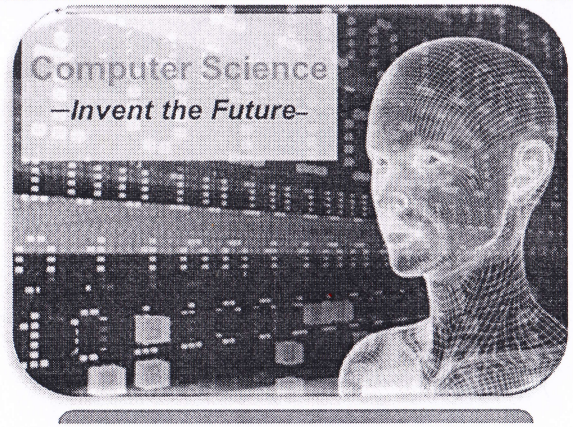
SCHEME AND SYLLABUS



21 SCHEME

Computer Science and Engineering

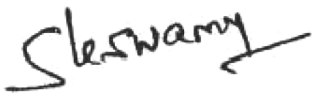
B.E

H.P. Rajashekhar Swamy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

SK Swamy
Head of Department
Computer Science Engineering
Global Academy of Technology

GLOBAL ACADEMY OF TECHNOLOGY
(Autonomous Institution Affiliated to VTU, Belagavi)
Accredited by NAAC with 'A' Grade,
NBA Accredited - CSE, ISE, ECE, EEE, ME, CV
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098

VISION, MISSION, PEO, PO and PSO Statements



GLOBAL ACADEMY OF TECHNOLOGY

Rajarajeshwarinagar,Ideal Homes Township, Bengaluru-560098

Ph: 080-28603158, Fax: 080-28603157

Department: Computer Science and Engineering

Vision

To achieve academic excellence and strengthen the skills to meet emerging challenges of computer science and engineering.

Mission

- To impart strong theoretical foundation in the field of Computer Science and Engineering accompanied with extensive practical skills.
- To inculcate research and innovation spirit through interaction with industry and carry out projects that address societal needs.
- Instill professional ethics and values with a concern for environment.

Sleswamy

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Program Educational Objectives [PEOs]

After successful completion of the program, the CSE graduates will be able to:

PEO1: Succeed in engineering/management positions with professional ethics.

PEO2: Engage in improving professional knowledge through certificate/post-graduate programs in engineering or management.

PEO3: Establish themselves as entrepreneurs and contribute to the society.

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Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusionsusing first principles of mathematics, natural sciences, and engineering sciences.
3. **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 the public health and safety, and the cultural, societal, and environmental considerations.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **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

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practice.

7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
10. **Communication:** Communicate effectively on complex engineeringactivities with the engineering community and with 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.
11. **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 multi disciplinary environments.
12. **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.

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Program Specific Outcomes (PSO)

At the end of the program, the CSE graduates will be able to :

PSO1: Design, Implement and test system software and application software to meet the desired needs.

PSO2: Develop solutions in the area of communication networks, database systems and computing systems.

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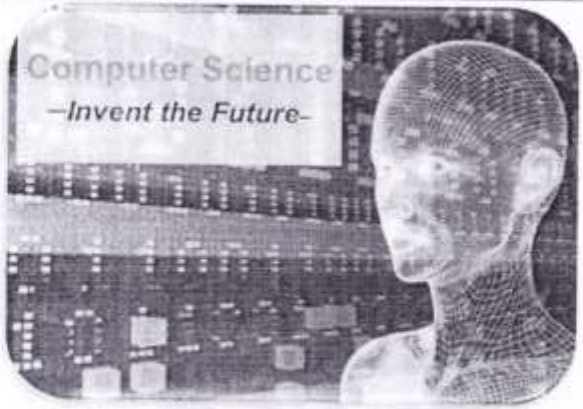
SCHEME AND SYLLABUS



Department of Computer Science and Engineering

III -IV Semester

(2021-22)

Computer Science

&

Engineering

GLOBAL ACADEMY OF TECHNOLOGY
(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH and IS branches)
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

21/12/2021
Head of Department
Computer Science Engineering
Global Academy of Technology
Bangalore - 98

H.P. Rajasekhar Swamy
Dean Academic
Global Academy of Technology,
Raja Rajeshwarinagar, Bengaluru-98

Scheme and Syllabus of UG Autonomous Program - 2021 Batch

(3rd and 4th Semester)

III SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21MAT31A	Discrete Mathematics – I	BS	MAT	2	2	0	50	50	100	3
2	21CSE32	Data Structures	PC	CSE	3	0	0	50	50	100	3
3	21CSE33	Digital Logic Design	IPC		3	0	2	50	50	100	4
4	21CSE34	Operating Systems	PC		3	0	0	50	50	100	3
5	21CSE35	Software Engineering	PC		3	0	0	50	50	100	3
6	21KSK36/46	Samskrutika Kannada	HSM	Any Department	1	0	0	50	50	100	1
	21KBK36/46	Balake Kannada									
	OR										
	21CPH36/46	Constitution of India and Professional Ethics									
7		**Ability Enhancement Course I**									
	21CSE371	Biology for Engineers	PC	CSE	1	0	0	50	50	100	1
	21CSE372	Soft Skills and Relationship			1	0	0				
8	21CSEL38	Data Structures Laboratory	PC	CSE	0	0	2	50	50	100	1
							Total	**400**	**400**	**800**	**19**

9	21MATDIP31	Additional Mathematics (For Lateral Entry Students)	BS	MAT	2	2	0	100	--	100	0

IV SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21MAT41A	Discrete Mathematics – II	BS	MAT	2	2	0	50	50	100	3
2	21CSE42	Design and Analysis of Algorithms	PC	CSE	3	0	0	50	50	100	3
3	21CSE43	Microcontroller and Embedded Systems	IPC		3	0	2	50	50	100	4
4	21CSE44	Object Oriented programming with Java	PC		2	2	0	50	50	100	3
5	21CSE45	Computer Organization and Architecture	PC		3	0	0	50	50	100	3
6	21KSK36/46	Samskrutika Kannada	HSM	Any Department	1	0	0	50	50	100	1
	21KBK36/46	Balake Kannada									
	OR										
	21CPH36/46	Constitution of India and Professional Ethics									
7	**Ability Enhancement Course II**										
	21CSE471	Environmental Studies	PC	CSE	1	0	0	50	50	100	1
	21CSE472	Personality Development			1	0	0				
8	21INT48	Inter/Intra Institutional Internship	INT	CSE	0	0	4	100	-	100	2
9	21CSEL49	Design and Analysis of Algorithms Laboratory	PC	CSE	0	0	2	50	50	100	1
							Total	**500**	**400**	**900**	**21**

