BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi) Avalahalli, Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Computer Science and Engineering

V and VI Semester Scheme and Syllabus

2022 Scheme - Autonomous

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Vision and Mission of the Department

Vision:

To develop technical professionals acquainted with recent trends and technologies of computer science to serve as valuable resource for the nation/society.

Mission:

Facilitating and exposing the students to various learning opportunities through dedicated academic teaching, guidance and monitoring.

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Program Educational Objectives (PEOs)

PEO'S	
PEO1	Lead a successful career by designing, analyzing and solving various problems in the field of Computer Science & Engineering.
PEO2	Pursue higher studies for enduring edification.
PEO3	Exhibit professional and team building attitude along with effective communication.
PEO4	Identify and provide solutions for sustainable environmental development.

Program Specific Outcomes (PSOs)

PSO'S	
PSO-1	Analyze the problem and identify computing requirements appropriate to its solution.
PSO-2	Apply design and development principles in the construction of software systems of varying complexity.

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Scheme of VI Semester

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BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2023– 24 Choice Based credit System (CBCS)

UG PROGRAM: Department of Computer Science and Engineering | **Semester: VI**

Sl. No	Course Category	Course Code	Course Title	Teaching Dept.	Teaching Hours /Week				Credits	Examination			
					L	T	P	PW		Duration	CIE Marks	SEE Marks	Total Marks
1	HS	21HSS61	Project and Finance Management	CSE	2	0	0	0	2	2	50	50	100
2	AEC	21AEC62	Bioinformatics	CSE	1	0	0	0	1	1	50	50	100
3	AEC	21CS63	Green IT and Sustainability	CSE	1	0	0	0	1	1	50	50	100
4	PE	21CS64X	Professional Elective – II	CSE	3	0	0	0	3	3	50	50	100
5	OE	21CS65X	Open Elective – I	CSE	3	0	0	0	3	3	50	50	100
6	PW	21CS66	Mini Project	CSE	0	0	0	4	2	3	50	50	100
7	PC	21CS67	Data Science and Machine Learning	CSE	3	0	0	0	3	3	50	50	100
8	PC	21CS68	Theory of computation	CSE	3	0	0	0	3	3	50	50	100
9	PC	21CSL69A	Data Science and Machine Learning Laboratory	CSE	0	0	2	0	1	3	50	50	100
10	PC	21CSL69B	Emerging Technology Laboratory	CSE	0	0	2	0	1	3	50	50	100
11	PC	21CSL69C	Mobile Application Development Laboratory	CSE	0	0	2	0	1	3	50	50	100
TOTAL					**16**	**0**	**6**	**4**	**21**	----	**550**	**550**	**1100**

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Professional Elective - Group II	
Course Code	**Course Title**
21CS641	Computer Network and Security
21CS642	Agile Technologies and DevOps
21CS643	Robotic Process Automation
21CS644	Augmented and Virtual Reality
21CS645	Big Data Analytics

Open Elective (OE) - Group I	
Course Code	**Course Title**
21CS651	Introduction to Operating System
21CS652	Oops with C++
21CS653	Web Technologies
21CS654	Python Programming
21CS655	Introduction to Data Structures

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Yelahanka, Bengaluru-560064

Date: 14.06.2023

CIE and SEE Pattern for 2021 Scheme
(Applicable from the AY 2021-22 onwards)

Important Note:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examinations (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 marks out of 50). The student is declared as a pass in the course if he / she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

4 CREDIT and 3 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs to be conducted for 40 Marks (90 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10 marks, total **20 marks**.
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (3 hours).

Question Paper Pattern:

Part - A: Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.

Part - B: There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question from each module.**

SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.

2 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks**.
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (2 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 100 questions each of 01 marks. The same is scale down to 50 marks.

1 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 50 Marks (1 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 50 questions each of 01marks. The same is scale down to 50 marks.

1 CREDIT LABORATORY COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Cumulative Assessment (CA) of each experiment is 20 Marks (Conduction 10 marks + Records 5 marks +Viva 5marks). The average of all the experiments to be taken for **20 marks.**
- Open Ended Experiments (OE) **10 marks.**
- 2 IAs Test to be conducted for 100 marks. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks. The average of 2 IA marks is scale down to **20 marks**.
- CIE marks =20 (CA) +10 (OE) + 20 (IA test) = 50 marks.
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks and scale down to 50 Marks.

Examinations to be conducted jointly by Two examiners. All the experiments are to be included for practical examination. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks.

CoE 16/06/2023 Dean AA 16/06/2023 Principal 19/6/23

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VI Semester Syllabus

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B.E. COMPUTER SCIENCE AND ENGINERRING

Choice Based Credit System (CBCS)

SEMESTER - VI

PROJECT & FINANCE MANAGEMENT (2:0:0) 2

(Effective from the academic year 2023-24)

Course Code	21HSS61	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	02

Course Objectives:

This course will enable students to:

1. Define the fundamentals of Project Management.
2. Identify the strategies involved in selection, prioritization, planning & scheduling of a project.
3. Understand the time value of money & apply it for decision making.
4. Analyze project risk, progress & results.
5. Make awareness about various sources of finance.
6. Gain Knowledge on working capital & capital budgeting.

Preamble: Project Management: Need for project management, management practices to meet the challenges of new economic environment, globalization process, rapid technological advancement, and quality concerns of the stakeholders.

Module – 1

Project Management: Definition of project, characteristics of projects, types of projects, project roles.

Project Selection & Prioritization: Strategic planning process, strategic objectives, identifying potential projects, feasibility study (environment, society), methods of selecting projects, prioritizing projects, securing and negotiating projects.

(05 Hours)

Module – 2

Project planning & scheduling: Project scope & check list, work break down structure, project schedule, uncertainty in project schedules.

Project resourcing & risk planning: Abilities needed when resourcing projects, estimate resource needs, cost planning & estimating, risk management planning, risk identification, risk analysis, project quality planning and project kick-off.

(05 Hours)

Module – 3

Project performing, progress & results: Project supply chain management, project balanced score card approach, terminate project early, finish project, customer feedback & approval.

