Department of Computer Science and Engineering
(Accredited by NBA)

Vision of the Department

To craft professionally skilled engineers with research orientation, innovative insights and a passion for life-long learning to meet the needs of Industry and Society.

Mission of the Department

M1: To offer need based curriculum in collaboration with industry.

M2: To inculcate professional skills with innovative thinking to address societal problems of multidisciplinary nature.

M3: To provide a congenial environment to learn and exhibit soft skills.

M4: To promote research culture and the need for life-long learning.

Program Educational Objectives (PEOs) - UG

PEO1: Excel in professional career and higher education by acquiring knowledge inmathematical, computing and engineering principles.

PEO2: Analyse societal problems and provide technically competent solutions.

PEO3: Possess academic excellence through innovative insights, soft skills and life-long learning.

Program Outcomes (POs) - UG Engineering Graduates will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineeringactivities, with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs) - UG

PSO1: Demonstrate the uses of knowledge by writing programs and integrate them with hardware/software products in multidisciplinary environment.

PSO2: Participate in planning and implementation of solutions to cater the industry specificrequirements.

Scheme of Teaching and Examination-2020

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2020-21)

V Semester BE **Academic year: 2023-24**

V Semester B.E. Computer Science and Engineering (Subjects and Syllabus as per AICTE-Model Curriculum for UG Course in Engg. & Tech.- Jan. 2018)						**Teaching Hours/week**				**Examination**			
Sl No.	**Course and Course Code**		**Course Title**	**Teaching dept.**	**Board of Exam**	**L**	**T**	**P**	**C**	**Duration in Hrs.**	**CIE**	**SEE**	**Total Marks**
01	PC	CS5TH1	Web Technologies	CS	CS	3	-	-	3	3	50	50	100
02	PC	CS5TH2	Object Oriented Modelling & Design	CS	CS	3	-	-	3	3	50	50	100
03	PC	CS5TH3	Data Communication	CS	CS	3	-	-	3	3	50	50	100
04	PC	CS5TH4	Database Management System	CS	CS	3	-	-	3	3	50	50	100
05	PE	CS5PE5x	Professional Elective-I	CS	CS	3	-	-	3	3	50	50	100
06	OE	CS5OE6x	Open Elective-I	CS	CS	3	-	-	3	3	50	50	100
07	PC	CS5MP1	Mini Project-I	CS	CS	-		4	2		50	50	100
08	PC	CS5LB1	Database Lab	CS	CS	-	-	3	1.5	3	50	50	100
09	PC	CS5LB2	Web Technology Lab	CS	CS	-	-	3	1.5	3	50	50	100
10	HS	SK5DP3	Skill Development-III	HS	HS	-	-	2	1	3	50	-	50
						18	**-**	**12**	**24**	**27**	**500**	**450**	**950**

Professional Elective I	**Code**	**Subject Name**
	CS5PE51	Advanced Data Structure
	CS5PE52	Fundamentals of Digital Image Processing
	CS5PE53	Unix System Programming

Open Elective I	**Code**	**Subject Name**
	CS5OE61	Data Structure and Algorithms
	CS5OE62	Database Management System
	CS5OE63	Operating System

Department: Computer Science & Engineering		**Semester:**	**V**
Subject: Web Technologies			
Subject Code:	CS5TH1	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	To introduce the fundamentals of the Internet, and the principles of web design.
2	To construct basic websites using HTML and Cascading Style Sheets.
3	To build dynamic web pages with validation using Java Script, J Query objects and by applying different event handling mechanisms.
4	To develop modern interactive web applications using JAVA

Unit	Description	Hrs
I	**Introduction to Web**: Definitions and history, The client server model,(till 1.3.5)where is the internet?, Domain Name system, Uniform Resource locators, **Introduction to HTML:** what is HTML? And where did it come from, HTML syntax, Semantic Markup, structure of HTML documents, Quick tour of HTML elements, HTML5 Semantic structure elements. HTML Tables and forms: Introducing Tables, styling Tables, Introducing forms, form control elements, Table and form accessibility, Micro formats.	8
II	**Introduction to Cascaded Style Sheet:** What is CSS? CSS syntax, Location of styles, Selectors, The cascade: how styles interact, The Box model, CSS text styling. JavaScript: Client side scripting: What is JavaScript and what can it do, JavaScript design Principles. Where does JavaScript go, syntax, JavaScript objects, The Document Object model (DOM), JavaScript events, Forms, J Query foundations (15.2).	8
III	**Web Frameworks** **Introducing Bootstrap 4:** Aadvantages, Implementing frame work files, Inserting the JavaScript files, starter template, Normalizing and Rebooting, Taking the starter template further, Using a static site generator, Converting the base template to a generator, Setting up the layout, Working with layouts: layouts, containers, creating a three column layout, **Working with content:** Reboot defaults and basics, how to style images, coding tables, **Playing with components:** Buttons, outlines, checkbox, radio etc.,	8
IV	**JDBC:** The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC / ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data types; Exceptions.	8
V	**Servlet:** Background; The Life Cycle of a Servlet; Servlet Development Options, Using Tomcat; A simple Servlet; The Servlet API; The javax. servlet Package; Reading Servlet Parameter; The javax. servlet. http package; Handling HTTP Requests and Responses, Using Cookies, Session Tracking. **JSP:** Java Server **Pages:** JSP, JSP Tags, Request string User Sessions, Cookies, Session Objects.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the fundamentals of web Technologies.
CO2	Design and validation of webpages using cascaded style sheets and frameworks.
CO3	Apply the JDBC APIs for accessing databases.
CO4	Illustrate the use of servlet APIs and JSP Scriplets
CO5	Design single page websites.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	1	3	2				1				2
CO2	1	3	2	1	2									3
CO3	1	1	2	2	3									1
CO4	1	1	2	2	3									3

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Web Development	Randy Connollyy, Ricardo Hoar	2nd edition, Pearson, 2017, ISBN 13: 978-0-13-340715-0
2	Learning Bootstrap 4	Matt Lambert	2nd edition, PACKT Publishing(open source), 2016 ISBN 978-1-78588-100-8
3	Java - The Complete Reference	Herbert Schildt	9th Edition, Tata McGraw Hill, 2014 ISBN: 978-1-25-900659-3
4	J2EE - The Complete Reference	Jim Keogh	Enterprise Edition, Tata McGraw Hill, ISBN-13:978-0-07-052912-0 ISBN-10: 0-07-052912-4

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Programming the World Wide Web	Robert. W. Sebesta	8th edition, Pearson,2015, ISBN-13: 978-0-13-377598-3
2	Introduction to Java Programming	Y Daniel Liang	10th edition, PHI ISBN-13: 978-0133761313 ISBN-10: 0133761312
3	The Java® Language Specification	James Gosling Bill Joy, Guy Steele Gilad Bracha Alex Buckley	Java SE 7 Edition ISBN-13: 978-0133260229 ISBN-10: 0133260224

Sl. No	Course Objectives
1	Apprehend the basic Object Oriented Modeling concepts with UML notations.
2	Describe the overview of Object Oriented Software Development Process.
3	Understand modeling concepts for the Object Oriented Analysis of real world applications.
4	Learn various modeling concepts for the Object Oriented Design and Implementation of real world applications.

