3	To study the storage management concepts
4	To familiarize students with the Linux environment
5	To learn the fundamentals of shell scripting/programming

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1	Use Unix utilities and perform basic shell control of the utilities	K3
2	Design different system calls for writing application programs.	K5
3	Implement various scheduling, page replacement algorithms and algorithms related to deadlocks.	K3
4	Design programs for shared memory management and semaphores.	K5

SYLLABUS

1	a) Study of Unix/Linux general purpose utility command list: man,who,cat, cd, cp, ps,ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown. b) Study of vi editor c) Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system d) Study of Unix/Linux file system (tree structure) e) Study of .bashrc, /etc/bashrc and Environment variables.
2	Write a C program that makes a copy of a file using standard I/O, and system calls
3	Write a C program to emulate the UNIX ls –l command.
4	Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l	sort
5	Simulate the following CPU scheduling algorithms: Round Robin (b) SJF (c) FCFS (d) Priority
6	Multiprogramming-Memory management-Implementation of fork (), wait (), exec() and exit (), System calls

7	Simulate the following: 1) Multiprogramming with a fixed number of tasks (MFT) 2) Multiprogramming with a variable number of tasks (MVT)
8	Simulate Bankers Algorithm for Dead Lock Avoidance
9	Simulate Bankers Algorithm for Dead Lock Prevention.
10	Simulate the following page replacement algorithms: a) FIFO b) LRU c) LFU
11	Simulate the following File allocation strategies (a) Sequenced (b) Indexed (c) Linked
12	Write a C program that illustrates two processes communicating using sharedmemory.
13	Write a C program to simulate producer and consumer problem using semaphores
14	Write C program to create a thread using pthreads library and let it run its function.
15	Write a C program to illustrate concurrent execution of threads using pthreads library

Reference Books:	
1	Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
2	Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems.)

Code	Category	L	T	P	C	I.M	E.M	Exam
B20HS3102	SOC	1	--	2	2	--	50	3Hrs.

SOFT SKILLS
(Common to AIDS, CSBS, CSE, ECE, & IT)

Course Objectives:

1.	To familiarize students with soft skills and how they influence their professional growth.
2.	To build/refine the professional qualities/skills necessary for a productive career and to instill Confidence through attitude building.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1	Apply soft skills in the work place and build better personal and professional relationships making informed decisions.	K3
2	Participate in group discussions/group activities, exhibit team spirit, use language effectively according to the situation, respond to their interviewer/employer with a positive mind, make answers to the questions asked during their technical/personal interviews, exhibit skills required for the different kinds of interviews (stress, technical, HR) that they would face during the course of their recruitment process.	K3

SYLLABUS

1.	Introduction to Soft Skills, Significance of Inter & Intra-Personal Communication
2.	SWOT Analysis, Creativity & Problem Solving
3.	LSRW, JAM, Presentation Skills
4.	Building a positive attitude, Leadership & Team Work
5.	Goal Setting – Guidelines for Goal Setting
6.	Group Discussion: Essential guidelines
7.	Telephone Etiquette, Telephonic Interview
8.	Resume Preparation: Common resume blunders, tips for betterment, Resume Review
9.	Employability Skills: Emotional Intelligence, Report Writing, Social Consciousness and Social Entrepreneurship, Stress Management.
10.	Awareness about Industry, Companies, Importance of researching the prospective workplace, Knowing about Selection Process
11.	Interview Skills: Types of Interviews, Mock Interview, Do's and Don'ts of Interview.

Text Books:	
1	Soft Skills & Employability Skills by Samina Pillai and Agna Fernandez, Cambridge University Press India Pvt. Ltd.
2	Soft Skills, by Dr. K. Alex, S. Chand & Company Ltd., New Delhi
Reference Books:	
1	The Art of Public Speaking by Dale Carnegie
2	The Leader in You by Dale Carnegie
3	Emotional Intelligence by Daniel Golman
4	Stay Hungry Stay Foolish by Rashmi Bansal
5	I have a Dream by Rashmi Bansal.
Additional Materials	
1	https://www.youtube.com/watch?v=LTnI7cmpDZI
2	https://www.youtube.com/watch?v=ic5O2sxhH9M
3	https://www.youtube.com/watch?v=4ZQkYSpmOdU
4	https://www.youtube.com/watch?v=d8p-5WcXoRs
5	https://www.youtube.com/watch?v=yZOar04g4zk&t=94s

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3102	**MC**	**3**	--	--	---	---	---	---

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COMPETITIVE CODING

(For IT, AIDS and CSBS)

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Course Objectives:

1	To enhance the Programming and Data Structure and Algorithm skills by solving number of real-world programming problems under crucial constraints including Time and Space Complexities.
2	Students to come up with an optimized Solution by passing all required test cases.
3	To Compete with various brilliant minds across the globe in enhancing Programming, Data Structure and Algorithm Skills, Analytical Skills, Problem Solving and Time Management Skills.

Course Outcomes:

S. No	Outcome At the end of the course, the students will be able to:	Knowledge Level
1	Solve Recursion and Backtracking Problems	K3
2	Solve various algorithms related to Number Theory	K3
3	Implement various algorithms related to Linear Data Structures	K4
4	Implement various algorithms related to Non - Linear Data Structures	K4
5	Implement Divide and Conquer and Greedy Algorithms	K4
6	Understand the concept of Dynamic Programming by solving problems	K2

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SYLLABUS

</div>

1	**Overview:** • Introduction to the Course
2	**Introduction to Recursion and Backtracking:** • Multiplication without using * Operator • Tower's of Hanoi • Ackermann's Problem • Convert given number Decimal to Binary and Binary to Decimal • Convert given Digit to String

3	**Number Theory:** • Euclid's Algorothm (Greatest Common Divisor) • Check the given number is Prime or Not • Find Prime Factors of a given Number • Binomial Coefficient • Generate the following Patterns 1 A * * * * * * * * * * 2 2 A B A * * * * * * * 3 3 3 A B C B A * * * * * * * * * * 4 4 4 4 A B C D C B A 5 5 5 5 5 A B C D E D C B A
4	**Stacks:** • Implement two Stacks in single Array • Infix to Postfix Conversion • Infix to prefix Conversion
5	**Queues:** • Implement Queue Operations using Two Stacks • Generate Binary Numbers between **1** to **N** using a Queue
6	**Linked List:** • Implementation of Reverse a Singly Linked List • Swapping of Two nodes in a Singly Linked List without Swapping Data
7	**Circular Linked List:** • Concatenate two Circular Linked List • Maximum and Minimum Value of Circular Linked List
8	**Trees:** • Check whether two Binary Trees are Identical or Not • Find the Height of a Binary Tree • Check for Height balancing of a Binary Tree
9	**Graphs:** • Find the Number of Connected components in a graph • Depth First Search • Breadth First Search • Cycle Detection using Breadth First Search
10	**Greedy Algorithm:** • Introduction to Greedy Technique • Prim's Minimum Spanning Tree • Kruskal's Minimum Spanning Tree • Dijkstra's Shortest Path Algorithm