(05 Hours)

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Module – 4
Financial Management: Evolution of financial management, key activities of finance manager, key decision areas in financial management, financial statement with balance sheet. Efficient utilization and generation of monetary resources and funds, a comparative study of finance and economics, Costs and revenue evaluation for various engineering operations. **Capital Budgeting:** Types of capital budgeting decisions, capital budgeting proposals, estimating cash flows for project appraisal, green capital budgeting. **(05 Hours)**
Module – 5
Working capital management: Factors affecting working capital requirement, operating cycle analysis, negative working capital, cash planning & managing cash flows. **Cost of capital and leverage Analysis**: Concept, significance, assumptions, factors affecting cost of capital, Leverage Analysis: operating leverage, financial leverage. **Recap:** All the 5 modules. **(05 Hours)**
Course outcomes: The students will be able to: CO1: Understand the selection, prioritization & initiation of individual projects. CO2: Understand WBS, scheduling, uncertainty & risks associated in project. CO3: Identify & Evaluate the progress and results of the project. CO4: Understand time value of money & use it for decision making. CO5: Outline capital requirements for starting a business & management of working capital.

	Textbooks
1.	Timothy J Kloppenborg, Project Management, Cengage Learning, 2nd Edition, 2009.
2.	John J Hampton, Financial Management, PHI Publication, 4th edition.
	References
1.	Pennington Lawrence, Project Management, McGraw-Hill, 1st edition.
2.	Joseph A Moder, Philips New Yark, Project Management with CPM & PRT, McGraw-Hill, 2nd edition, 1983.
3.	Harold Kerzner, Project Management A system approach to Planning, Scheduling & Controlling, CBS Publication, 2nd Edition, 2006.
4.	S.D. Sharma, Operations Research, Kedar Nath Ramnath, Meerut, New Edition, 2015.
5	M.Y. Khan, Financial Management, Tata Mc-Graw Hill, Fifth Edition, 2007.
6	O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai Publications, Second Edition, 1999.

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B.E COMPUTER SCIENCE and ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER VI

Bioinformatics (1:0:0) 1

(Effective from the academic year 2023-24)

Course Code	21AEC62	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam. Hours	01

Course Objectives:

1. Better understanding of dynamic biological processes and their understanding at molecular level enabled through and correlated using internet and Bioinformatics.
2. To relate the basic knowledge in Genetics & Molecular Biology and see how it can be applied through Bioinformatics perspective.
3. To utilize bioinformatics tools and databases for retrieving, analyzing, understanding and managing biological data.

Preamble: Bioinformatics is an interdisciplinary field mainly involving molecular biology and genetics, computer science, mathematics, and statistics. Data intensive, large-scale biological problems are addressed from a computational point of view.

Module – 1

Biological Data Acquisition

The form of biological information. Retrieval methods for DNA sequence, protein sequence and protein structure information

(3 Hours)

Module – 2

DATABASES

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases – primary sequence databases, protein sequence and structure databases, Organism specific databases.

(3 Hours)

Module – 3

DATA PROCESSING

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus global. Distance metrics. Similarity and homology. Scoring matrices.

(3 Hours)

Module – 4

METHODS OF ANALYSIS

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSI BLAST.

(3 Hours)

Module – 5

APPLICATIONS

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis: Comparative genomics, orthologs, paralogs.

(3 Hours)

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Course Outcomes: The students will be able to:

CO1: Apply the basic methodology in Bioinformatics to retrieve data.

CO2: Analyze bioinformatics tools and databases for understanding and managing biological data.

CO3: Examine the applications of bioinformatics in allied areas.

Textbooks:

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O"Reilley Media.

References:

1. Bioinformatics The Machine Learning Approach by Pierre Baldi and Soren Brunak.

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B.E COMPUTER SCIENCE and ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Green IT And Sustainability (1:0:0) 1

(Effective from the academic year 2023 -2024)

Course Code	21CS63	CIE Marks	50
Teaching Hours/Week (L: T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	01

Course Objectives:

1. Understand challenges for Green ICT and the environmental impact.
2. Learn different aspects of ICT metrics and Sustainable Cloud Computing.
3. Explore effects of software design on sustainability.

Module – 1

Green ICT -History, Agenda, and Challenges Ahead: Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead

. **(3 Hours)**

Module – 2

Emerging Technologies and Their Environmental Impact: Introduction, Number of Connected Devices, Increased, Functionality, Increased Number of Separate Functions, Increased Demand for Speed and Reliability, Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Video conference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering , Building Management Systems, Saving IT.

(3 Hours)

Module – 3

Measurements and Sustainability: Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures.

(3 Hours)

Module – 4

Sustainable Cloud Computing: Introduction, Challenges in the Use of Cloud Computing As Green Technology, Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications**.**

(3 Hours)

Module – 5

Sustainable Software Design: Overview and Scope, Evaluating Sustainability Effects, Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime Energy Consumption Basics , Analyzing the Energy Consumption of an Application , Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy Consumption of an Application: Compiler Techniques, Optimizing the Energy Consumption of an Application: Runtime Approaches**.**

(3 Hours)

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Course Outcomes:

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

CO1: Classify the challenges for Green ICT

CO2: Relate the environmental impact due to emerging technologies.

CO3: Demonstrate different aspects of ICT metrics.

CO4: Compare the various parameters related to Sustainable Cloud Computing.

CO5: Interpret the effects of software design on the sustainability.

Textbooks:

Text Books:

1. Green Information Technology – A Sustainable Approach, Mohammad Dastbaz Colin Pattinson, Babak Akhgar, Elsevier, 2015 Inc.
2. San Murugesan; G. R. Gangadharan, Harnessing Green IT: Principles and Practices, Wiley-IEEE Press.

Web links and Video Lectures (e-Resources)

- https://www.youtube.com/watch?v=kvn_-mJ2tSo
- https://www.youtube.com/watch?v=kxngsYn5N3Y
- https://www.youtube.com/watch?v=EgdFi3sCgzU
- https://www.brightest.io/sustainability-measurement
- https://www.youtube.com/watch?v=S2m49Op25Zw.