Unit	Description	Hrs
I	**Introduction** What is Object Orientation? What is Object Oriented development? Object Oriented themes. **Modeling as Design Technique** Modeling; abstraction; The three models. **Class Modeling** Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models. Advanced class modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages;	8
II	**State Modeling** Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. **Interaction Modeling** Use case models; Sequence models; Activity models; Use case relationships; Procedural sequence models; Special constructs for activity models.	8
III	**Process Overview** Development stages; Development life cycle. System Conception Devising a system concept; elaborating a concept; preparing a problem statement **Domain Analysis** Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. **Application Analysis** Application interaction model; Application class model; Application state model; Adding operations	8
IV	**System Design** Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.	8
V	**Class Design** Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. Implementation modeling Overview of implementation, Fine tuning classes, Fine tuning generalizations, Realizing associations.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the basic concepts of Object Oriented Modeling.
CO2	Formulate and Interpret Object Oriented Models.
CO3	Construct Domain and Application Analysis Models.
CO4	Build Design and Implementation Models

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-										1		
CO2	2	2										1		
CO3	2	2	1		2							1		
CO4	2	3	2	2	2		2					1		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Object-Oriented Modeling and Design with UML	Michael R Blaha, James R Rumbaugh	2nd Edition, Pearson Education, 2005, ISBN-13:978-0130159205

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Object-Oriented Analysis And Design with Applications	Grady Booch et al	3rd Edition, Pearson, 2007, ISBN:9780201895513
2	Practical Object-Oriented Design with UML	Mark Priestley	2nd Edition, Tata McGraw-Hill, 2003. ISBN:9780077103934
3	The Unified Modeling Language User Guide	Booch, G., Rumbaugh, J., and Jacobson	2nd Edition, Pearson, 2005, ISBN:9780201571684

Department: Computer Science & Engineering		**Semester:**	**V**
Subject: Data Communication			
Subject Code:	**CS5TH3**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	Understand the basiCS5TH2cs of data communication
2	Describe the types of transmission and conversion techniques for exchange of data between two or more networks
3	Understand the error detection and correction techniques
4	Acquire the knowledge of services and features of various protocols

Unit	Description	Hrs
I	**Data Communications and Network Models** Introduction: Data communications: Components, Data Representation, Data Flow, Networks: Network Criteria, Physical structure, Network Types, Local Area Network, Wide Area Network, switching, The Internet, Standards and Administration: Internet Standards, Internet Administration. Network models: Protocol Layering: Scenarios, Principles of layering, Logical Connection, TCP/IP Protocol Suite: Layered architecture, Layers in the TCP/IP Protocol Suite, Description of each layer, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model, OSI versus TCP/IP.	8
II	**Physical Layer and Media** Data and Signals: Analog and digital Data, Analog and Digital Signals, Periodic and Non-periodic, Digital Signals,: Bit rate , Bit Length, Digital Signal as a composite Analog signal, Transmission of Digital Signals. Transmission impairment: Attenuation, Distortion, Noise. Data rate limits: Noiseless Channel-Nyquist Bit Rate, Noisy Channels-Shannon Capacity, Using both limits. Performance: Bandwidth, Throughput, Latency, Bandwidth Delay Product, Jitter. Digital Transmission: Digital-to-Digital conversion; Analog-to-Digital conversion; Transmission modes.	8
III	**Physical Layer and Media Contd...** Analog Transmission: Digital - to - Analog conversion; Analog - to - Analog conversion. Bandwidth Utilization: Multiplexing; Spread spectrum. Transmission media: Guided media, unguided media Switching: Three Methods of Switching, Switching and TCP/IP Layer, Circuit switched networks, Packet Switching: Data gram networks Virtual-circuit networks, Structure of a switch.	8
IV	**Data Link layer** Introduction, Link-Layer Addressing, Error Detection and Correction:	8

	Introduction, Block coding; Cyclic Codes: Cyclic Redundancy Check, Polynomials, Cyclic Code Encoder using Polynomials, Cyclic Code Analysis, Advantages of Cyclic Codes, Other Cyclic Codes, Hardware Implementation, Checksum, Forward Error Correction, Data Link Control: DLC Services, Data-Link Layer Protocols, HDLC, Point-to-Point Protocol, Media Access Control: Random Access, Controlled Access, Channelization.	
V	Data Link layer Contd... **Wired LANs:** Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LAN's: Introduction, IEEE 802.11 Project, Bluetooth. - Architecture, Bluetooth Layers, Connecting Devices and Virtual LANs: Connecting Devices, Virtual LANs,	8

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the general principles of data communication
CO2	Identify the different types of signals and data codes for data communication
CO3	Analyze flow control and error control mechanisms and apply them using standard protocols
CO4	Identify the different types of communication media and compare the performance
CO5	Illustrate the applications of OSI & TCP/IP Model

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1					2					2		
CO2	3	3	3	3			3					3		
CO3	3	3	3	3			3					3		
CO4	3	3	2	3			2					2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data Communications and Networking,	Behrouz A. Forouzan:	5th Edition, Tata McGraw Hill, 2006 978-1-25-906475-3

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Communication Network – Fundamental Concepts and Key Architectures	Alberto Leon-Garcia and Indra, Widjaja:	2nd Edition, Tata cGraw-Hill, 2004. 978-0-07-059501-9
2	Data and Computer Communication,	William Stallings	8th Edition, Pearson Education, 2007. 978-81-317-1536-9
3	Computer and Communication Networks	Nader F. Mir	Pearson Education, 2007, 978-81-317-1543-7
4	Computer Networks	Andrew S. Tanenbaum	4th Edition, Pearson Education,2008 978-01-306-6102-9

Department: Computer Science & Engineering		**Semester:**	**V**
Subject: Database Management System			
Subject Code:	**CS5TH4**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	Knowledge of the architecture and functioning of Database Management Systems.
2	Understand and apply the principles of data modeling using Entity Relationship and develop a good database design.
3	Understand the use of Structured Query Language (SQL) and NoSQL
4	Apply normalization techniques to normalize a database and understand the need of database transaction.

Unit	Description	Hrs
I	**Introduction :** Introduction, An example, Characteristics of Database approach, Actors on the scene, Workers behind the scene, Advantages of using DBMS approach, A brief history of database applications, when not to use a DBMS. Data models, schemas and instances, Three schema architecture and data independence, Database languages and interfaces, The database system environment, Centralized and client-server architectures, Classification of Database Management systems.	8
II	**Data Modeling using the Entity-Relationship (ER) Model :** Using High-Level Conceptual, Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship types of degree higher than two. Relational Database Design, Using ER- to-Relational Mapping. Relational Model : Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and dealing with constraint violations.	8
III	**SQL :** Data Definition and Data Types, Specifying constraints in SQL, Basic queries in SQL, Insert, Delete and Update statements in SQL, More complex SQL Queries, Views (Virtual Tables) in SQL, Schema change statements in SQL.	8
IV	**Database Design:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys. Transaction Management, ACID properties, Transaction and schedules, Introduction to ARIES and WAL Protocol.	8
V	**Introduction to NoSQL (Not Only SQL):** Where is it used? , what is it?, Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, What we miss with NoSQL?, use of NoSQL in industry, NoSQL vendors, SQL versus NoSQL, NewSQL Introduction, Comparison of SQL, NoSQL and NewSQL	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the concepts of database management system.
CO2	Design database using conceptual and relational model.
CO3	Illustrate various DBMS commands using SQL and NoSQL
CO4	Apply normalization for Relational schema.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											1		
CO2	3	3	3	2							2	3		
CO3	3	3	3	3	2		3	2				3		
CO4	1			2			3					2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Database Systems	Elmasri and Navathe	7th Edition, Pearson Education, 2017, ISBN-13: 978-9332582705.
2	Big data And Analytics	Seema Acharya, Subhashini Chellappan, Infosys Limited	Publication Wiley India Private Limited,1st Edition 2015. ISBN:978- 81-265-5478-2

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Database Management Systems	Raghu Ramakrishnan and Johannes Gehrke	3rd Edition, McGraw-Hill, 2014, ISBN-13:978-9339213114.
2	An Introduction to Database Systems	C.J. Date, A. Kannan, S. Swamynatham	8th Edition, Pearson education, 2017, ISBN-13:978-817585568.

Department: Computer Science & Engineering		**Semester:**	**V**
Subject: Advanced Data Structures and Algorithms			
Subject Code:	**CS5PE51**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	To provide the foundations of the practical implementation and usage of Algorithms and Data Structures
2	To extend the students' knowledge of algorithms and data structures
3	To enhance students expertise in algorithm design techniques.
4	To enhance students expertise in analysis of algorithms.

Unit	Description	Hrs
I	**Review of basic Data Structures:** Importance and need of good data structures and algorithms, Strategies for choosing the appropriate data structures. **Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, the recurrence – tree method, the master method.	**8**
II	**Advanced Data Structures:** Splay Trees, B-trees, Fenwick tree, Fibonacci heaps, Data Structures for Disjoint Sets, Augmented Data Structures.	**8**
III	**Graph Algorithms:** Bellman-Ford Algorithm, Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method.	**8**
IV	**Number -Theoretic Algorithms :** Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element;	**8**
V	**String-Matching Algorithms:** Naïve string Matching; Rabin - Karp algorithm; Knuth-Morris-Pratt algorithm.	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Explain advanced algorithm and practical problem solving skills.
CO2	Comprehend advanced data structures and its requirement.
CO3	Analyze the efficiency and prove the correctness.
CO4	Select appropriate data structures and algorithm design approaches in a problem specific manner.