11	**Divide and Conquer:** • Introduction to Divide and Conquer Technique • Binary Search • Quick Sort • Merge Sort
12	**Dynamic Programming:** • Introduction to Dynamic Programming • Longest Common Subsequence • Longest Pallindrome Subsequence

CODING PLATFORMS:
- **CodeChef**
- **CodeForces**
- **LeetCode**
- **HackerRank**
- **HackerEarth**

Reference Books:

1	Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahini and Anderson-Freed, University Press,2008.
2	Data Structures using C by Aaron M. Tenenbaum, Y. Langsam and M.J. Augenstein, Pearson Education, 2009
3	Data Structures with C by Seymopur Lipschutz, Schaum Outline Series,2010.
4	Data Structures using C by R.KrishnaMoorthy G.Indirani Kumaravel, TMH, New Delhi,2008

SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)

(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
UG Programmes CE,CSE,ECE,EEE,IT & ME are Accredited by NBA
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

Estd:1980

Regulation: R20	III / IV - B.Tech. II - Semester

INFORMATION TECHNOLOGY

SCHEME OF INSTRUCTION & EXAMINATION
(With effect from 2020-21 admitted Batch onwards)

Course Code	Course Name	Category	Cr	L	T	P	Int. Marks	Ext. Marks	Total Marks
B20IT3201	Machine Learning	PC	3	3	0	0	30	70	100
B20IT3202	Design and Analysis of Algorithms	PC	3	3	0	0	30	70	100
B20IT3203	Computer Networks	PC	3	3	0	0	30	70	100
#PE-II	Professional Elective -II	PE	3	3	0	0	30	70	100
#OE-II	Open Elective-II	OE	3	3	0	0	30	70	100
B20IT3209	Machine Learning using Python Lab	PC	1.5	0	0	3	15	35	50
B20IT3210	Computer Networks Lab	PC	1.5	0	0	3	15	35	50
B20IT3211	Big Data Analytics Lab	PC	1.5	0	0	3	15	35	50
#SOC-IV	Skill Oriented Course - IV	SOC	2	1	0	2	--	50	50
B20MC3201	Employability Skills	MC	0	3	0	0	--	--	--
B20HS3204	*Gender Sensitization	HS	0	2	0	0	--	--	--
	TOTAL		21.5	21	0	11	195	505	700

	Course Code	Course
#PE-II	B20IT3204	Mobile Computing
	B20IT3205	MEAN Stack Development
	B20IT3206	Design Patterns
	B20IT3207	Scripting Language
	B20IT3208	Big Data Analytics
#SOC-IV	B20IT3212	Data Science: Natural Language Processing
	B20IT3213	Video Analytics
	B20IT3214	Distributed Technologies-MongoDB
#OE-II	Student has to study one Open Elective offered by CE or ECE or EEE or ME or S&H from the list enclosed.	

***Note:** Gender Sensitization is a Self-Learning noncredit Audit Course

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3201	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

MACHINE LEARNING

(For IT)

Course Objectives:

1.	Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
2.	Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Explain and apply the fundamental usage of the concept Machine Learning system	K3
2.	Demonstrate various classifications and Regression Techniques	K3
3.	Analyze the Ensemble Learning Methods	K4
4.	Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.	K4
5.	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction-** Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning. **Statistical Learning**: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.
UNIT-II (10 Hrs)	**Supervised Learning** (Regression/Classification): Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, **Linear Models:** Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, **Binary Classification:** Multiclass/Structured outputs, MNIST, Ranking.
UNIT-III (10 Hrs)	**Ensemble Learning and Random Forests:** Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking. **Support Vector Machine:** Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

UNIT-IV **(10 Hrs)**	**Unsupervised Learning Techniques:** Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.
UNIT-V **(10 Hrs)**	**Neural Networks and Deep Learning:** Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.
	.

Textbooks:	
1.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
2.	Data Science and Machine Learning: Mathematical and Statistical, D.P. Kroese, Z.I. Botev, T. Taimre, R. Vaisman, CRC Press. 2020
Reference Books:	
1.	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3202	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DESIGN AND ANALYSIS OF ALGORITHMS

(For IT)

Course Objectives: Students are Expected to

1	understand, analyze and denote time complexities of algorithms
2	Introduce the different algorithmic approaches for problem solving through numerous example problems
3	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic programming algorithms and analyze them.
4	Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

Course Outcomes: By the end of the course, the student will be able to

S.No	Outcome	Knowledge Level
1	Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms	K3
2	List and describe various algorithmic approaches and Solve problems using divide and conquer & greedy Method.	K3
3	Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations.	K3
4	Apply the Backtracking and Branch-and-bound strategies for solving complex problems	K3
5	Understand the basic concepts of NP-Hard and NP- Complete and Solve string matching using various algorithms.	K3

SYLLABUS

UNIT-I (10 Hrs)	Introduction: Algorithm Definition, Algorithm Specification, performance Analysis, Randomized Algorithms. Sets & Disjoint set union: introduction, union and find operations. Basic Traversal & Search Techniques: Techniques for Graphs, connected components and Spanning Trees, Bi-connected components and DFS.
UNIT-II (10 Hrs)	Divide and Conquer: General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort. The Greedy Method: The general Method, knapsack problem, container loading problem, Job sequencing with deadlines, minimum cost spanning Trees. Optimal Merge Patterns, Single Source Shortest paths.

UNIT-III (10 Hrs)	Dynamic Programming: The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, 0/1 knapsack, reliability Design, The traveling salesperson problem
UNIT-IV (8 Hrs)	Backtracking: The General Method, the 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem. Branch and Bound: FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack problem, Traveling salesperson problem.
UNIT-V (12 Hrs)	NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes, Cook's Theorem. String Matching: Introduction, Naİve String Matching Algorithm, Rabin-Karp Algorithm, Knuth-Morris-Pratt algorithm, Tries, Suffix Tree.