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B.E COMPUTER SCIENCE and ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Data Science and Machine Learning (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CS67	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Discuss the concepts of statistical learning.
2. summarize Linear regression and Classification techniques and outline Tree based methods.
3. Explain unsupervised learning with statistical learning.
4. Learning about a set of tools for modelling and understanding complex datasets.

Preamble:

Significance and Scope of the course: Data Science helps with creating insights from data that deals with real world complexities and Machine Learning helps in accurately predicting or classifying outcomes for new data points by learning patterns from historical data. Data scientists can work with machine learning with equal ease.

Data science allows data collected for other purposes to be applied to model problems related to various domains. Machine learning is expanding across all fields such as banking and finance, information technology, media & entertainment, gaming etc.

An Overview of Statistical Learning: *Wage Data, Stock Market Data, Gene Expression Data,* A Brief History of Statistical Learning

Module – 1

Statistical Learning: What Is Statistical Learning, Assessing Model Accuracy

(8 Hours)

Module – 2

Linear Regression: Simple Linear Regression, Multiple Linear Regression, Other Considerations in the Regression Model, Comparison of Linear Regression with *K*-Nearest

(8 Hours)

Module – 3

Classification: An Overview of Classification, Why Not Linear Regression? Logistic Regression, Linear Discriminant Analysis.

(8 Hours)

Module – 4

Tree-Based Methods: The Basics of Decision Trees, Bagging, Random Forests, Boosting

(8 Hours)

Module – 5

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Unsupervised Learning: The Challenge of Unsupervised Learning, Principal Components Analysis, Clustering Methods

Self-Study Topics:

- Reinforcement learning
- Convolutional Neural Network.
- Deep Learning algorithms

Recap/ Summary: Overview of various techniques under supervised and unsupervised learning with focus on application in each domain.

(8 Hours)

Course Outcomes: The students will be able to:

CO1: Apply the concepts of statistical learning.

CO2: Solve the given problem by using supervised learning methods.

CO3: Use the unsupervised learning methods for prediction.

CO4: Analyze statistical learning methods for various areas.

Textbooks:

1. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani. "Introduction to Statistical Learning (with Applications in R)", Springer, 2017.

References:

1. A First Course in Machine Learning (Chapman& Hall/Crc Machine Learning & Pattern Recognition) Simon Rogers, Mark Girolami, CRC Press, 2011.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Theory of Computation (3:0:0) 3

((Effective from the academic year 2023-24)

Course Code	21CS68	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Apply the core concepts in Automata and Theory of Computation
2. Identify different Formal Language Classes and their Relationships.
3. Design Grammars and Recognizers for different formal languages.
4. Prove or disprove theorems in automata theory using their properties.
5. Determine the decidability and intractability of Computational problems

Preamble: Implication and Scope of Theory of Computation and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research Trends.

Module – 1

Introduction to Finite Automata: Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata. Finite automata with Epsilon-transitions**.**

(8 Hours)

Module – 2

Regular expressions, Properties of Regular Languages: Finite Automata and Regular Expressions; Applications of Regular Expressions. Kleene's theorem. **Regular languages:** Proving languages not to be regular languages; Equivalence and minimization of automata.

(8 Hours)

Module – 3

Closure properties of regular languages: Decision properties of regular languages; **Context-Free Grammars and Languages:** Context–free grammars; Writing a grammar, Leftmost derivation, rightmost derivation, derivation trees; Applications; Ambiguity in grammars and Languages.

(8 Hours)

Module – 4

Properties of Context-Free Languages: Normal forms for CFGs. Closure properties of CFLs. **Pushdown Automata:** Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

(8 Hours)

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Module – 5
Introduction to Turing Machine: Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines; Turing Machine and Computers. **Undecidability:** A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems. **Recap:** Summary of the Course **(8 Hours)**
Course Outcomes: The students will be able to: CO1: Analyze the concept of abstract machines and their power to recognize languages. CO2: Apply the finite state machines for modelling and solving computing problems. CO3: Design context free grammar for formal languages. CO4: Analyze difference between decidability and undecidability. CO5: Achieve the proficiency with mathematical tools and formal methods.
Textbooks 1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman ,Introduction to Automata Theory, Languages and Computation, Pearson Education, 3rd Edition, 2007 2. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013.
References:
1. Peter Linz, An Introduction to Formal Languages and Automata, 3rd Edition, Narosa Publishers, 1998. 2. K.L.P. Mishra, Theory of Computer Science, Automata, Languages, and Computation, PHI Learning, 3rd Edition, 2009. 3. John C Martin, Introduction to Languages and Automata Theory, Tata McGraw- Hill, 3rd Edition, 2007. Allen I Holub, Compiler design in C, Prentice-Hall software series.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Data Science and Machine Learning Laboratory (0:0:2) 1

(Effective from the academic year 2023-24)

Course Code	21CSL69A	CIE Marks	50
Teaching Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To learn basics of R.
2. Implementation of the various machine learning techniques.

Write the R programming for the following Questions.

Q1.

a) Load Auto. Data file.
b) View the data in a spread sheet using fix () function.
c) Handle the missing element of the data matrix.
d) Check for dimensions and Variable names.

Q2.

a) Plot the scatterplots of the quantitative scatterplot variables.
b) Produce a numerical summary of each variable in Auto. Data file.

Q3.

a) Fit a Simple Linear Regression model using least square.
b) Produce confidence intervals and prediction intervals.
c) Analyze detailed information using summary function.

Q4.

a) Fit a multiple linear regression model using least squares.
b) Analyze detailed information using summary function.
c) Include interaction terms in a linear model using the lm() function.
d) Analyze detailed information using summary function.

Q5.

a) Fit a logistic regression model. Use the functions to access coefficients and particular aspects of the fitted model.
b) Compute the confusion matrix in order to determine how many observations were correctly or incorrectly classified.
c) Fit a linear discriminant analysis model.