Course Articulation Matrix

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											2		
CO2	2	2												
CO3			3											
CO4				3								2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Algorithms	T. H Cormen, C E Leiserson, R L Rivest and C Stein	3rd Edition, Prentice-Hall of India, 2010, ISBN-13:9780262033848

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Algorithm Design	Kleinberg J., Tardos	1st Edition, Pearson, 2012, ISBN-13:9780321295354

Department: Computer Science & Engineering		**Semester:**	**V**
Subject: Fundamentals of Digital Image Processing			
Subject Code:	**CS5PE52**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	Acquire fundamental concepts of digital image processing
2	Learn image preprocessing techniques
3	Gain the knowledge of extracting the features from digital image
4	Exposure to simulate simple image processing algorithms

Unit	Description	Hrs
I	**Introduction:** What is Digital Image Processing?, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Digital image representation, examples of field that use DIP. Simple image model, Sampling and quantization, some basic relationships between pixels, some basic transformations	**8**
II	**Digital image properties:** Histogram, Entropy, Eigen Values and Image quality metrics **Operations on digital images**: Addition, subtraction, multiplication and division. Logical operations: AND, OR and NOT. Spatial operations: Single pixel, neighborhood, contrast stretching, intensity slicing, Bit-plane slicing and power law transformations	**8**
III	**Image enhancement in the spatial domain:** Background, Basic gray level transformations, histogram processing, enhancement using arithmetic/logic operations, basics of spatial filtering, smoothing and sharpening spatial filters, combining spatial enhancement methods.	**8**
IV	**Image enhancement in the frequency domain:** Introduction to the frequency domain, smoothing and sharpening frequency domain filters, Homomorphic filtering, implementation, generation of spatial masks from frequency domain specifications, basics of color image processing	**8**
V	**Image segmentation:** Edge Detection - Line Detection - Curve Detection, Boundary Representation, Region Representation And Segmentation, Morphology-Dilation, Erosion, Opening And Closing	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the fundamental concepts of a digital image processing and pattern classification.
CO2	Analyze image preprocessing techniques.
CO3	Employ basic segmentation procedures to extract region of interest.
CO4	Apply suitable morphological operations for region description
CO5	Use modern tools to Simulate image processing concepts in a team.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											2		
CO2		2										2		
CO3			2	3								1		
CO4				3										

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Digital Image Processing using Mat Lab	R. C. Gonzalez, R. E. Woods	Publisher: Pearson-Prentice-Hall, ISBN: 0-13-008519-7,2nd Edition: 2018
2	Image Processing and Analysis	Jayaraman and Esaki Rajan	Mc Hill India, 2009
3	Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab	Toby Brecko	November 2018
4	Hands-On Image Processing with Python	by Sandipan Dey	November 2018 ISBN: 9781789343731

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Digital Image Processing	R. C. Gonzalez and R. E Woods	Publisher: Pearson Education, I*SBN*-10: 013168728X, 3rd Edition: 2007.
2	Pattern Classification	R. O. Duda, P. E. Hart, D. G. Stork,	Publisher: Wiley ISBN-13: 978-1-118-45668-2, ISBN: 1-118-45668-8, 3rd Edition, 2016

Department: Computer Science & Engineering		Semester:	V
Subject: **Unix System Programming**			
Subject Code:	CS5PE53	L – T – P - C:	3 – 0 – 0 – 3

Sl. No	Course Objectives
1	Understand the fundamental design of the UNIX operating system
2	Learn to use UNIX Application Program Interface
3	Develop system level programs in the UNIX environment
4	Design and build applications over the UNIx operating system.

Unit	Description	Hrs
I	File Types, Inodes in UNIX System V, and Application Program Interface to Files, UNIX Kernel support for files, Relationship of C Stream pointers and file descriptors. General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs.	8
II	Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions. Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Interpreter Files, system Function	8
III	Introduction, Terminal Logins, Network Logins, Process Group, Sessions, Controlling Terminal, Tcgetpgrp, tcsetpgrp and tcgetsid functions, Job Control. Signal Concepts, Signal function, Kill and raise functions, Signal sets, Sigpromask, sigpending, sigaction, abort sleep functions.	8
IV	Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. Introduction, Pipes, popen and pclose functions, FIFOs, Message Queues, Semaphores.	8
V	Socket APIs, Simple example using Socket APIs, History of RPC, RPC Programming Interface Levels, RPC Library Functions, rpcgen.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the fundamental concepts of UNIX APIs.
CO2	Create and handle the process synchronization.
CO3	Demonstrate various signal APIs.
CO4	Apply the concept of Inter Process Communication using IPC APIs.
CO5	Implement client – server application using IPC APIs.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1		2	2		1		2			2		
CO2	3	1		2	2		1		2			2		
CO3	3	1		2	2		1		2			2		
CO4	3	1		2	2		1		2			2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Unix System Programming Using C++	Terrence Chan	Prentice Hall India, 2016 ISBN: 10: 0133315622
2	Advanced Programming in the UNIX Environment	W.Richard Stevens	3rd Edition, Pearson Education PHI, 2017 ISBN: 978-0-321-63773-4

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	The Design of the UNIX Operating System	Maurice.J.Bach	Pearson Education / PHI, 1996 ISBN: 10 -0132017571
2	Advanced Unix Programming	Marc J. Rochkind	2nd Edition, Pearson Education, 2005,ISBN: 10: 0131411543

Department: Computer Science & Engineering		Semester:	V
Subject: Data Structures and Algorithms			
Subject Code:	CS5OE61	L – T – P - C:	3 – 0 – 0 – 3

Sl. No	Course Objectives
1	Know efficient storage mechanisms of data for an easy access.
2	Design and implementation of various basic data structures.
3	Introduce various techniques for representation of the data in the real world.
4	Develop application using data structures.

Unit	Description	Hrs
I	**Introduction:** History of Algorithms, Definition, Structures and Properties of Algorithms, Development of an Algorithm, Data Structures and Algorithms, Data Structures - Definition and Classification. **Analysis of Algorithms**: Efficiency of Algorithms, Asymptotic Notations. **Arrays**: Introduction, Array Operations, Number of Elements in an Array, Representation of Arrays in Memory.	8
II	**Stacks** Introduction, Stack Operations: Stack Implementation, Implementation of push and pop operations, Applications: Recursive programming, Infix, Prefix and Postfix Expressions, Evaluation of postfix expressions.	8
III	**Queues** Introduction, Operations on Queues: Insert and Delete operations. **Queue Implementation:** Implementation of insert and delete operations on a queue, Limitations of linear queues. **Circular Queues:** Operations on a circular queue.	8
IV	**Linked Lists** Singly Linked List: Representation of a singly linked list, Insertion and deletion in a singly linked list. Doubly Linked List: Representation of a doubly linked list, Advantages and disadvantages of a doubly linked list, Operations on doubly linked lists.	8
V	**Trees** Trees: Definition and Basic Terminologies, Representation of Trees Binary Trees: Basic Terminologies and types, Representation of Binary Trees, Binary Tree Traversals.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the basics of algorithms and data structures.
CO2	Explain the working principle of linear data structures and non-linear Data structures.
CO3	Illustrate different operations on data structures.
CO4	Demonstrate applications of linear data structures and non-linear data structures.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3	1												
CO3	2	3	2	1										
CO4	2	3	3	1										

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data Structures and Algorithms: Concepts, Techniques and Applications	G.A. Vijayalakshmi Pai	Tata McGraw Hill Education (2015) ISBN 10: 0070667268 ISBN 13: 9780070667266

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data Structures A Pseudocode approach with C	Richard F. Gilberg and Behrouz A. Forouzan	Thomson, 2005.

Sl. No	Course Objectives
1	Knowledge of the architecture and functioning of Database Management Systems.
2	Understand and apply the principles of data modeling using Entity Relationship and develop a good database design.
3	Understand the use of Structured Query Language (SQL).
4	Apply normalization techniques to normalize a database and understand the need of database transaction and controlling the consequences of concurrent data access.