Text Books:	
1.	EllisHorowitz,SartajSahni,SanguthevarRajasekaran,"FundamentalsofComputer Algorithms", 2nd Edition, Universities Press.
2.	Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press.

Reference Books:	
1.	Horowitz E. Sahani S: "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia Publications, 2008.
2.	S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3203	PC	3	--	--	3	30	70	3 Hrs.

COMPUTER NETWORKS

(For IT)

Course Objectives:

1.	To provide insight about networks, topologies, and the key concepts.
2.	To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
3.	To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
4.	To know the basic concepts of network services and various network applications.

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

S.No	Outcome	Knowledge Level
1.	Explain the functions of the different layer of the OSI Protocol.	K3
2.	Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.	K3
3.	Apply different access control techniques to understand operation of internet	K3
4.	Analyze to resolve IP addresses class full , perform routing	K4
5.	Understand DNS, EMAIL, HTTP,	K2

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History. **Physical Layer** –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared.
UNIT-II (10 Hrs)	**Data link layer:** Design issues, **Framing:** fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols:** simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. **Sliding window protocol:** One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field.

UNIT-III **(10 Hrs)**	**Media Access Control**: Random Access: Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access**: Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA). **Wired LANs:** Ethernet, Ethernet Protocol, Fast Ethernet (100 Mbps), Gigabit Ethernet **Wireless LANs**: 802.11architecture, Bluetooth Layers.
UNIT-IV **(10 Hrs)**	**The Network Layer Design Issues** – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, **Routing Algorithms**-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms General principles of congestion control, Congestion prevention polices. **Internet Working:** How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, NAT-, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6-, DHCP
UNIT-V **(10 Hrs)**	**The Transport Layer:** Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP. **Application Layer:** World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet ,- Resolution-Caching- Resource Records- DNS messages-Registrars-security of DNS Name Servers

Textbooks:	
1.	Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2.	Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.
3.	Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016
Reference Books:	
1.	Data Communications and Networks- Achut S Godbole, AtulKahate
2.	Computer Networks, Mayank Dave, CENGAGE

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3204	PE	3	--	--	3	30	70	3 Hrs.

MOBILE COMPUTING

(For IT)

Course Objectives:

1.	To understand the fundamentals of mobile communication.
2.	To understand the architecture of various Wireless Communication Networks.
3.	To understand the significance of different layers in mobile system Course Contents.

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

S.No	Outcome	Knowledge Level
1.	Develop a strong grounding in the fundamentals of mobile Networks	K3
2.	Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network	K3
3.	Comprehend, design, and develop a lightweight network stack.	K3
4.	Analyze the Mobile Network Layer system working	K4
5.	Explain about the WAP Model	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Wireless Networks:** Applications, History, Simplified Reference Model, Wireless transmission, Frequencies, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular Systems: Frequency Management and Channel Assignment, types of hand-off and their characteristics.
UNIT-II (10 Hrs)	**MAC** – Motivation, SDMA, FDMA, TDMA, CDMA, Telecommunication Systems, GSM: Architecture Location tracking and call setup, Mobility management, Handover, Security, GSM, SMS, International roaming for GSM, call recording functions, subscriber and service data management, DECT, TETRA, UMTS, IMT-2000.
UNIT-III (10 Hrs)	**Wireless LAN:** Infrared vs. Radio transmission, Infrastructure, Adhoc Network, IEEE 802.11WLAN Standards, Architecture, Services, HIPERLAN, Bluetooth Architecture & protocols.
UNIT-IV (10 Hrs)	**Mobile Network Layer:** Mobile IP, Dynamic Host Configuration Protocol, Mobile Transport Layer, Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/Fast recovery, Transmission/Time-out freezing, Selective retransmission, Transaction Oriented TCP.

UNIT-V **(10 Hrs)**	**Support for Mobility:** Wireless Application Protocol: Architecture, Wireless Datagram Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Wireless Session Protocol, Wireless Application Environment, Wireless Markup Language, WML Scripts, Wireless Telephone Application.

Textbooks:	
1.	Jochen Schiller, "Mobile Communication", Second Edition, Pearson Education, 2008.
2.	Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
Reference Books:	
1.	William Stallings, "Wireless Communications and Networks", Second Edition, Pearson Education, 2004.
2.	C. Siva Ram Murthy, B. S. Manoj, "Adhoc Wireless Networks: Architectures and Protocols", Second Edition, Pearson Education, 2008.
e-Resources	
1.	https://nptel.ac.in/courses/106/106/106106147/#
2.	https://www.tutorialspoint.com/android/index.htm

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3205	PE	3	0	0	3	30	70	3 Hrs.

MEAN STACK DEVELOPMENT

(For IT)

Course Objectives:

1.	MEAN stack is a full-stack JavaScript solution that **helps you write scalable, robust, and maintainable web applications quickly and easily using MongoDB, express, AngularJS, and Node. js**.
2.	User can develop a fully functioning website and deploy on a web server.
3.	It helps for distinguishing trends in multi-device implementation.

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

| S.No	Outcome	Knowledge Level
1.	Build static web pages using HTML 5 elements.	K3
2.	Apply JavaScript to embed programming interface for web pages and also to perform Client side validations.	K3
3.	Build a basic web server using Node.js, work with Node Package Manager (NPM) and recognize the need for Express.js.	K3
4.	Develop JavaScript applications using typescript and work with document database using MongoDB.	K3
5.	Utilize Angular JS to design dynamic and responsive web pages.	K3

SYLLABUS

UNIT-I (10Hrs)	HTML 5: Introduction to Web, Overview of Web Technologies, HTML - Introduction, HTML - Need, Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element, Sectioning Elements, Paragraph Element, Division and Span Elements, List Element, Link Element, Character Entities, HTML5 Global Attributes, Creating Table Elements, Table Elements : Colspan/ Rowspan Attributes, border, cellspacing and cellpadding attributes, Creating Form Elements, Input Elements - Attributes, Color and Date Pickers, Select and Datalist Elements, Editing Elements, Media, Iframe, Why HTML Security, HTML Injection, Clickjacking, HTML5 Attributes & Events Vulnerabilities, Local Storage Vulnerabilities, HTML5 - Cross-browser support, Best Practices For HTML Web Pages.
UNIT-II (10 Hrs)	JavaScript: Why we need JavaScript, What is JavaScript, Environment Setup, Working with Identifiers, Type of Identifiers, Primitive and Non Primitive Data Types, Operators and Types of Operators, Types of Statements, Non - Conditional Statements, Types of Conditional Statements, If and Switch Statements, Types of Loops, Types of Functions,

	Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope in Functions, Working With Classes, Creating and Inheriting Classes, In-built Events and Handlers, Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser and Document Object Model, Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods, Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API, Creating and consuming Modules.
UNIT-III **(10 Hrs)**	Node.js: Why and What Node.js, How to use Node.js, Create a web server in Node.js, Node Package Manager, Modular programming in Node.js, Restarting Node Application, File Operations. Express.js: Express Development Environment, Defining a route, Handling Routes, Route and Query Parameters, How Middleware works, Chaining of Middlewares, Types of Middlewares, Connecting to MongoDB with Mongoose, Validation Types and Defaults, Models, CRUD Operations, API Development, Why Session management, Cookies, Sessions, Why and What Security, Helmet Middleware, Using a Template Engine Middleware, Stylus CSS Preprocessor.
UNIT-IV **(10 Hrs)**	**Typescript:** Installing TypeScript, Basics of TypeScript, Function, Parameter Types and Return Types, Arrow Function, Function Types, Optional and Default Parameters, Rest Parameter, Creating an Interface, Duck Typing, Function Types, Extending Interfaces, Classes, Constructor, Access Modifiers, Properties and Methods, Creating and using Namespaces, Creating and using Modules, Module Formats and Loaders, Module Vs Namespace, What is Generics, What are Type Parameters, Generic Functions, Generic Constraints. **MongoDB:** Introduction Module Overview, Document Database Overview, Understanding JSON, MongoDB Structure and Architecture, MongoDB Remote Management, Installing MongoDB on the local computer (Mac or Windows), Introduction to MongoDB Cloud, Create MongoDB Atlas Cluster, GUI tools Overview, Install and Configure MongoDB Compass, Introduction to the MongoDB Shell, MongoDB Shell JavaScript Engine, MongoDB Shell JavaScript Syntax, Introduction to the MongoDB Data Types, Introduction to the CRUD Operations on documents, Create and Delete Databases and Collections, Introduction to MongoDB Queries.
UNIT-V **(10 Hrs)**	What is Angular, Features of Angular, Angular Application Setup, Components and Modules, Executing Angular Application, Elements of Template, Change Detection, Structural Directives - ngIf, ngFor, ngSwitch, Custom Structural Directive, Attribute Directives - ngStyle, ngClass, Custom Attribute Directive, Property Binding, Attribute Binding, Style and Event Binding, Built in Pipes, Passing Parameters to Pipes, Nested Components Basics, Passing data from Container Component to Child Component, Passing data from Child Component to ContainerComponent, Shadow DOM, Component Life Cycle, Template Driven Forms, Model Driven Forms or Reactive Forms, Custom Validators in Reactive Forms, Custom Validators in Template Driven forms, Dependency

	Injection, Services Basics, RxJS Observables, Server Communication using HttpClient, Communicating with different backend services using Angular HttpClient, Routing Basics, Router Links, Route Guards, Asynchronous Routing, Nested Routes.
	.

Textbooks:	
1.	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson
2.	Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly
3.	Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
4.	MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow,O'Reilly.

Reference Books:	
1.	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book,1st Edition, Dream Tech.
2.	An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda SKatila, Cengage Learning

e-Resources	
1.	https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overvie w (HTML5)
2.	https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overvie w (Javascript)
3.	https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overvie w (Node.js & Express.js)
4.	ttps://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview (Typescript) https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overvie w (Angular JS)
5.	https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/ overvie w (MongoDB)

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3206	PE	3	--	--	3	30	70	3 Hrs.

DESIGN PATTERNS

(For IT)

Course Objectives:

1.	Demonstration of patterns related to object oriented design
2.	Describe the design patterns that are common in software applications
3.	Analyze a software development problem and express it
4.	Design a module structure to solve a problem, and evaluate alternatives
5.	Implement a module so that it executes efficiently and correctly

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

S.No	Outcome	Knowledge Level
1.	Construct a design consisting of a collection of modules	K3
2.	Examine well-known design patterns (such as Iterator, Observer, Factory and Visitor)	K3
3.	Distinguish between different categories of design patterns	K3
4.	Ability to understand and apply common design patterns to incremental /iterative development	K3
5.	Identify appropriate patterns for design of given problem	K3
6.	Design the software using Pattern Oriented Architectures	K3

SYLLABUS

UNIT-I (10Hrs)	Introduction: Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern. A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.

UNIT-II (10 Hrs)	Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

UNIT-III (10 Hrs)	Structural Pattern: Adapter, Bridge, Composite, Decorator, açade, Flyweight, Proxy.

UNIT-IV **(10 Hrs)**	Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer.
UNIT-V **(10 Hrs)**	Behavioral Patterns: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, a Brief History, the Pattern Community an Invitation, a Parting Thought.
	.

Textbooks:	
1.	"Design Patterns", Erich Gamma, Pearson Education.

Reference Books:	
1.	"Head First Design patterns", Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
2.	"Design Patterns in Java", Steven John Metsker & William C. Wake, Pearson education, 2006
3.	"J2EE Patterns", Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
4.	"Design Patterns in C#", Steven John metsker, Pearson education, 2004.
5.	"Pattern Oriented Software Architecture", F.Buschmann & others, John Wiley & Sons.

e-Resources	
1.	https://www.javatpoint.com/design-patterns-in-java
2.	2. https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm
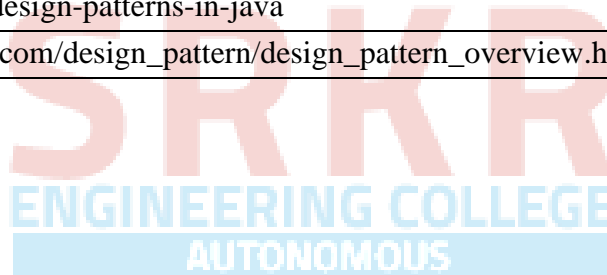
Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3207	PE	3	--	--	3	30	70	3 Hrs.