Q6.

d) knn() function to predict the market's movement, for K=1
e) Compare the result with K=3.
f) Fit a QDA model to the Smarket data.

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Q7.

a) Fit a classification tree in order to predict target variable.
b) Lists the variables that are used as internal nodes in the tree, the number of terminal nodes,
and the (training) error rate.
c) Plot the tree Structure, display the node labels.
d) Evaluate its performance on the test data.
e) Find the number of terminal nodes of each tree considered (size) as well as the corresponding error rate and the value of the cost-complexity parameter used.

Q8.

a) Fit boosted regression trees to the Boston data set.
b) Produce partial dependence plots for two variables considered.
c) Produces a relative influence plot and also outputs the relative influence statistics.
d) Produce partial dependence plots.
e) Use the boosted model to predict target variable on the test set.

Q9.

a) Perform PCA on the USArrests data set.
b) Plot the first two principal components.
c) Output the standard deviation of each principal component.
d) Compute the proportion of variance explained by each principal component.
e) Plot the PVE explained by each component and cumulative PVE,

Q10.

a) Performs K-means clustering.
b) Plot the data, with each observation colored according to its cluster assignment.
c) Implements hierarchical clustering.
d) Compute the 50 × 50 inter-observation Euclidean distance matrix.
e) Plot the dendrograms.

Course Outcomes: The students will be able to:

CO1: Interpret various Supervised and Unsupervised learning methods.

CO2: Analyze statistical learning methods for various data set.

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B.E COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Emerging Technology Laboratory (0:0:2) 1

(Effective from the academic year 2023 -24)

Course Code	21CSL69B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To apply essential software tools used for cross platform development software.
2. To analyze the contemporary advances and innovation in various fields of technology.
3. To study and implement converging technologies that is emerging in the domain.
4. To add to the research component in view of the future enhancements.

Tools Exploration

A comprehensive report contains purpose, working, inference, merits, and demerits of the tool. Snapshots of working with tools to be added. The list of tools is not just limited to the list given below. Students can choose any one tool under cyber forensics, data science and software engineering and submit the report.

List of tools

Cyber Forensics

1. Wireshark
2. SamSpade
3. NESSUS
4. NMAP
5. Forensics Acquisition of Websites

Data Science

1. ETL Tool (Any tool Kettle, Octapus etc.)
2. KNIME
3. Rapid Miner
4. R tool
5. Apache Spark / Hadoop
6. Python

Software Engineering

Rational Rose/Metamil/Enterprise Architecture: Introduction, creating class diagram, developing use case model, Domain model, UML Sequence diagrams, statecharts and activity diagrams.

1. Identify Use Cases and develop the Use Case model for ONLINE PURCHASE SYSTEM
2. Identify the conceptual classes and develop a domain model with UML Class diagram for LIBRARY MANAGEMENT SYSTEM.
3. Using the identified scenarios, find the interaction between objects and represent

Course Outcomes: The students will be able to:

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CO1: Analyze the state of art and literature in the fields/domains of Cyber Forensics, Data Science and software Design and Engineering CO2: Apply the concepts and implement the research component of the new technology to the solution. CO3: Assess the applicability of the design in various fields of modern technology including the emerging ones based on literature survey
Assessment Details (both CIE and SEE) **Lab Evaluation Scheme** A report having the purpose, working, inference, merits, and demerits of the tool and the snapshots of working with the tool to be presented. A total mark of 40 is to be scored by the student from both CIE and SEE together out of 100.

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B.E COMPUTER SCIENCE and ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Mobile Application Development Laboratory (0:0:2) 1

(Effective from the academic year 2023-24)

Course Code	21CSL69C	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Course Objectives:

1. Learn and acquire the art of Android Programming.
2. Install and Configure Android studio and its development tools to run the applications.
3. Use User Interface components for android application development.
4. Create Android applications using mobile related server-less database like SQLITE.
5. Inspect different methods of sharing data using services.

- The installation procedure of Android Studio & Java JDK tools shall be demonstrated and carried out in groups.
- Students shall learn and execute programs either in Java or Kotlin Language. The students are free to design their user interface layouts and controls to design the application programs in the syllabus.
- The mini project from Part B can be designed and developed using any modern tools relevant to Android Studio and can improvise by adding extra features to the existing topics (Projects/ Programs are not limited to the list given in Part B).·

Part A

1. Create an application to design a Digital Business Card. The card should have a company logo, the company name, and information like the name of the employee, job title, phone number, address, email, fax, Github Profile, LinkedIn Profile links and the website address. Design the application by using different fonts, colors, and with professional UI design outlook.

2. Develop an Android application using controls like Button, TextView, EditText for designing a native calculator having basic functionality like Addition, Subtraction, Multiplication, and Division. Also learn the different ways of handling button events.

3. Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.

4. Design an application for a simple alarm clock. Add features like setting up once-off alarm/ recurring and alarm, dismiss and snooze alarm.

5. Develop a simple application with one EditText so that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice.

6. Design an application for SMS application using Intent . Design a simple layout which

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shows a text called *message* in the top and followed by the header called *mobile number* and a *input field* which allows the user to enter the mobile number to which the message has to be sent. And also a *big input field* where the user is going to write the text message and a *send button. A toast message* that shows success/failure of SMS sending.

7. Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts

8. Create a SIGN Up activity with Username and Password. Validation of passwords should happen based on the following rules:
   - Password should contain uppercase and lowercase letters.
   - Password should contain letters and numbers.
   - Password should contain special characters.
   - Minimum length of the password (the default value is 8).

   On successful SIGN UP proceed to the next Login activity.

Here the user should SIGN IN using the Username and Password created during the signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else displays a toast message saying "Login Failed". The user is given only two attempts and after that displays a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.

Part B

1. Design an application that accesses your camera and scans the QR code or barcode and returns the results by Integrating the Mobile Vision API of Google Play Service.

2. Create two files of XML and JSON type with values for City Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.

3. Design an android media player application that includes audio, video and recording media. The applications should be able to l control the audio/video playback like start, stop, pause etc, record the audio/video file and store it in the external directory in mp3/mp4 format.