Unit	Description	Hrs
I	**Introduction** : Introduction, An example, Characteristics of Database approach, Actors on the scene, Workers behind the scene, Advantages of using DBMS approach, A brief history of database applications, when not to use a DBMS. Data models, schemas and instances, Three schema architecture and data independence, Database languages and interfaces, The database system environment.	8
II	**Entity-Relationship (ER) Model :** Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues.	8
III	**SQL** : Data Definition and Data Types, Specifying constraints in SQL, Basic queries in SQL, Insert, Delete and Update statements in SQL, More complex SQL Queries, Views (Virtual Tables) in SQL, Schema change statements in SQL.	8
IV	**Database Design:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.	8
V	**Transaction Management**: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock- Based Concurrency Control, Dealing with Deadlocks, Transaction support in SQL. Introduction to ARIES and Write –Ahead Log protocol.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the concepts of database management system.
CO2	Design database using conceptual and relational model.
CO3	Apply normalization to create and manipulate a relational database using SQL.
CO4	Explain the basics of transactions processing and consistency control.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											1		
CO2	3	3	3	2							2	3		
CO3	2	3	3	2	2		3	2				3		
CO4	1			2			3					2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Database Systems	Elmasri and Navathe	7thEdition, Pearson Education, 2017, ISBN-13: 978-9332582705.
2	Database Management Systems	Raghu Ramakrishnan and Johannes Gehrke	3rd Edition, McGraw-Hill, 2014, ISBN-13:978-9339213114.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Data base System Concepts	Silberschatz, Korth and Sudharshan	7th Edition, Mc-GrawHill, 2019, ISBN-13: 978-0078022159.
2	An Introduction to Database Systems	C.J. Date, A. Kannan, S. Swamynatham	8th Edition, Pearson education, 2017, ISBN-13:978-817585568.

Department: Computer Science & Engineering		Semester:	V
Subject: Operating system			
Subject Code:	CS5OE63	L – T – P - C:	3 – 0 – 0 – 3

Sl. No	Course Objectives
1	To learn the classes of operating system, design architecture and system calls. 4 To learn the mechanisms involved in resource management in an OS.
2	To understand the concepts of process synchronization and scheduling through various algorithms.
3	To gain knowledge on system concepts that includes Mutual exclusion algorithms and deadlock detection algorithms.
4	To learn the mechanisms involved in resource management in an OS.

Unit	Description	Hrs
I	Introduction to Operating Systems and System Structures: What operating systems do? Computer System architecture; Operating System structure. System Structures : Operating System Services, System calls; Types of system calls; Operating System structure;	8
II	Process Management: Process concept: Overview; Process scheduling; Operations on processes; Inter process communication. Multithreaded Programming: Overview: Motivation, Benefits; Multithreading models; CPU Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms: First Come, First Served Scheduling, Shortest-Job First Scheduling, Priority Scheduling, Round-Robin Scheduling.	8
III	Process Coordination: Synchronization: Background; The Critical section problem; Peterson's solution; Mutex Locks; Semaphores; Classical problems of synchronization; Monitors: Monitor usage, Dining philosophers using monitors. Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection; Recovery from deadlock.	8
IV	Memory Management: Memory Management Strategies: Background; Swapping; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Copy- on write; Pag; Transaction Processing; Metadata, Data types; Exceptions.	8
V	Storage Management: File System: File concept; Access methods; File system mounting. Implementing File Systems: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Mass storage structures; Disk structure ; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explore the fundamental concepts of various operating system services.
CO2	Describe various process management techniques to solve problems in multi-process environment. .
CO3	Select and apply suitable techniques for efficient management of system resources. Analyze the performance of various resource management techniques.
CO4	Analyze the performance of various resource management techniques.
CO5	Design Linux, Windows and MacOS X.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3						2		2		
CO2	3	3	2	3								2		
CO3	3	3	3	3								2		
CO4	2	2	2	2								2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Operating System Principles	Peter Baer Galvin, Greg Gagne	9th Edition, WileyIndia, ISBN: 9788126554270, 8126554274.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Operating systems - A concept based Approach	D.M Dhamdhere:	3rd Edition, Tata McGraw-Hill,2008, ISBN: 13:9781259005589,10:1259005585
2	An Introduction to Operating Systems; Concepts and Practice	P.C.P. Bhatt	4th Edition, PHI, 2013, ISBN: 9788120348363
3	Operating Systems	Harvey M Deital:	3rd Edition, Addison Wesley, 2007, ISBN: 9788131712894, 8131712893.

Department: Computer Science & Engineering		**Semester:**	**V**
Subject: Mini Project – I			
Subject Code:	**CS5MP01**	**L – T – P - C:**	**0 – 0 – 4 – 2**

Sl. No	Experiment Description

Mini Project Work Guidelines:

As a part of Mini project, all the students must carry out the following activities:

1. Students should form a group to carry out their project. The minimum of 1 student and a maximum of 2 in a group.
2. The groups will be attached to one Internal Guide by the Department.
3. Students have to carry out a detailed survey on the Topic on which they are interested to carry out the Mini-Project work. Students are expected to submit the Synopsis.
4. Based on survey identify the Problem statement in concerned with guide and prepare the squire specification report.
5. Implement the project work within the timeline.
6. Prepare and Give the presentation on time.
7. Prepare Project document and demonstrating their work.

Note:

Department encourages to do the interdisciplinary projects. (Guides will look in to that.)

Students can do the mini project in such a way that he/she may continue the same project work in 6th semester and final year.

Procedure for Guide allotment

Collecting the area of interest both from Students and as well as the staff and then we match the area of each other and allocate the guides

Mini Project Work Evaluation Scheme Evaluation Scheme:

Continuous evaluation will be done by respective Project Guides based on the following points: Regularity, Technical Knowledge and Competence, Programming Skills, Communication Skills, Demonstration skills, Technical Competence, presentation, Team Work and Documentation Skills of the students.

Department: Computer Science & Engineering		Semester:	V
Subject: Database Lab			
Subject Code:	CS5LB1	L – T – P - C:	0 – 0 – 3 – 1.5

Sl. No	Course Objectives
1	To understand how a real world problem can be mapped to schemas.
2	To solve different industry level problems & to learn its applications.

LAB CONTENT

Sl. No	Experiment Description
1	**A. Consider the following schema for Insurance database:** PERSON (driver_id , name, address); CAR (regno, model, year); ACCIDENT (reportno, accd_date, location); OWNS (driver_id , regno); PARTICIPATED (driver_id, regno, reportno, damage_amt);
2	**B. Consider the following database schema for student database:** STUDENT (usn, name, major, bdate); COURSE (courseno, cname, dept); TEXT (book_ISBN, book_title, publisher, author); ENROLL (usn, courseno, sem, marks); BOOK _ ADOPTION (courseno, sem, book_ISBN);
3	**C. Consider the following schema for a Library Database:** BOOK (Book_id, Title, Publisher_Name, Pub_Year); BOOK_AUTHORS (Book_id, Author_Name); PUBLISHER (Name, Address, Phone); BOOK_COPIES (Book_id, Branch_id, No-of_Copies) ; CARD(Card_No) ; BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date) ; LIBRARY_BRANCH (Branch_id, Branch_Name, Address);
4	**D. Consider the following schema for Order Database:** SALESMAN (Salesman_id, Name, City, Commission) ; CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id); ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)
5	**E. Consider the schema for Movie Database:** ACTOR (Act_id, Act_Name, Act_Gender) ; DIRECTOR (Dir_id, Dir_Name, Dir_Phone) MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST (Act_id, Mov_id, Role) RATING (Mov_id, Rev_Stars)

6	**F. Consider the schema for Company Database:** DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DLOCATION (DNo,DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN, PNo, Hours) **Instructions: Using given schema** 1. Draw an Entity-Relationship(ER) Model. 2. Implement SQL Queries using DDL and DML Statements. 3. Implement SQL Nested queries and Views

Course Outcomes:

Course outcome	Descriptions
CO1	Design database schema for a given problem-domain and enforce different constraints on a database using RDBMS.
CO2	Demonstrate the usage of SQL DML/DDL commands to populate and query a database.
CO3	Interpret, test and debug the program.
CO4	Communicate effectively through viva and write a report describing the experiment and its results.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3	2											
CO2	1	2	1	2	3							1		
CO3	2	3	3	3	3			2	3	2	2	3		
CO4														

Department: Computer Science & Engineering		Semester:	V
Subject: Web Technologies Lab			
Subject Code:	CS5LB2	L – T – P - C:	0 – 0 – 3 – 1.5

Sl. No	Course Objectives
1	To introduce the fundamentals of the Internet, and the principles of web design.
2	To construct basic websites using HTML and Cascading Style Sheets.
3	To build dynamic web pages with validation using Java Script, JQuery objects and by applying different event handling mechanisms.
4	To develop modern interactive web applications using JAVA

LAB CONTENT

Sl. No	Experiment Description
1	1. Design web pages using HTML. 2. Style web pages using CSS features.
2	3. Accepting and validating user entered data using JavaScript. 4. Design a webpage and handle the events using JQuery.
3	5. Write a program to design a webpage using frameworks
4	6. Write a Java program to handle the result sets in different ways. 7. Write a Java program to display the content of a table into a webpage.
5	8. Write a Servlet to store form data to database. 9. Write a program to handle the session in different ways. 10. Demonstrate the different types of JSP tags.