SCRIPTING LANGUAGES

(For IT)

Course Objectives: :

1.	Understand the concepts of scripting languages for developing web based projects
2.	Illustrates object oriented concepts like PHP, PYTHON, PERL
3.	Create database connections using PHP and build the website for the world
4.	Demonstrate IP address for connecting the web servers
5.	Analyze the internet ware application, security issues and frame works for application

Course Outcomes: After the completion of the course, student will be able to do the following

S.No	Outcome	Knowledge Level
1.	Ability to understand the PERL scripting languages	K2
2.	Understand the fundamentals of PHP to develop secured web application	K3
3.	Explain syntax and variables in TCL	K2
4.	Master an understanding of python especially the object-oriented concepts	K2

SYLLABUS

UNIT-I (10Hrs)	Introduction to PERL and Scripting: Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

UNIT-II (10 Hrs)	Advanced PERL: Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues. PHP Basics: PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT-III (10 Hrs)	Advanced PHP Programming: PHP and Web Forms, Files, PHP Authentication and Methodologies Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.

UNIT-IV **(10 Hrs)**	TCL: TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures ,input/output, procedures , strings , patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk-Visual Tool Kits, Fundamental Concepts of Tk ,Tk by example, Events and Binding , Perl-Tk.
UNIT-V **(10 Hrs)**	Python: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling. Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework

Textbooks:	
1.	1. The World of Scripting Languages, David Barron, Wiley Publications.
2.	Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3.	Beginning PHP and My SQL, 3rd Edition, Jason Gilmore, A press Publications (Dream tech).

Reference Books:	
1.	Open Source Web Development with LAMP using Linux, Apache, My SQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education. Programming Python,M.Lutz,SPD.
2.	PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications
3.	Tcl and the Tk Tool kit, Ousterhout, Pearson Education
4.	PHP and My SQL by Example, E.Quigley, Prentice Hall (Pearson).
5.	Perl Power, J.P.Flynt, Cengage Learning.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3208	PE	3	--	--	3	30	70	3 Hrs.

BIG DATA ANALYTICS

(For IT)

Course Objectives:

1.	To optimize business decisions and create competitive advantage with Big Data analytics
2.	To learn to analyze the big data using intelligent techniques
3.	To introduce programming tools PIG & HIVE in Hadoop echo system

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

S.No	Outcome	Knowledge Level
1.	**Identify** the characteristics of datasets and compare the trivial data and big data for various applications. Illustrate big data challenges in different domains.	K2
2.	**Explore** various techniques for mining data streams in real time analytics	K3
3.	**Explore** the features of Distributed File System in Hadoop framework.	K3
4.	**Illustrate** the features of Map-Reduce programming model to analyze the big data in Hadoop environment.	K3
5.	**Explore** the tools in Hadoop Eco system and Data Visualization techniques.	K3

SYLLABUS

UNIT-I (10 Hrs)	**Introduction:** Introduction to big data: Types of data, Characteristics of Big Data, Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.
UNIT-II (10 Hrs)	**Stream Processing:** Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams: Blooms Filter, Counting Distinct Elements in a Stream: FM Algorithm, Estimating Moments, Counting 1's in a Window: DGIM Algorithm, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Study - Real Time Sentiment Analysis.
UNIT-III (10 Hrs)	**Introduction to Hadoop:** History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics.
UNIT-IV (10 Hrs)	**Developing a Map Reduce Application:** How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

UNIT-V (10 Hrs)	**Frameworks and Applications:** Hadoop Echo System, Applications on Big Data Using Pig, Pig Architecture, Data processing operators in Pig, Applications on Big Data Using Hive, Hive Architecture, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper. Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

Text Books:	
1.	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition, 2015.
2.	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
3.	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.

Reference Books:	
1.	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
2.	Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data:The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
3.	Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT, 2016.
4.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3209	PC	-	--	3	1.5	15	35	3 Hrs.

MACHINE LEARNING USING PYTHON LAB

(For IT)

Course Objectives:

1	learn and understand different Data sets in implementing the machine learning algorithms.

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

S.No	Outcome	Knowledge Level
1	Implement procedures for the machine learning algorithms	K3
2	Design and Develop Python programs for various Learning algorithms	K4
3	Apply appropriate data sets to the Machine Learning algorithms	K3
4	Develop Machine Learning algorithms to solve real world problems	K4

SYLLABUS

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier
5	Develop a program for Bias, Variance, Remove duplicates , Cross Validation
6	Write a program to implement Categorical Encoding, One-hot Encoding
7	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
8	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
9	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

11	Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
12	Exploratory Data Analysis for Classification using Pandas or Matplotlib.
13	Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set
14	Write a program to Implement Support Vector Machines and Principle Component Analysis
15	Write a program to Implement Principle Component Analysis
Reference Books:	
1	Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3210	PC	-	--	3	1.5	15	35	3 Hrs.

COMPUTER NETWORKS LAB
(For IT)

Course Objectives:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Know how reliable data communication is achieved through data link layer.	K3
2.	Suggest appropriate routing algorithm for the network.	K3
3.	Analyze data link layer services, functions and protocols like HDLC.	K4
4.	Provide internet connection to the system and its installation.	K4
5.	Work on various network management tools	K3

SYLLABUS

1.	Study of Network devices in detail and connect the computers in Local Area Network.
2.	Write a Program to implement the data link layer farming methods such as Character stuffing ii) bit stuffing.
3.	Write a Program to implement data link layer farming method checksum.
4.	Write a program for Hamming Code generation for error detection and correction
5.	Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6.	Write a Program to implement Sliding window protocol for Goback N.
7.	Write a Program to implement Sliding window protocol for Selective repeat.
8.	Write a Program to implement Stop and Wait Protocol.
9.	Write a program for congestion control using leaky bucket algorithm
10.	Write a Program to implement Dijkstra's algorithm to compute the Shortest path through a graph
11.	Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12.	Write a Program to implement Broadcast tree by taking subnet of hosts.
13.	Wiresharki. Packet Capture Using Wire shark ii. Starting Wire shark iii. Viewing Captured Traffic iv. Analysis and Statistics & Filters.
14.	How to run Nmap scan