SEMESTER – III

SUBJECT: DATA STRUCTURES

Subject Code -	21CSE32	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the concept of pointers and, allocate and deallocate memory dynamically to pointers.
CLO2	To understand working principle of different types of data structures
CLO3	To identify and apply the appropriate data structure to solve a given problem.
CLO4	To develop applications using data structure algorithms.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations **Sorting:** Insertion Sort, Radix sort, Address Calculation Sort. **The Stack**: Definition and Examples - Primitive operations, examples **Representing Stacks in C**: Implementing the POP operation, testing for exceptional conditions, implementing the PUSH operation an Example: Infix, Postfix, and Prefix – Basic definitions and examples **Stack Applications** – Recursive Definition and Processes, Tower of Hanoi, conversion of infix to prefix and postfix, Evaluating a postfix expression	10 L1, L2,L3
MODULE 2 **Queues:** The Queue and its Sequential Representation: C Implementation of Queues, primitive operations on Queue, Array Implementation of a Priority Queue, circular Queue, double ended queue	6 L1, L2,L3
MODULE 3 **Dynamic Memory Allocation:** Introduction, Dynamic Memory Allocation, allocating a Block of Memory: malloc, allocating a Multiple Blocks of Memory: calloc, Releasing the	8 L1, L2, L3

Used Space: Free, Altering the size of Block: realloc. **Linked Lists:** Introduction and definition, representation of linked list in memory, primitive operations on linked list, Linked Implementation of Stacks, getnode and free node Operations, Linked Implementation of Queues	
MODULE 4 **Other list structures** - Circular lists and its primitive operations, doubly linked lists and its primitive operations, Applications of linked lists: Addition of long positive integers, addition of Polynomials. **Hashing:** Hash tables, Hash function, Overflow handling: Open Addressing, Chaining	8 L1, L2
MODULE 5 **Binary Trees:** Introduction and definition, Node Representation of Binary Trees, Internal and External Nodes, Implicit Array Representation of Binary Trees, Primitive operations on Binary Tree, threaded binary tree, Binary search tree and its primitive operations, General Expressions as Trees, evaluating an expression tree, constructing a Tree.	8 L1, L2, L3

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

CO32.1	Explain different types of data structures along with couple of sorting techniques.
CO32.2	Apply the operational aspects of stacks in problem solving.
CO32.3	Apply the operational aspects of queues in problem solving.
CO32.4	Demonstrate various aspects related to Linked Lists.
CO32.5	Explain the importance of Hash functions
CO32.6	Solve problems involving trees.

Textbooks:

1. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaz Sahni, Anderson, Freed, Second edition, University press, 2008, Reprinted 2016
2. "Data Structures using C", Seymour Lipschutz, Schaum's Outlines, McGraw Hill, Special Indian Edition, Thirteenth Reprint 2015.

Reference Books:

1. "Data Structures using C & C++", Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, Second Edition, Pearson, Tenth Impression 2020.
2. "Data Structures - A Pseudo code approach with C", Richard F. Gilberg and Behrouz A. Forouzan, Second Edition, CENGAGE LEARNING, Sixth Indian Reprint 2016.
3. Data Structures using C, E. Balagurusamy, Tenth reprint 2017, McGraw Hill Education

E-Books / Web References

1. https://www.freebookcentre.net/ComputerScience-Books-Download/Data-Structures-and-Algorithms.html
2. http://www.uoitc.edu.iq/images/documents/informatics-institute / Competitive_exam / DataStructures.pdf
3. https://people.cs.vt.edu/shaffer/Book/Java3e20110103.pdf

MOOCs

1. https://www.edx.org/course/introduction-to-data-structures
2. https://www.codespaces.com/best-data-structures-and-algorithms-courses-classes.html
3. https://nptel.ac.in/courses/106/102/106102064/
4. https://www.udacity.com/course/data-structures-and-algorithms-in-python--ud513

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO32.1	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO32.2	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO32.3	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO32.4	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO32.5	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO32.6	3	3	3	-	-	-	-	-	-	-	-	2	-	-
Average	3	3	3	-	-	-	-	-	-	-	-	2	-	-

Low-1: Medium-2: High-3

SUBJECT: DIGITAL LOGIC DESIGN

Subject Code	21CSE33	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours -	40	Examination Hours	03
No. of Credits: 04			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basic digital principles and working of various logic gates, and different techniques for simplification of Boolean function.
CLO2	Design combinational logic circuits and describe their applications.
CLO3	Understand the working of Flipflops
CLO4	Describe the working of counters

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Combinational Logic Circuits:** Binary Logic, Integrated Circuits, Boolean Functions, Canonical and Standard Forms, The Map Method Two, Three, Four -Variable Maps, Map Manipulation, Essential Prime Implicants, Product-Of-Sums Optimization, Don't-Care Conditions, minimalsum and minimal product. The Tabulation Method, Determination of Prime Implicants.	10 L1, L2,L3
MODULE 2 **Data processing circuits**: Combinational Logic Design Procedure, Adders, Subtractors, Code Converter, Magnitude Comparator, Multiplexers, Demultiplexers, 1-of-16 Decoder, Encoders, Exclusive-or Gates, Programmable Array Logic, ProgrammableLogic Arrays.	10 L1, L2,L3
MODULE 3 **Sequential Logic:** Introduction, Flip-Flops, Clocked D FLIP-FLOP, Edge-triggered DFLIP-FLOP, Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs	8 L1, L2, L3
MODULE 4 **Registers:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In-Serial Out, Parallel In - Parallel Out, Applications of Shift Registers.	6 L1, L2
MODULE 5 **Counters:** Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing theCounter Modulus, Counter Design as a Synthesis problem.	6 L1, L2, L3

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

CO33.1	Illustrate the minimization of combinational logic expressions using K- map and Quine - McCluskey methods.
CO33.2	Interpret different combinational logic circuits like Adders, Subtractors, Multiplexers, Decoders and Programmable Logic Arrays.
CO33.3	Demonstrate the working of Flipflops.
CO33.4	Explain the working of Registers.
CO33.5	Illustrate the working of Counters.

Textbooks:

1. R D Sudhakar Samuel, K.S. Nandini Prasad: Logic Design, 1st edition, Elsevier Publication, 2013
2. Charles H. Roth: Fundamentals of Logic Design, Jr., 5th Edition, Thomson, 2004

Reference Books:

1. Morris Mano: Digital Logic and Computer Design, 14th Impression, Pearson, 2012, ISBN 978-81-7758-409-7.

Laboratory Component

1. Design and implement half adder, Full Adder, Half Subtractor, Full Subtractor using Logic gates.
2. Given a 4-variable logic expression, simplify itusing appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC.
3. Realize a J-K Master / Slave Flip-Flop usingNAND gates and verify its truth table.
4. Design and implement code converter I) Binary to Gray (II) Gray to Binary Code using Logic gates.
5. Designandimplementamod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
6. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9).