4. Design an application using SQLite database to perform database operations on Student database like Name, USN, contact details and email id. Create the database handler class that extends SQLiteOpenHelper and implement its methods.

5. Develop a content provider application with an activity called "Meeting Schedule" which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called "Meeting Info" having Date Picker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying
   "No Meeting on this Date".

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6. Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in MkSDcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying "First Create a File".

7. Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the Start Task button, the banner message should scroll from right to left. On pressing the Stop Task button, the banner message should stop. Let the banner message be "Demonstration of Asynchronous Task".

8. Develop an application that makes use of the clipboard framework for copying and pasting text. The activity consists of two EditText controls and two Buttons to trigger the copy- and- paste functionality.

Text Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer- fundamentals-course-concepts/details

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014 ISBN-13: 97 8-8126547197
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O"Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
3. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13: 978-0134706054.

Course Outcomes: The students will be able to:

CO1: Create, test and debug Android application by setting up Android development environment.
CO2: Implement adaptive, responsive user interfaces that work across a wide range of devices.
CO3: Infer long-running tasks and background work in Android applications.
CO4: Demonstrate methods in storing, sharing and retrieving data in Android applications.
CO5: Infer the role of permissions and security for Android applications.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Computer Network and Security (3:0:0) 3

(Effective from the academic year 2023 -2024)

Course Code	21CS641	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Learn fundamentals of cryptography and its application to network security.
2. Apply basic number theory in cryptography, the design principals of symmetric and asymmetric cryptography, AES, and RSA.
3. The course will be emphasizing on algorithmic complexity and security vs performance trade off.
4. Understand network security threats, security services, and countermeasures.
5. Analyze well-known network security protocols such as IPSec, SSL, and WEP.
6. Explore vulnerability analysis of network security, hash functions, authentication, firewalls, and intrusion detection techniques.

Module – 1

Preamble:

This course describes the explosive growth in computer systems and their interconnections via networks. It has increased the dependence of both organizations and individuals on the information stored and communicated using these systems. This, in turn, has led to a heightened awareness of the need to protect data and resources from disclosure, to guarantee the authenticity of data and messages, and to protect systems from network-based attacks and the disciplines of cryptography and network security have matured, leading to the development of practical, readily available applications to enforce network security.

Foundations of cryptography and block Cipher Techniques: OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, model for Network Security. Classical Encryption Technique: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

(8 Hours)

Module – 2

Data Encryption and advanced encryption techniques: Block Ciphers, Data Encryption Standard and Advanced Encryption Standard Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round. Public Key Cryptography and Key Management: Principles of Public Key Cryptosystem, RSA algorithm, Key management, Diffie Hellman Key exchange.

(8 Hours)

Module – 3

Message Authentication and Hash Function: Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard. Authentication Applications: Kerberos, X.509 Authentication Service.

(8 Hours)

Module – 4

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Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME IP Security: IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

(8 Hours)

Module – 5

Web Security: Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET). System Security: Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewalls and Firewall Configuration.

Recap: This course has highlighted the topics namely fundamentals of cryptography, block ciphers, encryption algorithms, Message Authentication and Hash Algorithms, Security issues in E-mail, IP and also in the context of the Web. Further explores security systems namely IDS and Firewalls. The course facilitates learning at higher cognitive levels to gain deeper understanding.

(8 Hours)

Course Outcomes: At the end of the course **t**he students will be able to:

CO1: Apply encryption techniques for the given problem and analyze the results.

CO2: Design the Cipher technique and analyze the functioning of Cipher for the given problem.

CO3: Implement the Public and Private key based cryptography algorithms and conclude the results of algorithm based on output.

CO4: Design and implement the cryptographic algorithms using programming languages/ tools for the given problem/context.

CO5: Design the security planning for the given case study for data classification, access control and propose technical solution and submit the detailed report with plagiarism check.

Textbooks:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 4th Edition, Pearson Education, 2009. (Chapters: 1, 2.1-2.3, 3.1,3.2,3.5, 5.1,5.2, 6.2, 9.1,9.2, 10.1,10.2, 11.1- 11.4, 13.1, 13.3, 14.1, 4.2, 15.1, 15.2, 16.1-16.6, 17.1-17.3, 18.1, 18.2, 20.1

References:

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay: "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill, 2010. Atul Kahate, "Cryptography and Network Security" 2nd Edition TMH

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Agile Technologies and DevOps (3:0:0) 3

(Effective from the academic year 2023 -2024)

Course Code	21CS642	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Understand the differences between conventional and agile approaches.
2. Estimate in an incremental and iterative fashion using practical techniques.
3. Apply agile principles to a range of decision possibilities.
4. Learn DevOps for CI/CD using containers, container orchestration and pipelines.

Module – 1

Preamble: Agile Technologies involves discovering requirements and developing solutions through the collaborative effort of self-organizing and cross-functional teams and their customers and users. It advocates adaptive planning, evolutionary development, early delivery, and continual improvement, and it encourages flexible responses to changes in requirements, resource availability, and understanding of the problems to be solved.

DevOps is a set of practices that combines software development and IT operations. It aims to shorten the systems development life cycle and provide continuous delivery with high software quality.

This course will be discussing about Agile requirements, Agile Tools: JIRA, Scrum, Agile Process, Sprints, Testing, Test Automation, Devops on Cloud.

Introduction: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation, Impact of the course on societal and ethical issues and career perspective.

Introduction to Agile: Agile versus traditional method comparisons and process tailoring

Software Process Models – overview, Introduction to Agile, Various Agile methodologies - Scrum, XP, Lean, and Kanban, Agile Manifesto, Scrum: Scrum process, roles - Product Owner, ScrumMaster, Team, Project Manager, product manager, architect, events, and artifacts; Product Inception: Product vision, stakeholders, initial backlog creation.

(8 Hours)

Module – 2

Agile Requirements - User personas, story mapping, user stories, 3Cs, INVEST, acceptance criteria, sprints, requirements, product backlog and backlog grooming; Tools: Agile tracking tools such as JIRA; Scaled agile frameworks: SAFe, Scrum@Scale, and Disciplined Agile.