Course Outcomes:

Course outcome	Descriptions
CO1	Design web pages and style them using markup language.
CO2	Design and validate client side applications.
CO3	Develop database based applications and Server side Programs.
CO4	Interpret, test and debug the program.
CO5	Communicate effectively through viva voce and write a report describing the experiment and its results.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		1	1		2			1				
CO2	2	2	1		1	1	2	2			1			
CO3	2	1	2	1	2	2	2	2	2	1		1		
CO4	1	1	1		2	1		2		1	1			

Scheme of Teaching and Examination-2020

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2020-21)

VI Semester BE **Academic year: 2023-24**

VI Semester B.E. Computer Science and Engineering (Subjects and Syllabus as per AICTE-Model Curriculum for UG Course in Engg. & Tech.- Jan. 2018)						**Teaching Hours/week**				**Examination**			
Sl No.	**Course and Course Code**		**Course Title**	**Teaching dept.**	**Board of Exam**	**L**	**T**	**P**	**C**	**Duration in Hrs.**	**CIE**	**SEE**	**Total Marks**
01	PC	CS6TH1	Artificial Intelligence and Machine Learning	CS	CS	3	-	-	3	3	50	50	100
02	PC	CS6TH2	Compiler Design	CS	CS	3	-	-	3	3	50	50	100
03	PC	CS6TH3	Computer Networks	CS	CS	3	-	-	3	3	50	50	100
04	PC	CS6PE4x	Professional Elective-II	CS	CS	3	-	-	3	3	50	50	100
05	PE	CS6OE5x	Open Elective-II	CS	CS	3	-	-	3	3	50	50	100
06	OE	CS6MP1	Mini Project-II	CS	CS	-	-	6	3	3	50	50	100
07	PC	CS6LB1	Machine Learning Lab	CS	CS	-	-	3	1.5	3	50	50	100
08	PC	CS6LB2	Computer Networks Lab	CS	CS	-	-	3	1.5	3	50	50	100
09	HS	SK6DP4	Skill Development-IV	HS	HS	-	-	2	1	3	50	-	50
						15	-	14	22	27	450	400	850

	CODE	Name			CODE	Name
Professional Elective II	CS6PE41	Information Storage Management		Open Elective II	CS6OE51	Java Programming
	CS6PE42	IOT			CS6OE52	Python Programming
	CS6PE43	Data Science				

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Artificial Intelligence and Machine Learning			
Subject Code:	**CS6TH1**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	Understand Artificial Intelligence concept and its problem space.
2	Learn the field of Machine Learning, describing a variety of learning paradigms, algorithms, theoretical results, and applications.
3	To study the basics of supervised and unsupervised learning
4	Illustrate ML algorithm and their use in appropriate applications.

Unit	Description	Hrs
I	Introduction to Artificial Intelligence History of Artificial Intelligence, What Is Artificial Intelligence? Emergence of AI, Cognitive Science and AI, Logical Intelligence. Propositional Logic: Basics of Propositional Logic, Syntax, Semantics, Tautologies and Logical Implication, Logical Arguments, Derivation Systems, Resolution, Normal Forms, Derivations Using Resolution, Resolution Algorithm.	8
II	First-Order Logic Basics of First-Order Logic, Syntax, Semantics, Validity and Logical Implication. Derivation Systems, Modus Ponens for First-Order Logic. Introduction to Machine Learning : What is machine learning?, What kind of problems can be tackled using machine learning, A Simple Machine-Learning Task: Training Sets and Classifiers, Minor Digression: Hill-Climbing Search, Hill Climbing in Machine Learning, Some Difficulties with Available Data.	8
III	Bayesian Classifiers : The Single-Attribute Case, Vectors of Discrete Attributes, Probabilities of Rare Events: Exploiting the Expert's Intuition, How to Handle Continuous Attributes, Gaussian "Bell" Function: A Standard pdf, Approximating PDFs with Sets of Gaussians. Nearest-Neighbor Classifiers : The k-Nearest-Neighbor Rule, Measuring Similarity, Irrelevant Attributes and Scaling Problems, Performance Considerations, Weighted Nearest Neighbors, Removing Dangerous Examples, Removing Redundant Examples.	8
IV	Artificial Neural Networks : Multilayer Perceptrons as Classifiers, Neural Network's Error, Back propagation of Error, Special Aspects of Multilayer Perceptrons, Architectural Issues. Decision Trees : Decision Trees as Classifiers, Induction of Decision Trees, How Much Information Does an Attribute Convey? Binary Split of a Numeric Attribute, Pruning, Converting the Decision Tree into Rules.	8

V	Unsupervised Learning: Cluster Analysis, A Simple Algorithm: k-Means, More Advanced Versions of k-Means, Hierarchical Aggregation. Performance Evaluation: Basic Performance Criteria, Precision and Recall, Other Ways to Measure Performance, Learning Curves and Computational Costs, Methodologies of Experimental Evaluation.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the concepts of Artificial intelligence and Machine Learning.
CO2	Describe various supervised and unsupervised machine learning algorithms.
CO3	Illustrate the working of Machine Learning Algorithms.
CO4	Compare and analyze the performance of classifiers.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2			2	2		1	1	2	3		
CO2	2		2	3	3	2	2		1	1	2			
CO3	2	2	2	2	2	2	2	2	1	1	2	2		
CO4	2	2	2	2	2	2	2		1	1	2	1		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Artificial Intelligence With an Introduction to Machine Learning	Richard E. Neapolita n Xia Jiang	2nd Edition, Chapman and Hall/CRC, May 2018, ISBN-13: 9781138502383 ISBN-10: 1138502383
2	An Introduction to Machine Learning	Miroslav Kubat	2nd Edition, Springer, ISBN 978-3-319-63913-0 (eBook) ISBN 978-3-319-63912-3

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Machine Learning	Tom M. Mitchell	India Edition 2013, McGraw Hill Education, ISBN:13:9780070428072
2	Machine Learning – An Algorithmic Perspective	Stephen Marsland	2nd Edition, Chapman and Hall/CRC, 2014, ISBN-10:1466583282 ISBN-13:978-146 583283

Department: Computer Science & Engineering		Semester:	VI
Subject: Compiler Design			
Subject Code:	CS6TH2	L – T – P - C:	3 – 0 – 0 – 3

Sl. No	Course Objectives
1	Learn different phases of compiler design in detail.
2	Gain knowledge about the parsing techniques using top-down and bottom-up approach.
3	Understand the techniques of Syntax Directed Translation.
4	Gain knowledge about intermediate code generation and target code generation.