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO33.1	3	2	2	1	-	-	-	-	-	1	-	-	-	-
CO33.2	3	2	2	-	-	-	-	-	-	1	-	-	-	-
CO33.3	3	2	2	-	-	-	-	-	-	1	-	-	-	-
CO33.4	3	2	2	-	-	-	-	-	-	1	-	-	1	-
CO33.5	3	2	2	-	-	-	-	-	-	1	-	-	1	-
Average	3	2	2	1	-	-	-	-	-	1	-	-	1	-

Low-1: Medium-2: High-3

SUBJECT: OPERATING SYSTEMS

Subject Code	21CSE34	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the fundamentals of an Operating Systems and its structures.
CLO2	Understand the concept of processes, threads their scheduling mechanisms and implement efficient software solutions for process synchronization.
CLO3	Know Deadlock handling mechanism and Operations in Memory Management.
CLO4	Understand Virtual memory concepts.
CLO5	Study the mass storage and file management Concepts.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to operating system-** What operating system do, Operations System objective and functions, Operating System Services, Systems Calls, Process Concepts, Thread concepts, Virtual machines.	6 L1, L2
MODULE 2 **Process Scheduling** Basic concepts, Scheduling Algorithms, Scheduling Criteria, Operations on processes, Inter Process Communication. **Synchronization**: Background, Critical Section Problem, Peterson's Solution, Mutex, Semaphores.	10 L1, L2,L3
MODULE 3 **Process Synchronization and Deadlock** System Model, Deadlock Characterization, Classic problems of Synchronization. Principles of Deadlocks, Methods for Handling Deadlocks Deadlock Prevention, Deadlock Avoidance : Banker's Algorithm, Deadlock Detection and recovery from Deadlock	8 L1, L2
MODULE 4 **Virtual memory management** Background, Demand Paging, Contiguous memory allocation, paging, Structure of page table, Swapping, Virtual memory. Page Replacement algorithms: FIFO page replacement, Optimal page replacement, LRU page replacement	8 L1, L2

MODULE 5	8
Secondary Storage Structures and File System Overview of Mass Storage Structure, HDD Scheduling, Error Detection and Correction, Storage Device Management, Storage attachment, RAID Structure-Redundancy, Parallelism, RAID levels, File Concepts, File organization, File directories Directory Structure, Protection	L1, L2, L3

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

CO34.1	Understand the basic concepts and structures of operating systems.
CO34.2	Interpret the process management, CPU scheduling and synchronization tools.
CO34.3	Explain the deadlock handling methods and memory management mechanisms.
CO34.4	Describe Virtual memory concepts.
CO34.5	Illustrate mass storage structure, file system management

Textbooks:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 10th edition, Wiley-India, 2018.
2. William Stallings, Operating Systems internals and design Principles, 7th Edition, 2017.

Reference Books

1. Modern Operating Systems, Andrew S Tanenbaum and Herbert Bos, Fourth Edition, Pearson Education,2014.
2. Thomas Anderson and Michael Dahlin, Operating Systems: Principles and Practice, Recursive Books, 2014.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.

E-Books/Web References

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne. Operating System Concepts, Wiley India, 10th edition, 2018.
2. http://edclap.com/mod/resource/view.php?id=1445&forceview=1
3. Operating Systems Course Notes: by Dr. John T.Bell https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/
4. Andrew S. Tanenbaum, Modern Operating Systems, PHI, 3rd edition, 2009.

MOOCs

1. http://onlinevideolecture.com/?course=computer-science&subject=operating-systems2.
2. https://nptel.ac.in/courses/106/106/106106144/
3. http://www.nptel.ac.in/courses/106108101/
4. E-learning:www.vtu.ac.in

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO34.1	3	-	-	-	-	-	-	1	-	1	-	2	1	-
CO34.2	3	2	2	-	2	-	-	1	-	1	-	3	1	-
CO34.3	3	2	2	2	-	-	-	1	-	1	-	3	1	-
CO34.4	3	2	2	2	-	-	-	1	-	1	-	3	1	-
CO34.5	3	-	-	-	2	-	-	1	-	1	-	3	1	-
Average	3	2	2	2	2	-	-	1	-	1	-	3	1	-

Low-1: Medium-2: High-3

SUBJECT: SOFTWARE ENGINEERING

Subject Code	21CSE35	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Outline software engineering principles and activities involved in building large software programs
CLO2	Get well versed with Software design using UML tools and various system models
CLO3	Understand Agile Software development and Agile methods - SCRUM
CLO4	Introduce Software Testing and Software Evolution processes
CLO5	Explain project planning, Cost estimation techniques, Software quality, standards and metrics

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Professional Software Development -Software Engineering, Case studies. **Software Processes**: Software process models - Waterfall Model, Incremental Model and Spiral Model, Software Process Activities **Requirement Engineering:** Requirements Specification, Requirement's elicitation and analysis, Requirements Validation, Requirements Management, Functional Specification and Non-Functional Requirements, The software requirements document	8 L1, L2
MODULE 2 **Software Design and Planning:** Object oriented design concepts using UML tool: Star UML application, Design patterns, Implementation issues, Open-Source Development. **System Models:** Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering.	8 L1, L2,L3
MODULE 3 **Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. SCRUM Methodology. **Case study:** Sales force, Kanban Framework, Introduction to GitHub	8 L1, L2,L3
MODULE 4 **Software Testing:** Development testing, Test - driven development, Release testing, User testing, Dataflow testing and Path Testing.	8 L1, L2,L3

Software Evolution: Evolution processes, Program evolution dynamics, Software maintenance, Legacy system management	
MODULE 5 **Project planning**: Software pricing, Plan-driven development, Project scheduling, Agile planning, Case Study on Project Planning and Management **Quality management:** Software quality, Software standards, Reviews and inspections, Software measurement and metrics	8 L1, L2, L3

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

CO35.1	Understand the fundamentals of Software Engineering, Software process models and Requirements Engineering.
CO35.2	Use UML tool for software design.
CO35.3	Implement UML tool to design various software activity.
CO35.4	Describe Software testing methods and Software Evolution processes.
CO35.5	Discuss project planning process, Cost estimation models, Software Quality standards and metrics.

Textbooks:

1. **Ian Sommerville, Software Engineering**, Pearson Education, 10th Edition, 2016. **ISBN**:978-0133943030.
2. The SCRUM Primer, Ver2.0,http://www.goodagile.com/scrumprimer/scrumprimer20.pdf.

Reference books:

1. **Pressman Roger R**, Software Engineering: A Practitioner's Approach, Tata McGraw-Hill, 7th Edition, 2010.
2. **Pankaj Jalote,** An integrated approach to software engineering, Springer US, 3rd Edition, 2005.
3. **Michael Blaha, James Rumbaugh**, Object Oriented Modeling and Design with UML, Pearson Education, 2nd Edition, 2005.
4. **Rajib Mall**, Fundamentals of Software Engineering, 4th Edition, PHI Learning Private Limited, 2014.
5. **Tom Pender**, UML Bible, Wiley Publishing, 2003.