(8 Hours)

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Module – 3
Agile Process: Definition of Done, Definition of Ready; Estimation; Agile forecasting and project Management - Big visible information radiators, velocity, progress tracking, Track Done pattern, project forecasting, Ux Design, Control the Flow: Sprint Planning, Sprint Reviews, Sprint Retrospectives, Sprint Planning - Agile release and iteration (sprint) planning, Develop Epics and Stories, Estimating Stories, Prioritizing Stories (WSJF technique from SAFe), Create product roadmap. **(8 Hours)**
Module – 4
Sprints: Iterations/Sprints Overview. Velocity Determination, Iteration Planning Meeting, Iteration, Planning Guidelines, Development, Testing, Daily Stand-up Meetings, Progress Tracking, Velocity Tracking, Monitoring and Controlling: Burn down Charts, Inspect & Adapt (Fishbone Model), Agile Release Train. **(8 Hours)**
Module – 5
Testing: Functionality Testing, UI Testing, Performance Testing, Security Testing, Tools - Selenium Agile Testing: Principles of agile testers; The agile testing quadrants, Agile automation, Test automation pyramid DevOps: Continuous Integration and Continuous Delivery CI/CD: Jenkins Creating pipelines, Setting up runners Containers and container orchestration (Dockers and Kubernetes) for application development and deployment; Checking build status; Fully Automated Deployment; Continuous monitoring with Nagios; Introduction to DevOps on Cloud. **Summary:** Recap of the essential agile techniques and DevOps **(8 Hours)**
Course Outcomes: The student will be able to: CO1: Understand Agile Testing principles for real life situations and learn the basics of SAFe for scaled agile. CO2: Interpret and apply various principles, phases and activities of the Scrum methodology. CO3: Compare and contrast the differences between Agile and other project management. Methodologies. CO4: Identify and use various tools for Agile development and CI/CD.
Textbooks:
1. Jim Highsmith, "Agile Project Management: Creating Innovative Products", Second Edition By , Addison-Wesley Professional, 2009. 2. James A. Crowder, Shelli Friess, "Agile Project Management: Managing for Success", Springer 2014.
References:
1. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide For Testers And Agile Teams", Pearson, 2010 6. More Agile 2. Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee "DevOps: Puppet, Docker, and Kubernetes", Ke-Jou Carol Hsu, Packet, Sricharan Vadapalli, DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive, Packet, 2018.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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SEMESTER – VI

Robotic Process Automation (3:0:0) 3

(Effective from the academic year 2023 -2024)

Course Code	21CS643	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Gain a clear understanding of RPA and benefits, understanding the limits and constraints of automation.
2. Understand the basic AA components, features and technology.
3. Acquire the knowledge on purpose and use of the control center.
4. Understand the various use cases and write bots.

Module – 1

Preamble: Robotic process automation (RPA) is a form of business process automation technology based on metaphorical software robots or on artificial intelligence /digital workers. It is sometimes referred to as software robotics. RPA involves the use of software that mimics human actions while interacting with applications in a computer and accomplishing rule-based tasks. This often requires reading from and typing or clicking on existing applications that are used to perform the given tasks.

RPA Foundations: What is RPA, Flavors of RPA, History of RPA, The Benefits of RPA- The downsides of RPA, RPA Compared to BPO, BPM and BPA, Consumer Willingness for Automation, The Workforce of the Future. RPA Skills: On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR, Databases, APls, Al, Cognitive Automation, Agile, Scrum, Kanban and Waterfall, DevOps, Flowcharts.

(8 Hours)

Module – 2

Components of RPA, RPA Platforms, About UiPath, The future of automation. Record and Play: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step-by-step examples using the recorder.

(8 Hours)

Module – 3

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow. **Data Manipulation:** Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example)

(8 Hours)

Module – 4

Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, when to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points.

(8 Hours)

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Module – 5
Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, debugging techniques, Collecting crash dumps, Error reporting. **Recap**/Summary of the Course **(8 Hours)**
Course Outcomes: The students will be able to: CO1: Apply the robotic process automation knowledge to solve problems. CO2: Analyze RPA Scripts for different use cases. CO3: Interpret various aspects of debugging of RPA applications. CO4: Develop basic robots using UiPath Community Edition.
Textbooks:
1. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, 2020, ISBN-13 (electronic):978-7-4842-5729-6, Publisher: A press 2. Alok Mani Tripathi, Learning Robotic Process Automation, Packt, 1st Edition, 2018.
References:
1. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and Their Benefits, CreateSpace Independent Publishing Platform, 2018.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Augmented and Virtual Reality (3:0:0) 3

(Effective from the academic year 2023 -2024)

Course Code	21CS644	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

To understand the basics of virtual reality.

To understand geometric modeling and Virtual environment.

To study about Virtual Hardware's and Software's.

To develop Virtual Reality applications.

Module – 1

Preamble: Understanding the importance of the study of virtual reality and its applications in the field of Engineering.

Introduction to virtual reality: Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics –Flight Simulation – Virtual environments–requirement – benefits of virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D **Computer Graphics** :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image. **(8 Hours)**

Module – 2

Virtual environment: Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and non- linear translation - shape & object in between – free from deformation – particle system- Physical **Simulation:** Introduction – Objects falling in a gravitational field – Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

(8 Hours)

Module – 3

Geometric modeling: Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A **Generic VR system:** Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction – VR Systems. **(8 Hours)**

Module – 4

Introduction to Augmented Reality: Definition, scope, brief history, Examples, Related Fields

(8 Hours)

Module – 5

Displays: Multimodal displays, Visual Perception, Requirements and characteristics, spatial display and visual display

Summary: The student will be able to analyze and apply various concepts related to vector calculus and differential equations.