Unit	Description	Hrs
I	**Introduction, Lexical analysis** Language processors; The structure of a Compiler; Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Recognition of tokens. **Syntax Analysis** **Introduction:** The role of the parser, Syntax-Error Handling, Error- recovery strategies; Writing a Grammar: Lexical versus Syntactic analysis.	8
II	Syntax Analysis Contd… Elimination of left-recursion and left-factoring; Top-down Parsing: Recursive-Descent Parsing , FIRST and FOLLOW; LL(1) Grammars, Non recursive Predictive Parsing.	8
III	Syntax Analysis Contd… **Bottom-up Parsing:** Reductions, shift-reduce parsing, Conflicts during shift-reduce parsing, Introduction to LR parsing: Simple LR: Why LR Parsers? Items and the LR(0) automaton , The LR parsing algorithm, Constructing SLR-parsing tables.	8
IV	**Syntax-Directed Translation** Syntax-Directed Definitions; Evaluation order for SDDs: Dependency graphs, Ordering the Evaluation of Attributes, S-attributed and L-attributed definitions; Applications of SDT; Syntax Directed Translation Schemes- Postfix Translation Scheme, Parser stack implementation of postfix SDT's, SDT's with actions inside productions.	8
V	Intermediate-Code Generation, Code Generation **Intermediate-Code Generation:** Variants of syntax trees: Directed Acyclic Graphs for expressions; Three-address code: Addresses and Instructions, Quadruples, Triples. Translation of expressions; Control- flow and Switch statements. **Code Generation:** Issues in the design of a Code Generator, The Target Language: A Simple Target Machine Model; Addresses in the target code; Basic blocks and Flow graphs, Optimization of basic blocks.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the structure of a compiler along with the functionalities of different phases.
CO2	Apply different techniques to perform top-down and bottom-up parsing.
CO3	Illustrate the Syntax Directed Translation techniques in the construction of compiler.
CO4	Demonstrate the techniques of Intermediate Code Generation and target code generation in the design of a compiler.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		3							2		
CO2	2	3	3	2	3							2		
CO3	2	3	3	2	3							2		
CO4	2	3	3	2	3							2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Compilers- Principles, Techniques and Tools	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman	2nd Edition, Addison-Wesley, 2007. ISBN: 0-321-48681-1

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Modern Compiler Implementation in C	Andrew W Apple	1st Edition, (Revised) Cambridge University Press, 2004 ISBN-13: 978-0521607650
2	Compiler Construction Principles & Practice	Kenneth C Louden	1st Edition, Thomson Education, 1997. ISBN-13: 97 -0534939724

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Computer Networks			
Subject Code:	**CS6TH3**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	Understand the routing algorithms and congestion control techniques
2	Analyze the services and features of transport layer protocols.
3	Understand the principles and operations behind various application layer protocols
4	Acquire the knowledge of Network Security

Unit	Description	Hrs
I	**Network Layer** 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 Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast routing, Multicast routing, Congestion Control Algorithms: Approaches to Congestion Control, Traffic-aware routing, Admission control, Traffic throttling, Load Shedding	8
II	**Network Layer continued** Quality of Service: Application requirements, Traffic shaping, Packet scheduling, Admission control, Internetworking: How networks differ, how networks can be connected, Tunneling, Internetwork routing, Packet fragmentation. The Network Layer in the Internet: The IP version 4 protocol, IP addresses, IP version 6, Internet control protocols.	8
III	**Transport Layer** Services Provided to the Upper Layers, Transport Service Primitives, Berkeley Sockets, Elements of Transport protocols: Addressing, Connection establishment, Connection release, Error control and Flow control, Multiplexing, Crash recovery, Introduction to UDP, Remote Procedure Call. Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.	8
IV	**Transport layer continued, Application Layer** TCP Connection Management Modeling, TCP Sliding window, TCP Timer Management, TCP Congestion Control. DNS-Domain Name System: The DNS Name Space, Domain Resource Records, Name Servers. Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery. HTTP-The Hyper Text Transfer Protocol.	8
V	**Network Security** Introduction: Security Goals, Attacks, Services and Techniques. Confidentiality: Symmetric Key Ciphers, Asymmetric Key Ciphers. Other aspects of security: Message Integrity, Message Authentication, Entity Authentication, Key Management.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Analyze and apply various routing algorithms to find shortest paths for packet delivery
CO2	Interpret the appropriate protocol for reliable/unreliable communication.
CO3	Explain the features and operations of various application layer protocols
CO4	Design subnets and calculate the IP addresses to fulfill the network requirements

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3		3			1		2		
CO2	2	2	3	2	2	2	2			1		1		
CO3	2	2	2	2	1	2	2	2	1	1	2	2		
CO4	2	3	3	2	2		2			1	1			

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Computer Networks	Andrew S. Tanenbaum and David J Wetherall.	5th Edition, 2019, ISBN 978-93-325-1874-2
2	Data Communications and Networking	Behrouz A. Forouzan	5th Edition, ISBN-13: 978-1-25-906475-3

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Computer Networking- A Top-Down approach	James F Kurose and Keith W Ross	6th Edition, Pearson Education, 2017 ISBN-13: 978-0-13-285620-1
2	Data and Computer Communications	William Stallings	8th Edition, Pearson Education, ISBN- 978-81-317-1536-9
3	Communication Networks – Fundamental Concepts and Key architectures	Alberto Leon-Garcia and Indra Widjaja	2nd Edition, Tata McGraw-Hill, 2017,ISBN-13:978-0-07-059501-9 ISBN-13: 978-0072463521

Sl. No	Course Objectives
1	To understand the basics of Storage Networks and Devices
2	To understand the availability of different storage technologies
3	To understand the working and availability of channels for communication
4	To know the applications of storage technologies, Backup & Recovery mechanisms

Unit	Description	Hrs
I	**Introduction**: Introduction, Information Storage, Data center infrastructure, Key challenges, Information Life cycle, Server centric IT architecture and its limitations, Storage centric IT architecture and its advantages, Case study: Replacing a server with storage networks.	**8**
II	**Intelligent Disk Subsystems:** Architecture of intelligent disk subsystems, Hard disks and internal I/O channels, JBOD, Storage virtualization using RAID and different RAID levels, RAID 0, RAID 1, RAID 10, RAID 01, RAID 4 and RAID 6, RAID Comparisons, Caching: Acceleration of hard disk access, Caching: Intelligent disk subsystems, Logical Unit Numbers, Remote Mirroring, Comparison, Availability of disk subsystems.	**8**
III	**Fiber Channel:** The physical i/o path from the CPU to the storage system, SCSI(Small Computer System Interface): basics, Storage Networks, Fiber Channel Protocol Stack: Links & Topologies, (Fiber Channel 0) FC0, (Fiber Channel 1) FC1, (Fiber Channel 2) FC2, (Fiber Channel 3) FC3, Link & Fabric Services, (Fiber Channel 4) FC4 & (Upper Layer Protocols) ULPs,.	**8**
IV	**Network Attached Storage:** Local file systems: File systems and Databases, Journaling, Snapshots, Volume Manager, Network file systems and file servers, Shared disk file systems, Comparison: NAS (Network Attached Storage), FC SAN (Fiber Channel Storage Area Networks) and iSCSI SAN	**8**
V	**Storage Virtualization:** Definition of Storage virtualization, Implementation considerations, Storage virtualization on Block or File level, Symmetric and Asymmetric **storage** virtualization.	**8**

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the concepts of Storage networks and its various technologies.
CO2	Apply different storage technologies like RAID, LUN, Instant Copying, Remote Mirroring etc., to establish Data center to fulfill the storage requirements.
CO3	Design error free, efficient and effective data transmission between nodes and data centers using Fiber channel, SCSI and other technologies.
CO4	Analyze the problems in different scenarios to provide the solutions.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											2		
CO2		2		2										
CO3			3	2								2		
CO4		2										2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Storage networks explained	Ulf troppens, Rainer erkins and Wolfgang Muller	Wiley India, 2017
2	Information Storage and Management,	G.Somasundaram, Alok Shrivastava (Editors)	EMC Education Services, Wiley-India, 2016.

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Storage area network essentials: A complete guide to understanding and implementing SANs	Richard Barker and Paul Massiglia	John wiley India, 2012.
2	Storage networks: the complete reference	Robert spalding	Tata Mcgraw-hill, 2003.