15.	Operating System Detection using Nmap
16.	Do the following using NS2 Simulatori. NS2 Simulator-Introduction ii. Simulate to Find the Number of Packets Dropped iii. Simulate to Find the Number of Packets Dropped by TCP/UDP iv. Simulate to Find the Number of Packets Dropped due to Congestion v. Simulate to Compare Data Rate& Throughput.
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Textbooks:	
1.	Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2.	Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.
3.	Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016
Reference Books:	
1.	Data Communications and Networks- Achut S Godbole, AtulKahate
2.	Computer Networks, Mayank Dave, CENGAGE

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3211	**PC**	**-**	**--**	**3**	**1.5**	**15**	**35**	**3 Hrs.**

BIG DATA ANALYTICS LAB

(For IT)

Course Objectives: Students need to

1	Understand Distributed Systems and Parallel Processing.
2	implement distributed applications using Hadoop platform

Course Outcomes: By the end of this lab sessions Students will be able to

S.No	Outcome	Knowledge Level
1	**Install** Hadoop Distributed File system in sudo distributed and Fully distributed mode	K3
2	**Implement** Map Reduce Programs for different applications	K3
3	**Setup** different tools like Pig and Hive on top of HDFS	K3
4	**Write** different scripts and Queries on Pig and Hive tools	K3

SYLLABUS

1.	**Hadoop:** https://hadoop.apache.org/release/2.7.6.html
2.	**Java:** https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html
3.	**Eclipse**

Software Requirements: https://www.eclipse.org/downloads/

Exp No	List of Experiments:
1	**Week 1, 2:** 1. Implement the following Data structures in Java a) Linked Lists b) Stacks c) Queues d) Set e) Map
2	**Week 3:** 2. (i) Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed (ii) Use web based tools to monitor your Hadoop setup.

3	**Week 4:** 3.Implement the following file management tasks in Hadoop: ☐ Adding files and directories ☐ Retrieving files ☐ Deleting files **Hint:** A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
4	**Week 5:** 4. Run a basic Word Count MapReduce program to understand MapReduce Paradigm.
5	**Week 6:** 5. Write a map reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.
6	**Week 7:** 6.Use MapReduce to find the shortest path between two people in a social graph. **Hint**: Use an adjacency list to model a graph, and for each node store the distance from the original node, as well as a back pointer to the original node. Use the mappers to propagate the distance to the original node, and the reducer to restore the state of the graph. Iterate until the target node has been reached.
7	**Week 8:** 7. Implement Friends-of-friends algorithm in MapReduce. **Hint:** Two MapReduce jobs are required to calculate the FoFs for each user in a social network.The first job calculates the common friends for each user, and the second job sorts the common friends by the number of connections to your friends.
8	**Week 9:** 8. Implement an iterative PageRank graph algorithm in MapReduce. **Hint:** PageRank can be implemented by iterating a MapReduce job until the graph has converged. The mappers are responsible for propagating node PageRank values to their adjacent nodes, and the reducers are responsible for calculating new PageRank values for each node, and for re-creating the original graph with the updated PageRank values.
9	**Week 10:** 9. Perform an efficient semi-join in MapReduce. **Hint:** Perform a semi-join by having the mappers load a Bloom filter from the Distributed Cache, and then filter results from the actual MapReduce data source by performing membership queries against the Bloom filter to determine which data source records should be emitted to the reducers.
10	**Week 11:** 10. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

11	**Week 12:** 11. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes
Reference Books:	
1	Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.
2	Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3	Hadoop in Practice by Alex Holmes, MANNING Publishers
4	Mining of massive datasets, Anand Rajaraman, Jeffrey D Ullman, Wiley Publications

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3212	**SOC**	**1**	**--**	**2**	**2**	**--**	**50**	**3 Hrs.**

DATA SCIENCE: NATURAL LANGUAGE PROCESSING

(For IT)

Course Objectives:

1	This course will enable students to learn about data science and its applications.

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

S.No	Outcome	Knowledge Level
1	Explore natural language processing (NLP) libraries in Python.	**K2**
2	Learn various techniques for implementing NLP including parsing & text processing.	**K2**
3	Understand how to use NLP for text feature engineering	**K2**

SYLLABUS

1	Demonstrate Noise Removal for any textual data and remove regular expression pattern such as hash tag from textual data.
2	Perform lemmatization and stemming using python library nltk.
3	Demonstrate object standardization such as replace social media slangs from a text.
4	Perform part of speech tagging on any textual data.
5	Implement topic modeling using Latent Dirichlet Allocation (LDA) in python.
6	Demonstrate Term Frequency – Inverse Document Frequency (TF – IDF) using python
7	Demonstrate word embeddings using word2vec
8	Implement Text classification using naïve bayes classifier and text blob library.
9	Apply support vector machine for text classification.
10	Convert text to vectors (using term frequency) and apply cosine similarity to provide closeness among two text.
11	Case study 1: Identify the sentiment of tweets In this problem, you are provided with tweet data to predict sentiment on electronic products of netizens.
12	Case study 2: Detect hate speech in tweets. The objective of this task is to detect hate speech in tweets. For the sake of simplicity, we say a tweet contains hate speech if it has a racist or sexist sentiment associated with it. So, the task is to classify racist or sexist tweets from other tweets.

Web References:	
1	https://www.analyticsvidhya.com/blog/2017/01/ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python/
2	https://datahack.analyticsvidhya.com/contest/linguipedia-codefest-natural-language-processing-1/?utm_source=ultimate-guide-to-understand-implement-natural-language-processing-codes-in-python&utm_medium=blog
3	https://www.analyticsvidhya.com/blog/2018/07/hands-on-sentiment-analysis-dataset-python/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3213	SOC	1	--	2	2	--	50	3 Hrs.

VIDEO ANALYTICS

Course Objectives: students are expected to

1	Perform motion estimation, modeling and digital video processing.
2	Do image recognition and motion recognition

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

S.No	Outcome	Knowledge Level
1	Illustrate the principles and techniques of digital image	K2
2	Demonstrate the image recognition and motion recognition	K2
3	Discuss the fundamentals of digital video processing	K1
4	Illustrate the motion estimation, segmentation and modeling	K3
5	Analyze video processing in applications	K4

SYLLABUS

Note: Implement the following applications using MATLAB/Open CV/Python

1	Image enhancement application
2	Object/image recognition applications based on digital image transforms.
3	Image analysis systems for object recognition
4	Content Based Image Retrieval
5	Image compression, Image Fusion
6	Image Steganography, Watermarking
7	Video Enhancement and Noise Reduction
8	Motion Estimation and Segmentation
9	Motion Tracking
10	Multi-target/Multi-camera tracking
	Action Recognition List of Augmented Experiments: (Weeks 13 – Week 16) (Any two of the following experiments can be performed)
1.	Implement Optical character recognition
2.	Implement Image Captioning and Visual Question Answering
3.	Implement Gesture Recognition.
4.	Implement Smart Surveillance and Tracking

Reference Books:

1	"Practical Image and Video Processing Using MATLAB", Oge Marques,Wiley-IEEE Press,2011

2	"Image Engineering: Processing, Analysis and Understanding", Yu Jin Zhang, Tsinghua University Press, 2009
3	"Object Detection and Recognition in Digital Images: Theory and Practice", Boguslaw Cyganek ,Wiley 2013

Code	Category	L	T	P	C	I.M	E.M	Exam
B20IT3214	SOC	1	--	2	2	--	50	3 Hrs.