(8 Hours)

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Course outcomes:
The students will be able to: CO1: Adopt various principles and concepts of virtual reality and its application. CO2: CO2: Apply different geometric modelling. CO3: Develop virtual model for different problems.
Textbooks:
1. John Vince," Virtual Reality Systems", Pearson Education, 2007.
References:
1. Dieter Schmalstieg, Tobias Hollerer, "Principles and Practices Augmented Reality Principles and Practices", Addisen Wesley, Ebook

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Big Data Analytics (3:0:0) 3

(Effective from the academic year 2023-24)

Subject Code	21CS645	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable the students to:

1. Understand fundamentals of Big Data analytics
2. Explore the Hadoop framework and Hadoop Distributed File system.
3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
4. Employ MapReduce programming model to process the big data.
5. Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

Module – 1

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

(8 Hours)

Module – 2

Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.

Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands.

Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

(8 Hours)

Module – 3

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.

(8 Hours)

Module – 4

MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.

(8 Hours)

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Module – 5
Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Item sets and Association Rule Mining. **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics **(8 Hours)**
Course outcomes: The students will be able to: Understand fundamentals of Big Data analytics. CO1: Investigate Hadoop framework and Hadoop Distributed File system. CO2: Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data. CO3: Demonstrate the MapReduce programming model to process the big data along with Hadoop tools. CO4: Use Machine Learning algorithms for real world big data. CO5: Analyze web contents and Social Networks to provide analytics with relevant visualization tools
Text Books:
1. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966 2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN13: 978-9332570351.
References:
1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O‟Reilly Media, 2015.ISBN-13: 978-9352130672 2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014ISBN-13: 978-8126551071 3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261 4. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System

(CBCS) SEMESTER – VI

Introduction to Operating System (3:0:0) 3

(Effective from the academic year 2023-24)

Subject Code	21CS651	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

- Explain the fundamentals of operating system.
- Comprehend multithreaded programming, process management, memory management and storage management.
- Familiar with various types of operating systems

Module – 1

Introduction: What OS do, Computer system organization, architecture, structure, Operations, Process, memory and storage management, Protection and security, Distributed systems, Special purpose systems, computing environments. System Structure: OS Services, User - Operating System interface, System calls, Types of system calls, System programs, OS design and implementation, OS structure, Virtual machines, OS generation, system boot. **Chapter 1,2**

(8 Hours)

Module – 2

Process Concept: Overview, Process scheduling, Operations on process, IPC, Examples in IPC, Communication in client-server systems. Multithreaded Programming: Overview, Models, Issues, Process Scheduling: Basic concept, Scheduling criteria, Algorithm, Algorithm Evaluation.

Chapter 3,4,5 **(8 Hours)**

Module – 3

Synchronization: Background, the critical section problem, Petersons solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Deadlocks: System model, Deadlock characterization, Method of handling deadlock, Deadlock prevention, Avoidance, Detection, Recovery from deadlock **Chapter 6**

(8 Hours)

Module – 4

Memory management strategies: Background, swapping, contiguous memory allocation, paging, structure of page table, segmentation. Virtual Memory management: Background, Demand paging, Copy-on-write, Page replacement, allocation of frames, Thrashing. **Chapter 7,8**

(8 Hours)

Module – 5

File system: File concept, Access methods, Directory structure, File system mounting, File sharing, protection, Mass Storage Management: Disk Structure, Disk scheduling algorithms. **Chapter 9,11**

(8 Hours)

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Course outcomes: The students will be able to CO1: Demonstrate the need of OS and different types of OS CO2: Apply suitable techniques for management of different resources. CO3: Realize the different concepts of OS in the platform of usage.	
Textbooks:	
1.	Silberschatz, P B Galvin, G Gagne, Operating systems, 9th edition, John Wiley and sons,
Reference Book:	
1.	William Stalling, "Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
2.	Andrew S Tanenbaum, Herbert BOS, "Modern Operating Systems", Pearson Education, 4th Edition, 2016

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

OOPS with C++ (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CS652	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Learning Objectives: This course will enable students to:

- Understanding about object-oriented programming and Gain knowledge about the capability to store information together in an object.
- Understand the capability of a class to rely upon another class and functions.
- Understand about constructors which are special type of functions.
- Create and process data in files using file I/O functions.
- Use the generic programming features of C++ including Exception handling

Module – I

Introduction to Object Oriented Programming: Computer programming background- C++ overview. First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.

Textbook 1: Chapter 1(1.1 to 1.8)

(8 Hours)

Module – II

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Functions: Member functions, Friend functions and Function overloading.

Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20) , chapter 4(4.3,4.4,4.5,4.6,4.7,4.9) Chapter 5(5.4,5.5,5.6, 5.15)

(8 Hours)

Module – III

Inheritance & Polymorphism: Derived class Constructors, Multiple Constructor in a class , destructors-Types of Inheritance Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.

Polymorphism: Operator Overloading, Virtual Functions, Pure Virtual functions.

Textbook 2: Chapter 6 (6.2,6.4,6.11), Chapter 7(7.2), chapter 8 (8.1 to,8.8), Chapter 9(9.6, 9.7)

(8 Hours)

Module – IV

I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations.

Textbook 1: Chapter 12(12.5) , Chapter 13 (13.6,13.7) **(8 Hours)**

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Module – V	
Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch block Throw statement- pre-defined exceptions in C++ **Textbook 2: Chapter 13 (13.2 to 13.6)** **(8 Hours)**	
Course outcomes: After studying this course, students will be able to: CO1: Illustrate the basic concepts of object-oriented programming. CO2: Design appropriate classes for the given real-world scenario. CO3: Apply the knowledge of compile-time / run-time polymorphism to solve the given problem. CO4: Use the knowledge of inheritance for developing optimized solutions	
Textbooks	
1.	Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2	Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd, Fourth Edition 2010.
Web links and Video Lectures (e-Resources)	
1.	Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2	Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw
Tutorial Link:	
1	https://www.w3schools.com/cpp/cpp_intro.asp
2	https://www.edx.org/course/introduction-to-c-3

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

WEB TECHNOLOGIES (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CS653	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Learning Objectives: This course will enable students to:

1. Illustrate the Semantic Structure of HTML and CSS
2. Compose forms and tables using HTML and CSS
3. Design Client-Side programs using JavaScript and Server-Side programs using PHP
4. Infer Object Oriented Programming capabilities of PHP
5. Examine JavaScript frameworks such as jQuery and Backbone

Module – I

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, Introduction to CSS, What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

Textbook 1: Ch. 2, 3

(8 hours)

Module – II

HTML Tables and Forms, Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks.