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Internet of Things			
Subject Code:	**CS6PE42**	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	To understand the vision and introduction of IoT.
2	To learn the concepts of IOT in market perspective
3	To Learn Data and Knowledge Management and use of Devices in IoT Technology
4	To Understand the IoT Reference Models ,Real World Design Constraints and Asset Management

Unit	Description	Hrs
I	**M2M to IoT - The Vision :** Introduction, From M2M to IoT - A brief background, M2M communication, IoT, M2M towards IoT-the global context - Game changers, General technology and scientific trends, Trends in information and communications technologies, , A use case example, Differing Characteristics.	8
II	**M2M to IoT- A Market Perspective:** Introduction - Information marketplaces, Some Definitions - Global value chains, Ecosystems vs. value chains, Industrial structure, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT - The information-driven global value chain.	7
III	**M2M and IoT Technology Fundamentals** : Devices and gateways - Introduction, Basic devices, Gateways, Data management - Introduction, Managing M2M data, Considerations for M2M data, Business processes in IoT - Introduction, IoT integration with enterprise systems, Distributed business processes in IoT, Knowledge Management - Data, information, and knowledge, A knowledge management reference architecture. Retrieval Layer	9
IV	**Architecture Reference Model:** Introduction, Reference Model and architecture, IoT Reference Model - IoT domain model, Information model, Functional model, Communication model, Safety, privacy, trust, security model.	8
V	**Real-World Design Constraints**: Introduction, Technical Design constraints hardware is popular again - Devices and networks, Data representation and visualization, Interaction and remote control. **Asset Management:** Introduction, Expected benefits, -Maintenance in the M2M Era, Hazardous goods management in the M2M Era	8

Course Outcomes:

Course outcome	Descriptions
CO1	Interpret the vision of IoT from a global context and determine the market perspective of IoT
CO2	Compare and contrast the use of devices, gate ways and, data management in IoT
CO3	Analyze and design different reference models in IoT
CO4	Evaluate the applications of IoT and identify real world design constraints.

Course Articulation Matrix

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	2	2					2		
CO2	2	3	3	2	3					1		1		
CO3	1	3	3	2	3					1				
CO4		2		1	1	2	2				3	1		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle	1st Edition, Academic Press, 2014. (ISBN-13: 978-0124076846)

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	1st Edition, VPT, 2014 (ISBN-13: 978-8173719547)
2	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything	Francis da Costa	1st Edition, A press Publications, 2013 (ISBN-13: 978-1430257400)

Department: Computer Science & Engineering		Semester:	VI
Subject: Data Science and Analytics			
Subject Code:	CS6PE43	L – T – P - C:	3 – 0 – 0 – 3

Sl. No	Course Objectives
1	To learn the fundamentals of data science and big data
2	To gain in-depth knowledge on descriptive data analytical techniques.
3	To gain knowledge to implement simple to complex analytical. Algorithms in big data frameworks.
4	To develop programming skills using required libraries and packages to perform data analysis in Python.
5	To understand and perform data visualization, web scraping, machine learning and natural language processing using various Data Science tools

Unit	Description	Hrs
I	**INTRODUCTION TO DATA SCIENCE AND BIG DATA** Data Science – Fundamentals and Components – Data Scientist – Terminologies Used in Big Data Environments – Types of Digital Data – Classification of Digital Data – Introduction to Big Data – Characteristics of Data – Evolution of Big Data – Big Data Analytics – Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools.	8
II	**DESCRIPTIVE ANALYTICS USING STATISTICS** Types of Data – Mean, Median and Mode – Standard Deviation and Variance – Probability – Probability Density Function – Types of Data Distribution – Percentiles and Moments – Correlation and Covariance – Conditional Probability – Bayes' Theorem – Introduction to Univariate, Bivariate and Multivariate Analysis – Dimensionality Reduction using Principal Component Analysis and LDA – Dimensionality Reduction using Principal Component Analysis and Linear Discriminant Analysis (LDA) – Principal Component Analysis (PCA) example with Iris Data Set from UCI repository. Transactions and dealing with constraint violations.	8
III	**PREDICTIVE MODELING AND MACHINE LEARNING** Linear Regression – Polynomial Regression – Multivariate Regression – Multi Level Models – Data Warehousing Overview – Bias/Variance Trade Off – K Fold Cross Validation – Data Cleaning and Normalization – Cleaning Web Log Data – Normalizing Numerical Data – Detecting Outliers – Introduction to Supervised And Unsupervised Learning – Reinforcement Learning – Dealing with Real World Data – Machine Learning Algorithms –Clustering – Python Based Application.	8
IV	**DATA ANALYTICAL FRAMEWORKS** Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL).	8
V	**DATA SCIENCE USING PYTHON**	8

	Introduction to Essential Data Science Packages: Numpy, Scipy, Jupyter, Stats models and Pandas Package – Data Munging: Introduction to Data Munging, Data Pipeline and Machine Learning in Python – Data Visualization Using Matplotlib – Interactive Visualization with Advanced Data Learning Representation in Python.	

Course Outcomes:

Course outcome	Descriptions
CO1	Explain data science concepts and its fundamentals.
CO2	Demonstrate the process in data science
CO3	Explain machine learning algorithm necessary for data science
CO4	Perform data analytics and visualization using Python

Course Articulation Matrix

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											2		
CO2	2											2		
CO3		2	2	3								2		
CO4	1	2	2	3	2							2		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Hands On Data Science & Python Machine Learning	Frank Pane	Packt Publishers, 2017. ISBN-13 978-1787280748
2	Big data And Analytics	SeemaAcharyaSubhashini Chellappan, Infosys Limited	Publication:Wiley India Private Limited,1st Edition 2015. ISBN:978- 81-265-5478-2

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Python Data Science Essentials	AlbertoBoschetti Luca Massaron	Packt Publications,2nd Edition,2016. ISBN 9781789537864
2	Big Data Black Book	DT Editorial Services	Dream Tech Press, 2015 ISBN 13 9789351197577
3	Python Machine Learning	Yuxi (Hayden) Liu	Packt Publication, 2017 ISBN-13 978-1783553112

Department: Computer Science & Engineering		Semester:	VI
Subject: Java Programming			
Subject Code:	CS6OE51	L – T – P - C:	3 – 0 – 0 – 3

Sl. No	Course Objectives
1	Understand the fundamentals of Object-Oriented Programming in Java.
2	Understand the principles of inheritance, packages and interfaces.
3	Understand fundamentals of exception handling mechanisms.
4	Write Object oriented programs.

Unit	Description	Hrs
I	**History and Evolution of Java** **An overview of Java**: The Java's Magic: The Bytecode, The Java buzzwords, object-oriented programming, A first simple program, A second short program, two control statements, Java keywords. **Data types, Variables and Arrays:** The primitive types, Integers, Floating-Point types, characters, Booleans, variables, types conversion and casting, automatic type promotion in expressions, arrays.	8
II	**Operators and Control Statements** **Operators:** Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses. **Control Statements:** Java's selection statements: if and switch, iteration statements: while, do-while, for, the for-each version of the for loop, nested for loops, Jump statements: using break, continue and return.	8
III	**Introducing Classes and A Closer Look at Methods and Classes** **Introducing Classes:** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this keyword, Garbage Collection, The finalize() method, A Stack Class. **A Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Introducing Access Control, Understanding Static, Introducing final, Introducing Nested and Inner Classes.	8
IV	**Inheritance and Packages** **Inheritance:** Inheritance Basics, Using Super, Creating Multilevel Hierarchy, When Constructors are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance. **Packages:** Packages, Access Protection, Importing Packages.	**8**
V	**Interfaces and Exception Handling** **Interfaces:** Defining and Interface, Implementing Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces, Interfaces can be	**8**

	Extended. **Exception Handling:** Exception-handling fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.	

Course Outcomes:

Course outcome	Descriptions
CO1	Describe the fundamentals of Object-Oriented Programming.
CO2	Identify classes, objects, members of a class and relationships among them needed for specific problem.
CO3	Design and implement object oriented solutions involving multiple objects, packages and interfaces.
CO4	Develop programs by using exception handling mechanisms.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3												
CO2	2	3	2	1										
CO3	1		3	2							2			
CO4		2	3	2										

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Java – The Complete Reference	Herbert Schildt	9th Edition, Tata McGraw Hill, 2014, ISBN–13 :978-93-392-1209-4

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Introduction to Java Programming	Y. Daniel Liang	10th Edition, Pearson Education, 2015, ISBN : 978-0-13-3761313

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Python Programming			
Subject Code:	CS6OE52	**L – T – P - C:**	**3 – 0 – 0 – 3**

Sl. No	Course Objectives
1	Learn the procedure of Python interpreter installation and its working.
2	Understand the concepts of conditional and loop statements
3	Implement built-in and user defined functions.
4	Build and execute lists, tuples, dictionaries and sets in Python.