E-Books/Web References

1. https://www.softwaretestingmaterial.com/category/agile/
2. https://www.scrum.org/resources/
3. https://www.atlassian.com/agile/kanban

MOOCs

1. https://nptel.ac.in/noc/courses/106/
2. E-learning: www.vtu.ac.in

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO35.1	3	-	-	-	-	1	1	1	-	3	-	2	3	3
CO35.2	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO35.3	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO35.4	3	-	-	-	-	1	1	1	-	3	-	2	3	3
CO35.5	3	1	-	-	-	1	1	1	-	3	2	2	3	3
Average	3	1	3	-	-	1	1	1	-	3	2	2	3	3

Low-1: Medium-2: High-3

SUBJECT: BIOLOGY FOR ENGINEERS

Semester:	3	**CIE Marks**	50
Course Code	21CSE371	**SEE Marks**	50
Hours/Week (L: T: P)	1:0:0	**Duration of SEE (hours):**	3
Type of Course	AEC	**Credits**	1

Course Learning Objectives:

The course will enable students to

Sl. No	Course Learning Objectives (CLO)
CLO1	Introduction to Basics of Biology which includes cell, the unit of life, Different types of cells and classification of living organisms.
CLO2	Understanding what are biomolecules present in a cell, their structure function and their role in a living organism. Application of certain bio molecules in Industry.
CLO3	Brief introduction to human physiology, which is essential for bioengineering field.
CLO4	Application of biology in our daily life using different technology, for production of medicines to transgenic plants and animals to designing new biotechnological products

Module 1	No. of Hours	RBT Level
Introduction to Basic Biology: Cell: What is a Cell, Cell theory, Cell shapes, structure of a Cell, Cell cycle chromosomes The Plant Cell and animal Cell, protoplasm, prokaryotic and eukaryotic Cell, Plant Tissue and Animal Tissue. Brief introduction to five kingdoms of classification.	03	L2
Module 2		
Introduction to Bio-molecules: Carbohydrates, proteins, Amino acid, nucleic acid (DNA and RNA) and their types. Enzymes and their application in Industry. Large scale production of enzymes by Fermentation.	03	L2
Module 3		
Human Physiology: Nutrition (Classes of nutrients or food substances), Digestive systems, Respiratory system (two kinds of respiration – aerobic and anaerobic) Respiratory organs, respiratory cycle. Radiology of Lungs, Excretory system.	03	L2

Module 4		
Application of Biology: Brief introduction to Production of vaccines, Enzymes, antibodies, Cloning in microbes, plants and animals, Basics of biosensors, biochips, Bio fuels, and Biosensors. What is Tissue engineering? And its application, transgenic plants and animals, Bio engineering (production of artificial limbs, joints and other parts of body).	03	L2

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

CO1	Explain different types of cells and basis for Classification of living organisms.
CO2	Explain about biomolecules structure and function, their role in a living organism and usefulness in Industry.
CO3	Explain different types of respiratory system
CO4	Identify the areas in real life where Biology can be implemented.

Reference Books:

1. Cell and Molecular Biology - P.K.Gupta
2. Cell Biology - Verma and Agarwal
3. Cell Biology - Rastogi
4. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
5. T Johnson, Biology for Engineers, CRC press, 2011 Molecular Biology and Biotechnology 2nd ed. J.M. Walker and E.B. Gingold. Panima Publications. PP 434.

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

Low-1: Medium-2: High-3

BMEgi

SUBJECT: SOFT SKILLS AND RELATIONSHIPS

Semester:	3	CIE Marks	50
Course Code	21CSE372	SEE Marks	50
Hours/Week (L: T: P)	1:0:0	Duration of SEE (hours):	3
Type of Course	AEC	Credits	1

Course Learning Objectives:

The course will enable students to

Sl. No	Course Learning Objectives (CLO)
CLO1	Introduce fundamentals of various aspects of personality traits.
CLO2	Expose students towards problem solving.
CLO3	Enable the students to develop time management skills
CLO4	Educate students about Interpersonal relationships.

Module 1	No. of Hours	RBT Level
Soft Skills: What are soft skills. Need for soft skills. **Introduction to Personality Development:** What is personality, types of personality, personality development, elements of personality development, SWOT Analysis, Goal Setting, Creativity	03	L5
Module 2		
Thinking Skills and problem Solving: Core thinking skills, categories of thinking, need for problem solving, skills for problem solving, process of problem solving, stages of problem solving, methods of problems solving.	03	L5
Module 3		
Time Management and Goal Setting: Importance of time, techniques of time management, prioritization of activities, avoiding time wasters. Concept of goals, characteristics of goals, importance of goal setting, common obstacles to goal achievement, methods to achieve set goals.	03	L5
Module 4		
Interpersonal relationships: Importance of interpersonal relationship skills, types of interpersonal relationship skills, uses of interpersonal relationship skills, factors affecting interpersonal relationship skills, how to accommodate different styles, consequences of	03	L5

interpersonal relationships.		

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

CO1	Develop personality development techniques in terms of handling success and failure.
CO2	Develop core thinking skills along with problem solving capability.
CO3	Develop good time management skills along with goal setting
CO4	Develop interpersonal relationships.

Reference Books:

1. Barun K Mitra, "Personality Development and Soft Skills".
2. Manmohan Joshi, "Soft Skills".
3. Dale Carnegie, "How to Win Friends and Influence People"
4. Stephen R Covey, "The 7 Habits of Highly Effective People"
5. David Schwartz, "The Magic of Thinking Big"
6. Jeff Keller, "ATTITUDE is everything".
7. Joseph Murphy, "The Power of Subconscious Mind".

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

Low-1: Medium-2: High-3

SUBJECT: DATA STRUCTURES LABORATORY

Course Code	21CSEL38	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	20	Duration of SEE (Hours)	03
Credits: 01			

Course Objectives:

The course will enable students to

CLO1	Understand elementary data structures with an emphasis on problem solving.
CLO2	Develop skills to design and analyze simple linear and non-linear data structures.
CLO3	Strengthen the ability to identify and apply the suitable data structure for the given real-world problem.
CLO4	Enables them to gain knowledge in practical applications of data structures.

S. No.	Programs	RBT levels
1	Write a menu driven program to implement primitive operations on stack a) Push b) Pop c) Display. The program should print appropriate messages for stack overflow and stack underflow	L3
2	Write a program to demonstrate: a) Tower of Hanoi problem and b) Ackermann's function	L3
3	Write a program to convert INFIX notation to POSTFIX	L3
4	Write a program for evaluation of POSTFIX notation.	L3
5	Write a menu driven program for QUEUE that performs following primitive operations: insertion, deletion and display	L3
6	Write a menu driven program for CIRCULAR QUEUE that performs following primitive operations: insertion, deletion and display	L3
7	Write a menu driven program to perform primitive operations on single linked list.	L3
8	Write a program to reverse a single linked list	L3
9	Write a program to traverse a tree using in-order, pre-order and post-order.	L3
10	Write a program to perform insertion, deletion, and traversal of a binary search tree	L3

Note:

1) Every program should have algorithm before writing the program.
2) Code should be traced with minimum of two test cases.
3) To be implemented using UBUNTU as OPEN SOURCE (Either GEDIT or VI Editor)

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

CO38.1	Develop programs related to stacks and its applications
CO38.2	Develop programs related to queues and its variations
CO38.3	Develop programs related to linked lists
CO38.4	Develop programs related to non-linear data structures trees and its variations

Text Books:

1. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaz Sahni, Anderson, Freed, Second edition, University press, 2008, Reprinted 2016
2. "Data Structures using C", Seymour Lipschutz, Schaum's Outlines, McGraw Hill, Special Indian Edition, Thirteenth Reprint 2015.