Textbook 1: Ch. 4,5

(8 hours)

Module – III

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, Introduction to Server-Side Development with PHP, What is Server-side Development, A web server's Responsibilities, Quick tour of PHP, Program
Control, Functions.

Textbook 1: Ch. 6, 8

(8 hours)

Module – IV

PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, what are Errors and Exceptions? PHP Error Reporting.

Textbook 1: Ch. 9, 10

(8 hours)

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Module – V
Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes. **Textbook 1: Ch. 13, 15,17** **(8 hours)**

Course outcomes:

Students will be able to:

CO1: Adapt HTML and CSS syntax and semantics to build web pages.

CO2: Construct and visually format tables and forms using HTML and CSS.

CO3: Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate. and display the contents dynamically.

CO4: Appraise the principles of object-oriented development using PHP.

CO5: Inspect JavaScript frameworks like jQuery and Backbone which facilitates developer to focus on core features.

Text books

1.	Randy Connolly, Ricardo Hoar, "Fundamentals of Wed Development", 1stEdition, Pearson Education India. (ISBN:978-9332575271)

References

1.	Robin Nixon, "Learning PHP, MySQL & JavaScript with JQuery, CSS and HTML5", 4th Edition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
2.	Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
3.	Nicholas C Zakas, "Professional JavaScript for Wen Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
4.	David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Lts, 2014.

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DEPARTMENT OF COMPUTER AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Python Programming (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CS654	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples and dictionaries.
3. Demonstrate the use of functions.
4. Implement the Object-Oriented Programming concepts in Python.

Module – I

Introduction: **Python Basics**, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control**, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit()

Textbook 1: Chapter 1,2 **(8 hours)**

Module – II

Introduction to functions: Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, A Short Program: Guess the Number.

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, List-like Types: Strings and Tuples

Textbook 1: Chapter 3,4 **(8 hours)**

Module – III

Dictionaries and Structuring Data, The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things

Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker

Textbook 1: Chapter 5,6 **(8 hours)**

Module – IV

Files and exceptions: Text files, Writing variables, Directories, Pickling, Exceptions **Debugging,** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE's Debugger

Textbook 1: Chapter 10, Textbook 2: Chapter 11

(8 hours)

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Module – V
Classes and objects, Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, **Classes and functions,** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The_str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation. **Textbook 2: Chapter 12,13,14** **(8 hours)**
Course outcomes: The students will be able to: CO1: Understand syntax and semantics of python programming. CO2: Apply knowledge of python programming for different applications. CO3: Develop python programs to realize various computational applications. CO4: Interpret the concepts of Object-Oriented Programming as used in Python.

Textbooks:	
1.	Al Sweigart,**"Automate the Boring Stuff with Python",**1stEdition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist, 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)
References	
1.	David Beazley, Brian K. Jones, Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, Kindle Edition, O'Reilly Media; 3rd edition (10 May 2013)
2.	Charles R. Severance, Python for Everybody: Exploring Data Using Python 3, 1st Edition, Create Space Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/python learn/ENus/pythonlearn.pdf)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER -VI

Introduction to Data Structures (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CS655	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Learn and identify different data structures in C programming language.
2. Assess the use of suitable data structures in problem-solving.
3. Implement the usage of data structures using C programming language.
4. Develop solutions for practical problems.

Module – I

C Recap: Pointers.

Data Structures: Introduction, Classification, Operations.

Arrays: Declarations, Accessing/Storing of Elements, Operations, Passing arrays to Functions, Pointers and Arrays, Arrays of Pointers. Sorting (selection, insertion, bubble), and searching (Linear, Binary), Programming Examples. **Dynamic memory allocation**.

Textbook 1: 1.11, 2.1-2.3, 3.1-3.8, 14.1-14.3, 14.7-14.9. **Textbook 2:** 1.2.2.

(8 hours)

Module – II

Structures: Introductions, Nested Structures, Arrays of Structures, Structures and Functions, Self-referential Structures.

Linked Lists: Definition, Representation of linked lists in Memory, Singly Linked List,

Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, Circular Doubly Linked List—programming Examples.

Textbook 1: 5.1-5.5, 6.1-6.5.

(8 hours)

Module – III

Stacks: Definition, Stack Operations, Array Representation of Stacks, Linked representation of Stacks, Operations on Linked Stack, Programming Examples.

Recursion: Factorial, GCD, Fibonacci Sequence, Tower of Hanoi.

Textbook 1: 7.1-7.5, 7.7.4.

(8 hours)

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Module – IV
Queues: Introduction, Array representation of Queues, Linked representation of Queues, Types of Queues, Applications of Queues (Excluding Josephus Problem), Programming Examples. **Textbook 1:** 8.1-8.5. **(8 hours)**
Module – V
Trees: Introduction, Types of Trees, Creating a Binary Tree, Binary Tree Traversals - Inorder, postorder, preorder, Level Order. **Binary Search Trees:** BST create, Insert, and search -, Programming Examples. **Graphs:** Introduction, Terminologies, Directed graphs, Matrix and Adjacency List Representation of Graphs, Breadth First Search, Depth First Search - Programming Examples. **Textbook 1:** 9.1-9.4, 10.1, 10.2.1, 10.2.2, 10.2.3, 13.1-13.3, 13.5, 13.6. **(8 hours)**
Course outcomes: CO1: Understand the concepts of data structures. CO2: Implement data structures using C Programming language. CO3: Apply various data structures in problem-solving using C language. CO4: Design and develop solutions using Data Structures for practical problems.

Textbooks:	
1.	Reema Thareja, Data structures using C, 2nd Ed, Oxford University Press.
2.	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
References:	
1.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014