Unit	Description	Hrs
I	**The Context of Software Development**: About Python, Installing Python, The Python Interpreter, Python editors and IDEs, Learning Programming with Python, Writing a Python Program, A Longer Python program. Values and Variables: Integer Values, Variables and Assignment, Identifiers, Floating-point Numbers, Control Codes within Strings, User Input, Controlling the print Function, String Formatting, Multi line Strings. Expressions and Arithmetic: Expressions, Mixed Type Expressions, Operator Precedence and Associativity, Formatting Expressions, Comments, Errors, Syntax Errors, Run-time Errors, Logic Errors, Arithmetic Examples, More Arithmetic Operators.	8
II	**Conditional Execution:** Boolean Expressions, The Simple if Statement The if/else Statement, Compound Boolean Expressions, The pass Statement, Floating-point Equality, Nested Conditionals, Multi-way Decision Statements, Conditional Expressions, Errors in Conditional Statements. **Iteration**: The while Statement, Definite Loops vs. Indefinite Loops, The for Statement, Nested Loops, Abnormal Loop Termination, while/else and for/else, Infinite Loops, Iteration Examples, Computing Square Root, Drawing a Tree, Printing Prime Numbers, Insisting on the Proper Input.	8
III	**Using Functions**: Introduction to Using Functions, Functions and Modules, The Built-in Functions, Standard Mathematical Functions, time Functions, Random Numbers, System-specific Functions. **Writing Functions**: Function Basics, Parameter Passing, Documenting Functions, Function Examples, Better Organized Prime Generator, Command Interpreter ,Restricted Input, Better Die Rolling Simulator, Tree Drawing Function , Floating-point Equality.	8
IV	**More on Functions**: Global Variables, Default Parameters, Recursion, Making Functions Reusable, Functions as Data. **Lists**: Motivation, List Structures, Lists (Sequences) in Python, Iterating Over Lists (Sequences) in Python, More on Python Lists. **Objects**: Using Objects, String Objects, List Objects.	8

V	Dictionaries, and Sets: Dictionaries, Using Dictionaries, Counting with Dictionaries, Grouping with Dictionaries, Keyword Arguments, Sets, Set Quantification with all and any, Enumerating the Elements of a Data Structure.	8

Course Outcomes:

Course outcome	Descriptions
CO1	Explain the Python syntax and be fluent in the use of Python flow control and iterations.
CO2	Describe the type of operators, built-in libraries and functions.
CO3	Develop Python programs using List and object concepts.
CO4	Create, run and manipulate the Python programs using core data structures like tuples, dictionaries and sets.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	1													
CO3		2	2									1		
CO4		2	2		1							1		

Text Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Fundamentals of Python Programming	Richard L. Halterman	Southern Adventist University, 2019, E-book, ISBN:9781539530268
2	Introduction to Computer Science Using Python: A Computational Problem-Solving	Charles Dierbach	1st Edition, Jhon Wiley & Sons, Inc. Publications,2012, ISBN:9780470555156

Reference Books:

Sl No	Text Book title	Author	Volume and Year of Edition
1	Think Python	Allen Downey	2nd Edition, O"Reilly Media, ISBN: 9781491939369
2	Learning Python	B.Nagesh Rao	1st Edition, A cyberplus publication, 2017, ISBN:9788193392300

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Mini Project - II			
Subject Code:	CS6MP01	**L – T – P - C:**	**0 – 0 – 6 – 3**

Experiment Description
Mini Project Work Guidelines: As a part of Mini project, all the students must carry out the following activities: 1. Students should form a group to carry out their project. The minimum of 1 student and a maximum of 2 in a group. 2. The groups will be attached to one Internal Guide by the Department. 3. Students have to carry out a detailed survey on the Topic on which they are interested to carry out the Mini-Project work. Students are expected to submit the Synopsis. 4. Based on survey identify the Problem statement in concerned with guide and prepare the squire specification report. 5. Implement the project work within the timeline. 6. Prepare and Give the presentation on time. 7. Prepare Project document and demonstrating their work. **Note:** • **Department encourages to do the interdisciplinary projects. (Guides will look in to that.)** • **Students can do the mini project in such a way that he / she may continue the same project work for final year.**
Procedure for Guide allotment Collecting the area of interest both from Students and as well as the staff and then we match the area of each other and allocate the guides'
Mini Project Work Evaluation Scheme **Evaluation Scheme:** Continuous evaluation will be done by respective Project Guides based on the following points: Regularity, Technical Knowledge and Competence, Programming Skills, Communication Skills, Demonstration skills, Technical Competence, presentation, Team Work and Documentation Skills of the students.

Course Outcomes:

Course outcome	Descriptions
CO1	Apply the engineering knowledge to identify the problem in a specified area.
CO2	Analyze the problem and design the high level modules.
CO3	Design the suitable ecological algorithms / methodologies and plan to work with a team.
CO4	Implement the solutions by selecting suitable language / tools / platforms / frameworks.
CO5	Communicate effectively through oral presentation and prepare detailed report describing the project and results.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3											2		
CO2		2										2		
CO3		2	3						3			2		
CO4					3							2		
CO5										3	1			

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Machine Learning			
Subject Code:	**CS6LB1**	**L – T – P - C:**	**0 – 0 – 3 – 1.5**

Sl. No	Course Objectives
1	Make use of Data sets in implementing the machine learning algorithms.
2	Implement the machine learning concepts and algorithms in any suitable language of choice.
3	Understand and present the key algorithms and theorems that form the core of machine learning.
4	Discuss how the learning performance varies with the number of training examples presented.

LAB CONTENT

Sl. No	Experiment Description
	CYCLE - I
1	Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
2	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
3	Write a program to construct a Bayesian network considering Iris data set.
4	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
5	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
	CYCLE -II
6	Solve the given machine learning problem by applying the concepts discussed in the course:CS6TH1 Naive Bayes, Linear Regression, ANN, K-Nearest Neighbors, Support Vector Machine and K – Means

Course Outcomes:

Course outcome	Descriptions
CO1	Implement the machine learning algorithms.
CO2	Design Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems.

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			3									
CO2	3	3			3									
CO3	3	3	3	3	3							3		
CO4	3	3			3							3		

Department: Computer Science & Engineering		**Semester:**	**VI**
Subject: Computer Networks Lab			
Subject Code:	**CS6LB2**	**L – T – P - C:**	**0 – 0 – 3 – 1.5**

Sl. No	Course Objectives
1	To understand fundamental underlying principles of computer networking
2	Acquire the knowledge of routing algorithms and congestion control algorithms
3	Compare the performance of various communication protocols

Experiment Description

PART – A

1. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and determine collision across different nodes.
2. Simulate an Ethernet LAN using N nodes (6-10) change error rate and data rate and compare throughput.
3. Simulate an Ethernet network of 6 to 15 nodes, for 1-persistent, vary number of transmitting nodes and compare collision count, throughput, mean delay and response time.
4. Simulate a three-node point-to-point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.
5. Simulate a four-node point-to-point network, and connect the links as follows: n1-n3, n2-n3 and n3-n4. Apply TCP agent between n1-n4 and UDP n2-n4. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
6. Simulate simple BSS with transmitting nodes in wire-less LAN and determine the performance with respect to transmission of packets.
7. Simulate the different types of Internet traffic such as FTP and TELNET over a network and analyze the throughput.
8. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion

PART-B

1. Write a program for Error Detecting code using CRC codes.
2. Write a program for Frame Sorting Technique used in buffers.
3. Write a program for distance vector routing algorithm to find the suitable path for transmission.
4. Write a program to find the shortest path using Link State Routing.
5. Write a program for congestion control using leaky bucket algorithm.
6. Write a program to implement Inter process Communication (IPC) using FIFO queues.
7. Using TCP/IP sockets, write a client - server program to make the client send the file name and to make the server send back the contents of the requested file if present.
8. Write a program for simple RSA algorithm to Encrypt and Decrypt the Data.

Course Outcomes:

Course outcome	Descriptions
CO1	Interpret the basics principles of computer networking
CO2	Design and implement Routing and Congestion control Algorithms
CO3	Analyze and evaluate the performance of various networking protocols

Course Articulation Matrix

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1		2	2	1	2	1	2		
CO2	2	1	3	2	1	1	2	2	1	2	1	1		
CO3	2	2	2	1	1		2	2	1	1	2	1		