Reference Books:

1. "Data Structures using C & C++", Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, Second Edition, Pearson, Tenth Impression 2020.
2. "Data Structures - A Pseudo code approach with C", Richard F. Gilberg and Behrouz A. Forouzan, Second Edition, CENGAGE LEARNING, Sixth Indian Reprint 2016.
3. Data Structures using C, E. Balagurusamy, Tenth reprint 2017, McGraw Hill Education

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO38.1	3	3	3	-	3	-	-	2	-	-	-	2	2	-
CO38.2	3	3	3	-	3	-	-	2	-	-	-	2	2	-
CO38.3	3	3	3	-	3	-	-	2	-	-	-	2	2	-
CO38.4	3	3	3	-	3	-	-	2	-	-	-	2	2	-
Average	3	3	3	-	3	-	-	2	-	-	-	2	2	-

Low-1: Medium-2: High-3

SEMESTER – IV

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS

Subject Code	21CSE42	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Apply mathematical concepts and notations to define a problem.
CLO2	Understand and apply algorithms design techniques
CLO3	Gain ability to solve real life problems using algorithms techniques.
CLO4	Understand the limitations of Algorithmic power.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** What is an Algorithm?, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Algorithm Specification, **Performance Analysis**: Space complexity, Time complexity **Asymptotic Notations:** Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples	6 L1, L2,L3
MODULE 2 **ALGORITHM DESIGN TECHNIQUES – I:** **BRUTE FORCE:** Brute force string matching algorithms. **DIVIDE & CONQUER:** General method, Recurrence equation for divide and conquer, Binary Search, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer.	6 L1, L2,L3
MODULE 3 **ALGORITHM DESIGN TECHNIQUES – II:** **GREEDY METHOD:** Introduction, General method, Knapsack Problem, Job sequencing with deadlines, **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm, **Single source shortest paths:** Dijkstra's Algorithm, **Optimal Tree problem:** Huffman Trees and Codes **Transform and Conquer Approach**: Heaps and Heap Sort, AVL Tree, 2-3 Tree	10 L1, L2, L3

MODULE 4 **ALGORITHM DESIGN TECHNIQUES – III:** **DYNAMIC PROGRAMMING:** Introduction, Transitive closure - Warshall's and Floyds algorithm, Knapsack problem & memory functions, Bellman Ford algorithm **DECREASE & CONQUER:** Introduction – Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting using DFS and source removal method.	10 L1, L2
MODULE 5 **ALGORITHM DESIGN TECHNIQUES – IV:** **BACKTRACKING:** N-Queens problem, Sum of subsets problem, Hamiltonian cycles **BRANCH & BOUND:** Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem **LIMITATIONS OF ALGORITHM POWER:** Decision Trees for sorting and searching **Approximation Algorithms for NP-Hard Problems** – Traveling Salesperson Problem using Nearest-neighbor algorithms	8 L1, L2, L3

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

CO42.1	Explain the basic techniques of analyzing the algorithms using time & space complexity and asymptotic notations
CO42.2	Devise algorithms using brute force and Divide and Conquer techniques for a given problem.
CO42.3	Demonstrate Graph Algorithms using greedy method, Transform and Conquer Approach to model Engineering Problems.
CO42.4	Employ Dynamic Programming and Decrease & Conquer strategies to solve a given problem.
CO42.5	Use Back Tracking, Branch and Bound design techniques for solving Computationally hard problems.

Text Books:

1. "Introduction to The Design and Analysis of Algorithms", Anany Levitin, Third Edition, Pearson, Tenth Impression 2020
2. "Computer Algorithms/C++", Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran", University Press, Second Edition, Reprinted 2017.

Reference Books:

1. "Introduction to Algorithms", Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, MIT Press, Third Edition, PHI Learning Private Limited, 2019

E-Books/Web References:

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

MOOCs:

1. https://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO42.1	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO42.2	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO42.3	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO42.4	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO42.5	3	3	3	-	-	-	-	-	-	-	-	2	3	-
Average	3	3	3	-	-	-	-	-	-	-	-	2	3	-

Low-1: Medium-2: High-3

SUBJECT: MICROCONTROLLER AND EMBEDDED SYSTEMS

Subject Code	21CSE43	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 4			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basics of microcontroller and embedded systems design.
CLO2	Learn the addressing modes, instructions, and assembler directives and develop the ALP to solve problems.
CLO3	Develop embedded C programs for microcontrollers and run on the simulator, target board and various interfaced hardware devices.
CLO4	Use Microcontroller peripheral programming and embedded onboard and external serial protocols to design required embedded systems.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **ARM Embedded Systems:** Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM **Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions**(T1: Chapters 1, 2)**	10 L1, L2
MODULE 2 **Introduction to the ARM Instruction Set**: Introduction to the ARM Instruction Set : Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants, Simple programming exercises.**(T1: Chapters 3, 4)**	10 L1, L2
MODULE 3 **Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controllers, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types). **(T2: Chapters 1, 2)**	8 L1, L2
MODULE 4 **Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded	6 L1, L2

Systems-Application and Domain specific. Hardware Software Co-Design. **(T2: Chapters 3,4,5)**	
MODULE 5 **RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, how to choose an RTOS. **(T1: Chapters 11,12)**	6 L1, L2

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

CO43.1	Describe ARM embedded systems and ARM processor fundamentals
CO43.2	Discuss ARM instruction set and ARM assembly language programs
CO43.3	Understand the basic Embedded System components and their selection method based on the characteristics and attributes
CO43.4	Understand the characteristics, quality attributes of Embedded Systems and Hardware Software Co-Design
CO43.5	Explain Real time operating system and its features

Text Books:

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition

Reference Books:

1. Raghunandan..G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019
2. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.

E-Books / Web References

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developer's guide, Elsevier, Morgan Kaufman publishers, 2008 https://doc.lagout.org/electronics/Game%20boy%20advance/ARM_BOOKS/ARM_System_Developers_Guide-Designing_and_Optimizing_System_Software.pdf
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition. https://archive.org/stream/K.Shibu Introduction To Embedded Systems Tmh2009/K.%20Shibu- Introduction%20To%20Embedded%20Systems-Tmh%20%282009%29_djvu.txt

MOOCs

1. https://nptel.ac.in/courses/106/105/106105193/
2. E-learning: www.vtu.ac.in

Lab Component

Conduct the following experiments by writing program using ARM7TDMI/LPC2148 using an evaluation board/simulator and the required software tool

1. Write a program to multiply two 16-bit binary numbers.
2. Write a program to find the sum of first 10 integer numbers.
3. Write a program to find factorial of a number.
4. Write a program to add an array of 16-bit numbers and store the 32-bit result in internal RAM.
5. Write a program to find the square of a number (1 to 10) using look-up table.
6. Write a program to find the largest/smallest number in an array of 32 numbers.
7. Write a program to count the number of ones and zeros in two consecutive memory locations.

Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler

8. Display "Hello world" message using Internal UART.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO43.1	3	1	1	-	3	-	-	-	-	-	-	-	-	1
CO43.2	3	2	1	-	3	-	-	-	-	-	-	-	-	1
CO43.3	2	1	1	-	3	-	-	-	-	-	-	-	-	1
CO43.4	3	1	1	-	3	-	-	-	-	-	-	-	-	1
CO43.5	3	1	1	-	3	-	-	-	-	-	-	2	-	1
Average	3	1	1	-	3	-	-	-	-	-	-	2	-	1

Low-1: Medium-2: High-3

SUBJECT: OBJECT ORIENTED PROGRAMMING WITH JAVA

Subject Code	21CSE44	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Learn fundamental features of object oriented language
CLO2	Set up Java JDK environment to create, debug and run simple Java programs
CLO3	Learn object oriented concepts using programming examples
CLO4	Create multi-threaded programs and event handling mechanism
CLO5	Learn string handling methods using programming examples

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to JAVA:** Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. **Classes & Objects:** Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection.	10 L1, L2,L3
MODULE 2 **Inheritance:** inheritance basics, using super, creating multi-level hierarchy, method overriding, Abstract class **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, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions	8 L1, L2,L3
MODULE 3 **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. **Multi-Threaded Programming:** Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, producer consumer problems.	8 L1, L2, L3
MODULE 4 **Event Handling:** Two event handling mechanisms; The delegation event model; Event	8 L1, L2,L3

classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.	
MODULE 5 **String Handling:**The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder	6 L1, L2, L3

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

CO44.1	Understand the fundamental concepts of object oriented programming.
CO44.2	Write java programs to illustrate the concept of inheritance and exception handling.
CO44.3	Apply Multi-threading concepts to create parallel programming.
CO44.4	Apply Event Handling mechanisms to create interactive programs.
CO44.5	Write programs using string handling functions

Textbooks:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007

Reference Books:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806
2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
3. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO44.1	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO44.2	3	3	2	-	-	-	-	-	1	1	-	2	-	2
CO44.3	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO44.4	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO44.5	1	1	-	-	-	-	-	-	1	1	-	2	-	3
Average	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**-**	**3**

SUBJECT: COMPUTER ORGANIZATION AND ARCHITECTURE

Subject Code	21CSE45	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Prerequisites:

Discrete Mathematics 1

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basic sub systems of a computer, their organization, structure and operation.
CLO2	Illustrate organization of basic processing unit and different ways of communicating with I/O devices.
CLO3	Understand internal organization of memory and the concepts of cache memory.
CLO4	Learn arithmetic and logical operations with integer and floating-point operands.
CLO5	Explain the fundamentals of computer architecture and concepts of pipelining.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Basic Structure of Computers:** Basic Operational Concepts, Bus Structures, Performance –Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs**: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Additional Instructions	8 L1, L2
MODULE 2 **Input/ Output Organization:** Basic Input and Output Operations, Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Direct Memory Access, Buses **Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization	8 L1, L2
MODULE 3 **Memory System:** Basic Concepts, Semiconductor RAM Memories – Internal organization of memory chips, Static memories, Asynchronous and synchronous DRAM, Structure of larger memories, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations – Hit rate and miss penalty	8 L1, L2, L3

MODULE 4	8
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication- Bit-pair recoding of multipliers, Integer Division, Floating-point Numbers and Operations.	L1, L2, L3
MODULE 5	8
Fundamentals of Computer Design: Defining computer architecture, Quantitative Principles of computer design. **Pipelining: Basic and Intermediate Concepts**: Introduction, Pipeline hazards, Implementation of pipeline, what makes pipelining hard to implement? **Instruction –Level Parallelism:** ILP: Concepts and challenges.	L1, L2

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

CO45.1	Explain the basic structure of computers, machine instructions and addressing modes.
CO45.2	Explain the concept of interrupts, DMA and basic processing unit
CO45.3	Describe the internal organization of memory and the mapping of cache memory
CO45.4	Solve arithmetic operations on binary numbers at circuit level.
CO45.5	Illustrate the fundamentals of computer architecture and concepts of pipelining.

Text Books:

1. **Computer Organization-** Carl Hamacher, Zvonko Vranesic, Safwat Zaky:, 5th Edition, Tata McGraw Hill
2. **Computer Architecture, A Quantitative Approach** – John L. Hennessey and David A. Patterson:, 4th Edition, Elsevier, 2007.

Reference Books:

1. **Computer Organization & Architecture** - William Stallings, 9th Edition, Pearson, 2015.
2. **Advanced Computer Architecture Parallelism, Scalability** – Kai Hwang:, Programability, Tata Mc Grawhill, 2003.

E-Books / Web References: -NIL-

1. Computer Organization & Architecture - William Stallings
   http://home.ustc.edu.cn/~louwenqi/reference_books_tools/Computer%20Organization%20and%20Architecture%2010th%20-%20William%20Stallings.pdf

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc21_cs61/preview
2. https://nptel.ac.in/courses/117105078

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO45.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO45.2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO45.3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO45.4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO45.5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
Average	2	1	-	-	-	-	-	-	-	-	-	-	-	-

Low-1: Medium-2: High-3

SUBJECT: ENVIRONMENTAL STUDIES

Semester:	4	CIE Marks	50
Course Code	21CSE471	SEE Marks	50
Hours/Week (L: T: P)	1:0:0	Duration of SEE (hours):	3
Type of Course	AEC	Credits	1

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	Create and disseminate knowledge to the students about environment
CLO2	Sensitize students towards environmental concerns, issues, and impacts.
CLO3	Make the students to apply their knowledge for efficient environmental decision-making, management and sustainable development.
CLO4	Prepare students for successful career in environmental departments, research institutes, industries, consultancy and NGOs, etc.

Module 1	No. of Hours	RBT Level
The Environment: The Atmosphere, Hydrosphere, Lithosphere, Biosphere, Ecology, Ecosystem, Biogeochemical Cycle (Carbon Cycle, Nitrogen Cycle), Environment Pollution: Air Pollution, Water Pollution, Soil Pollution, Radiation Pollution.	03	L2
Module 2		
Population Ecology: Individuals, Species, Pollution, Community, Control Methods of Population, Urbanization and its effects on Society, Communicable Diseases and its Transmission, Non-Communicable Diseases.	03	L2
Module 3		
Environmental Movements in India: Grass root Environmental movements in India, State Pollution Control Board, Central Pollution Control Board	03	L2
Module 4		
Natural Resources: Conservation of Natural Resources, Management and Conservation of Wildlife, Soil Erosion and Conservation, Environmental Laws: Water Act, 1974, Air Act, 1981, The Wildlife (Protection) Act, 1972, Environment Protection, 1986, Natural Disasters and their Management.	03	L2

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

CO1	Acquire fundamental knowledge of different aspects of environment and pollution.
CO2	Explain urbanization along with communicable and non-communicable diseases.
CO3	Explain Environmental Movements in India:
CO4	Understand the various laws of environment.