DISTRIBUTED TECHNOLOGIES-MONGODB

(For IT)

Course Objectives: This Course will enable students to

1	Master the leading document-oriented NoSQL database, MongoDB Architecture, CRUD, Schema
2	Design, Data Modelling and Indexing using real-life case studies
3	Learn how to design Schema using Advanced Queries Course Outcomes

Course Outcomes: At the end of the course the student will be able to:

S.No	Outcome	Knowledge Level
1	Install, configure and setup the drivers to use MongoDB with your programming language of choice	K6
2	Gain an in-depth understanding of main features of MongoDB and their use cases	K2
3	Retrieve data in the database using advanced querying	K2
4	choice to build new types of applications for mobile, cloud, e-commerce and and social technologies Perform Experiments related to the following concepts	K3

SYLLABUS

1	MongoDB on Windows
2	MongoShell
3	Databases, Documents
4	Collections
5	MongoDB Connections
6	Query and Projection
7	Operators
8	Agrregation Pipeline Operators
9	Database Commands
10	Shell Methods

Code	Category	L	T	P	C	I.M	E.M	Exam
B20MC3201	MC	3	--	--	--	--	--	3 Hrs.

EMPLOYABILITY SKILLS

(Common to AIDS, CSBS, CSE, ECE & IT)

Part-A: Verbal Ability

Course Objectives:

1.	To introduce concepts required in framing grammatically correct sentences and identifying errors While using Standard English.
2.	To familiarize the learner with high frequency words as they would be used in their professional career.
3.	To inculcate logical thinking in order to frame and use data as per the requirement
4.	To acquaint the learner of making a coherent and cohesive sentences and paragraphs for composing a written discourse.
5.	To familiarize students with soft skills and how it influences their professional grow.

Course Outcomes: The students will be able to

S.No	Outcome	Knowledge Level
1	Detect grammatical errors in the text/sentences and rectify them while answering their competitive/company specific tests and frame grammatically Correct sentences while writing.	K3
2	Answer questions on synonyms, antonyms and other vocabulary-based Exercises while attempting CAT, GRE, GATE and other related tests.	K3
3	Use their logical thinking ability and solve questions related to analogy, Syllogisms, and other reasoning-based exercises.	K3
4	Choose the appropriate word/s/phrases suitable to the given context in order to make the sentence/paragraph coherent.	K3

SYLLABUS

UNIT-I	Spotting Errors, Sentence Improvement
UNIT-II	Synonyms, Antonyms, Frequently Confused Words, Foreign Phrases, Idioms and Phrasal Verbs, Collocations.
UNIT-III	Foreign Phrases, Idioms and Phrasal Verbs, Collocations, Analogies, Odd One Out
UNIT-IV	Sentence completion, Sentence Equivalence, Close Test
UNIT-V	Reading Comprehension, Para Jumbles

Text Books:	
1.	Oxford Learners,, Grammar–Finder by John Eastwood, Oxford Publication.
2.	RS Agarwal books on objective English and verbal reasoning
3.	English Vocabulary in Use-Advanced, Cambridge University Press
4.	Collocations In Use, Cambridge University Press
5.	Soft Skills & Employability Skills by Samina Pillai and Agna Fernandez, Cambridge University Press India Pvt .Ltd.
6.	Soft Skills, by Dr.K.Alex, S. Chand & Company Ltd., New Delhi
Reference Books:	
1.	English Grammar in Use by Raymond Murphy, CUP
2.	Websites: Indiabix,800score, official CAT, GRE and GMAT sites
3.	Material from IMS, Career Launcher and Time institutes for competitive exams
4.	The Art of Public Speaking by Dale Carnegie
5.	The Leader in You by Dale Carnegie
6.	Emotional Intelligence by Daniel Golman
7.	Stay Hungry Stay Foolish by Rashmi Bansal
8.	I have a Dream by Rashmi Bansal.

Part-B: Quantitative Aptitude-I

Course Objectives:	
1.	To familiarize students with basic problems on numbers and ratios problems.
2.	To enrich the skills of solving problems on time, work, speed, distance and also Measurement of units.
3.	To enable the students to work efficiently on percentage values related to shares, profit and Loss problems.
4.	To inculcate logical thinking by exposing the students to reasoning related questions.
5.	To inculcate logical thinking by exposing the students to reasoning related questions.

Course Outcomes:

S.No.	Course Outcome	Knowledge Level
1.	The students will be able to perform well in calculating on number problems and various units of ratio concepts	K3
2.	The students will be able to solve problems on time and distance and units related solutions	K3
3.	The students will become adept in solving problems related to profit and loss, in specific, quantitative ability	K3
4.	The students will present themselves well in the recruitment process	K3