Reference Books:

1. Dash MC and Mishrs PC, Man and Environment, McMillan, London.
2. Mishra PC and Das MC, Environment and Society, McMillan, London.
3. Odeem EP, Fundamentals of Ecology, Natraj Publication.
4. Mishra DD, Fundamental Concept in Environmental Studies, S.Chand, New Delhi.
5. Asthana DK and Asthana Meera, A Testbook of Environmental Studies, S. Chand, New Delhi.

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

Low-1: Medium-2: High-3

SUBJECT: PERSONALITY DEVELOPMENT

Semester:	4	**CIE Marks**	50
Course Code	21CSE472	**SEE Marks**	50
Hours/Week (L: T: P)	1:0:0	**Duration of SEE (hours):**	3
Type of Course	AEC	**Credits**	1

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	Introduce fundamentals of various aspects of personality traits.
CLO2	Expose students to right attitudinal and behavioral aspects
CLO3	Enable the students to develop humble nature
CLO4	Enable students to develop decision making and time management skills

Module 1	No. of Hours	RBT Level
Introduction to Personality Development: The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.	03	L3
Module 2		
Attitude & Motivation Attitude: Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation	03	L5
Module 3		
Self-esteem: Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self-esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.	03	L3
Module 4		
Other Aspects of Personality Development: Body language - Problem-solving - Conflict	03	L5

and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics – Good manners and etiquette.		

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

CO1	Develop personality development techniques in terms of handling success and failure.
CO2	Develop a positive attitude which is the result of a disciplined and deliberate way of seeing, thinking, and responding to life.
CO3	Describe the importance of self-esteem and interpersonal relationships.
CO4	Develop leadership qualities, time management skills and work ethics,

Reference Books:

1. Norman Vincent Peale, "The Power of Positive Thinking".
2. Dale Carnegie, "How to Win Friends and Influence People"
3. Stephen R Covey, "The 7 Habits of Highly Effective People"
4. David Schwartz, "The Magic of Thinking Big"
5. Jeff Keller, "ATTITUDE is Everything".
6. Jospeh Murphy, "The Power of Subconscious Mind".

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

Low-1: Medium-2: High-3

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Course Code	21CSEL49	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours:	20	Duration of SEE (Hours)	03
Credits: 01			

Course Objectives:

CLO1	Introduce various designing techniques and methods for algorithms
CLO2	Performance analysis of Algorithms using asymptotic and empirical approaches
CLO3	Demonstrate a familiarity with major algorithms and data structures.
CLO4	Give clear idea on algorithmic design paradigms like Divide-and-Conquer, Dynamic Programming, Greedy Method, Backtracking, Branch and Bound etc.

S. No.	Programs	RBT levels
1	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 1000 and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be generated using the random number generator. Demonstrate how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.	L3
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 1000, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be generated using the random number generator. Demonstrate how the divide-and-conquer method works along with its time complexity analysis.	L3
3	Find Minimum Cost Spanning Tree of a given connected undirected graph using i) Kruskal's algorithm. ii) Prim's algorithm.	L3
4	Write a program to find shortest path using Dijkstra's algorithm.	L3
5	Write a program to: **a.** Implement All-Pairs Shortest Paths problem using Floyd's algorithm **b.** Implement the 0/1 Knapsack problem using Dynamic Programming.	L3
6	Implement Travelling Sales Person problem using Dynamic programming.	L3
7	Write a program to Print all the nodes reachable from a given starting node in a digraph using BFS method.	L3
8	Write a program to Check whether a given graph is connected or not using DFS method.	L3

9	Implement N-Queen's problem using Back Tracking.	L3
10	Design and implement a program to find a subset of a given set S = {Sl, S2.....,Sn} of n positive integers Whose SUM is equal to a given positive integer d. For example, if S = {1, 2, 5, 6, 8} and d= 9, there are two solutions {1, 2, 6} and {1, 8}. Display a suitable message, if the given problem instance doesn't have a solution.	L3

Note:

1) Every program should have algorithm before writing the program.
2) Code should be traced with minimum of two test cases.
3) To be implemented using UBUNTU as OPEN SOURCE (Either GEDIT or VI Editor)

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

CO49.1	Illustrate the time complexity of problems related to divide and conquer strategy.
CO49.2	Apply the concepts related to Greedy method to develop programs
CO49.3	Solve the problems related to dynamic-programming paradigm.
CO49.4	Apply the concept of Decrease and Conquer technique to solve problems related to graphs.
CO49.5	Write programs related to Backtracking design technique.

Text Books:

1. "Introduction to The Design and Analysis of Algorithms", Anany Levitin, Third Edition, Pearson, Tenth Impression 2020
2. "Computer Algorithms/C++", Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran", University Press, Second Edition, Reprinted 2017.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO49.1	3	3	3	-	3	-	-	2	-	-	-	2	3	-
CO49.2	3	3	3	-	3	-	-	2	-	-	-	2	3	-
CO49.3	3	3	3	-	3	-	-	2	-	-	-	2	3	-
CO49.4	3	3	3	-	3	-	-	2	-	-	-	2	3	-
CO49.5	3	3	3	-	3	-	-	2	-	-	-	2	3	-
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**3**	**-**

Low-1: Medium-2: High-3

Head of Department
Computer Science Engineering
Global Academy of Technology
Bangalore - 98

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V & VI Semester
Scheme & Syllabus
(2021-22)
Department of
Computer Science and
Engineering

SCHEME AND SYLLABUS

Department of Computer Science and Engineer

GLOBAL ACADEMY OF TECHNOLOGY
Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH and IS branches
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

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Scheme for UG Autonomous Program – 2021 Batch

V SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21CSE51	Computer Networks	IPC	CSE	3	0	2	50	50	100	4
2	21CSE52	Database Management Systems	PC		3	0	0	50	50	100	3
3	21CSE53	Automata Theory and Computability	PC		3	0	0	50	50	100	3
4	21CSE54X	**Program Elective 1** 1. Data Science 2. Cryptography 3. Embedded Intelligent Systems 4. Algorithmic Problem Solving	PEC		2	2	0	50	50	100	3
5	21***55	Research Methodology	AEC		3	0	0	50	50	100	3
6	**Ability Enhancement Course III**										
	21CSE56X	Physical Activity, Health and Wellness	AEC		1	0	0	50	50	100	1
		Leadership and Management Skills									
7	21CIV57/67	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	OR										
	21UHV57/67	Universal Human Values	HSM	Any Department							
8	21CSEL58	Database Management Systems Laboratory	PC	CSE	0	0	2	50	50	100	1
							TOTAL	**450**	**450**	**900**	**19**