	using analytical and logical skills which he or she developed during the course as they are very important for any person to be placed in the industry	
5.	The students will earn to apply Logical thinking to the problems of Syllogisms and be able to effectively attempt competitive examinations like CAT, GRE, GATE for further studies	K3
	SYLLABUS	
UNIT-I	Numbers, LCM and HCF, Chain Rule, Ratio and Proportion Importance of different types of numbers and uses of them: Divisibility tests, finding remainders in various cases, Problems related to numbers, Methods to find LCM, Methods to find HCF, applications of LCM, HCF. Importance of chain rule, Problems on chain rule, Introducing the concept of ratio in three Different methods, Problems related to Ratio and Proportion	
UNIT-II	Time and work, Time and Distance Problems on manpower and time related to work, Problems on alternate days, Problems on hours of working related to clock, Problems on pipes and cistern, Problems on combination of the some or all the above, Introduction of time and distance, Problems on average speed, Problems on Relative speed, Problems on trains, Problems on boats and streams, Problems on circular tracks, Problems on polygonal tracks, Problems on races.	
UNIT-III	Percentages, Profit Loss and Discount, Simple interest, Compound Interest, Partnerships, shares and dividends. Problems on percentages-Understanding of cost price, selling price, marked price, discount, percentage of profit, percentage of loss, percentage of discount, Problems on cost price, selling price, market price, discount. Introduction of simple interest, Introduction of compound interest, Relation between simple interest and compound interest, Introduction of partnership, Sleeping partner concept and problems, Problems on shares and dividends, and stocks.	
UNIT-IV	Introduction, number series, number analogy, classification, Letter series, ranking, directions Problems of how to find the next number in the series, Finding the missing number and related sums, Analogy, Sums related to number analogy, Ranking of alphabet, Sums related to Classification, Sums related to letter series, Relation between number series and letter series, Usage of directions north, south, east, west, Problems related to directions north, south, east, west.	
UNIT-V	Data sufficiency, Syllogisms Easy sums to understand data sufficiency, Frequent mistakes while doing data sufficiency, Syllogisms Problems.	
Text Books:		
1.	Quantitative aptitude by RS Agarwal	

2.	Verbal and nonverbal reasoning by RS Agarwal
3.	Puzzles to puzzle you by shakunatala devi.

References:	
1.	Barrons by Sharon Welner Green and IraK Wolf (Galgotia Publications pvt. Ltd.)
2.	Websites: m4maths, Indiabix, 800score, official CAT, GRE and GMAT sites
3.	Material from IMS, Career Launcher and Time,, institutes for competitive exams
4.	Books for CAT by Arun sharma.
5.	Elementary and Higher algebra by HS Hall and SR Knight.
Websites:	
1.	www.m4maths.com
2.	www.Indiabix.com
3.	www.800score.com
4.	Official GRE site
5.	Official GMAT site

Code	Category	L	T	P	C	I.M	E.M	Exam
B20HS3204	HS	2	--	--	--	--	--	--

GENDER SENSITIZATION

(Common to ALL Branches)

Course Objectives:

1.	To develop students' sensibility with regard to issues of gender in contemporary India.
2.	To provide a critical perspective on the socialization of men and women.
3.	To introduce students to information about some key biological aspects of genders.
4.	To help students reflect critically on gender violence and workplace security.
5.	To expose students to more egalitarian interactions between men and women.

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

S.No	Outcome	Knowledge Level
1.	Understand the important issues relating to gender in contemporary India.	K2
2.	Get sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender.	K2
3.	Attain a finer grasp of how gender discrimination works in our society and how to counter it.	K2
4.	Acquire insight into the gendered division of labour and its relation to politics and economics.	K2
5.	Develop a sense of appreciation for both men and women in all walks of life.	K3

SYLLABUS

UNIT-I	**Understanding Gender and Related Concepts - Gender in Everyday Life** Introduction: Conceptual Connotation – Sex and Gender – Basic Gender Concepts - Gendered Socialization – Gender Stereotypes –Exploring Attitudes towards Gender – Gender Roles & Relationships - Myths – Gender in Indian society – Early days – Later Vedic Period –Medieval and British Period – Independent India.
UNIT-II	**Introduction to Gender Justice- Notion and Significance** Division and Valuation of Work – Housework- The Invisible Work - "My Mother doesn't work," - Offences against Women –Fact and Fiction - Status of Women in Society – Gender and Human Rights - Gender Equality – Gender Justice – Notion and Significance
UNIT-III	**International and Constitutional Perspectives on Gender Equality** The International Bill of Rights, 1979 –Declaration on the Elimination of Violence against women 1993 –The Rights of Women –Beijing Platform for Action 1995 – Constitutional Guarantees – Fundamental Rights – Equality.

	Gender and Culture
UNIT-IV	Gender and Film - Gender and Electronic Media – Gender and Advertisement – Gender and Popular Literature – Gender Issues - Gender-Sensitive Behaviour – Gender being Together as Equals.
UNIT-V	**Gender Violence- Within and Beyond** Violence – Gender Violence – Types of Gender Violence –Gender Violence in Indian Perspective – -Women Specific Legislations for the Elimination of Violence Within and Beyond.

Reference Books:

1.	"Towards A World Of Equals: A Bilingual Textbook on Gender" by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas, and Susie Tharu, Published by Telugu Akademi (2015).
2.	Ferber, Holcomb & Wentling, Sex, Gender & Sexuality: The New Basics, Oxford Univ. Press 2008.
3.	Flavia Agnes, Sudhir Chandra, Monmayee Basu, Women and Law in India, Oxford Univ. Press 2004.
4.	Mamta Rao, Law Relating to Women and Children, Eastern Book Co, Lucknow.
5.	K.I. Vibhute, Criminal Law, Lexis Nexis, 12th Edn.
6.	N. Prabha Unnithan (ed.), Crime & Justice in India, Sage Pub., 2013.
7.	Ritu Gupta, Sexual Harassment at Workplace, Lexis Nexis, 2013.
8.	IGNOU: Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi IGNOU.

Web links:

1.	https://nptel.ac.in/courses/110105080
2.	https://www.youtube.com/watch?v=2Xfp2eiTte0
3.	https://www.youtube.com/watch?v=-FCEBe5VNcA&t=41s
4.	https://www.youtube.com/watch?v=7n9IOH0NvyY
5.	https://www.youtube.com/watch?v=dpC2jGqu4G0
6.	https://www.youtube.com/watch?v=kcW4ABcY3zI&t=99s
7.	https://www.youtube.com/watch?v=dlXw1PbnWKM
8.	https://www.youtube.com/watch?v=9bayaZ18_po
9.	https://www.youtube.com/watch?v=ZbLq23cGFV4&t=1662s
10.	https://www.youtube.com/watch?v=61aYvb0Vo68
11.	https://www.youtube.com/watch?v=728H4Khf7Gk&t=1793s
12.	https://www.youtube.com/watch?v=y2Yk-rSZ7PI
13.	https://www.youtube.com/watch?v=wSqFvcjDpos
14.	https://www.youtube.com/watch?v=AljDd7nj9wE
15.	https://www.youtube.com/watch?v=MKPM0f2fOjM