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VI SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21CSE61	Big Data Analytics	PC	CSE	2	2	0	50	50	100	3
2	21CSE62	Artificial Intelligence and Machine Learning	PC		3	0	0	50	50	100	3
3	21CSE63	Full Stack Development	IPC	CSE	3	0	2	50	50	100	4
4	21CSE64X	**Program Elective 2** 1. Social network Analysis 2. Unix Network Programming 3. Model thinking 4. Advance Java	PEC		2	2	0	50	50	100	3
5	21CSE65X	**Open Elective 1** 1. Introduction to AI & ML 2. Semantic Web 3. Cyber Security 4. Cloud Computing	OEC		3	0	0	50	50	100	3
6	**Ability Enhancement Course IV**										
	21**66X	Society, Culture and Human Behaviour	AEC	Respective Department	1	0	0	50	50	100	1
		Financial Literacy and Banking									
7	21CIV57/67	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	OR										
	21UHV57/67	Universal Human Values	HSM	Any Department							
8	21MPT68	Mini Project	MP	CSE	Two Contact hours per week			50	50	100	2
9	21CSEL69	Machine Learning Laboratory	PC	CSE	0	0	2	50	50	100	1
				TOTAL				**450**	**400**	**900**	**21**

SEMESTER – V

SUBJECT: COMPUTER NETWORKS

Subject Code	**21CSE51**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 04			

Course Learning Objectives:

The course will enable students to:

CLO1	Demonstration of application layer protocols
CLO2	Discuss transport layer services and understand UDP and TCP protocols
CLO3	Explain routers, IP and Routing Algorithms in network layer
CLO4	Understand the different Network Security Concepts
CLO5	Discuss Wireless networks and Mobile Networks concepts

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Application Layer:** Principles of Network Applications: Network Application Architectures, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages	**8** **L1, L2,L3**
MODULE 2 **Transport Layer:** Introduction and Transport-Layer Services: Overview of the Transport Layer in the Internet,: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, TCP Congestion Control: Fairness.	**9** **L1, L2,L3**

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MODULE 3 **The Network layer:** What's Inside a Router?: Input Processing, Switching, Output Processing. The Internet Protocol: datagram format, IPv4 addressing, ICMP, IPv6, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm.	**7** **L1, L2, L3**
MODULE 4 **Network Security:** Overview of Network Security: Elements of Network Security, Classification of Network Attacks, Security Methods, Symmetric-Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Public-Key Cryptography: RSA Algorithm, Diffie-Hellman Key-Exchange Protocol, Authentication: Hash Function, Secure Hash Algorithm (SHA), Digital Signatures, Firewalls and Packet Filtering, Packet Filtering, Proxy Server.	**8** **L1, L2**
MODULE 5 **Wireless and Mobile Networks:** Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G: LTE, Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM	**8** **L1, L2, L3**

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

CO51.1	Understand principles of application layer protocols
CO51.2	Explain transport layer UDP and TCP protocols services
CO51.3	Summarize Internet Protocol and network layer routing algorithms
CO51.4	Understand different network security algorithms.
CO51.5	Discuss the wireless and mobile network covering IEEE 802.11 standard

Textbooks:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

E-Books / Web References:

1. https://eclass.teicrete.gr/modules/document/file.php/TP326/%CE%98%CE%B5%CF%89%CF%81%CE%AF%CE%B1%20(Lectures)/Computer_Networking_A_Top-Down_Approach.pdf

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2. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf

MOOCs:

1. https://www.my-mooc.com/en/mooc/computer-networking--ud436/
2. https://www.udacity.com/course/computer-networking--ud436
3. https://onlinecourses.swayam2.ac.in/cec19_cs07/preview

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO51.1	1	-	-	-	1	1	-	-	1	1	-	3	1	-
CO51.2	1	-	-	-	2	1	-	-	1	1	-	3	1	-
CO51.3	2	2	1	1	2	1	-	-	1	1	-	3	1	1
CO51.4	1	-	-	-	-	1	-	-	1	1	-	3	1	-
CO51.5	1	-	-	-	-	1	-	-	1	1	-	3	1	-
Average	**1**	**2**	**1**	**1**	**2**	**1**	**-**	**-**	**1**	**1**	**-**	**3**	**1**	**1**

Low-1: Medium-2: High-3

Lab Component (Program can be written in C/C++/ Java)

1. Write a socket program to implement echo command.
2. Perform File Transfer in Client & Server Using TCP/IP.
3. Remote Command Execution in Client Server model.
4. Write a program to demonstrate Address Resolution Protocol operation.
5. Write a program to demonstrate Link state routing algorithm.
6. Write a program to demonstrate Distance vector routing algorithm.
7. Demonstrate the working of Leaky Bucket concept in Congestion.
8. Demonstrate the working of Token Bucket concept in Congestion.
9. Using RSA algorithm, encrypt a text data and Decrypt the same.
10. Write a program to perform sliding window operation.

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SUBJECT: DATABASE MANAGEMENT SYSTEMS

Subject Code	**21CSE52**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Provide a strong foundation in database concepts, technology, and practice.
CLO2	Provides a strong foundation on normalization techniques to design a database
CLO3	Demonstrate the use of concurrency and transactions in database
CLO4	Design and build database applications for real world problems

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Introduction; An example; Characteristics of Database approach; Advantages of using DBMS approach; Data models, schemas and instances; Three-schema architecture and data independence **Entity-Relationship Model:** An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types, sample ER Diagrams.	**8** **L1, L2,L3**
MODULE 2 **Relational Model and Relational Algebra:** Relational Model Concepts, Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION.	**8** **L1, L2,L3**
MODULE 3 **SQL:** SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL, Views in SQL, Stored procedures.	**8** **L1, L2, L3**
MODULE 4 **Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second, Third and Boycee codd Normal Forms. **NoSQL Databases:** MongoDB: CRUD and Nesting, Indexing, Aggregating, Mapreduce, Replica Sets, Sharding, GeoSpatial, and GridFS	**8** **L1, L2,L3**

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MODULE 5	8
Transactions Management: Transaction properties, transaction state, schedule and its types, Serializability, recoverability, Concurrency Control And Recovery System: Concurrency control, lock based protocols, time-stamp based protocols, ARIES recovery algorithm	**L1, L2, L3**

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

CO52.1	Apply the basic concepts and create ER models for various applications.
CO52.2	Implement SQL queries for complex Relational Algebra operations.
CO52.3	Write queries using SQL commands.
CO52.4	Design relational database model for an application and use functional dependencies in normalizing the database schema. Understand the basics of NoSQL
CO52.5	Demonstrate the use of concurrency control and transactions in database

Textbooks:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.
2. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGraw Hill, New Delhi, India.
3. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.

Reference Books:

1. Silberschatz, Korth and Sudharshan: Database System Concepts, 6th Edition, Mc-GrawHill, 2010.
2. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.
3. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.

E-Books / Web References:

1. http://www.mim.ac.mw/books/Elmasri-Navathe-Fundamentals-of-Database-Systems-5th-Editi.pdf
2. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DATABASE%20MANAGEMENT%20SYSTEMS.pdf
3. https://pragprog.com/titles/pwrdata/seven-databases-in-seven-weeks-second-edition/

MOOCs:

1. https://archive.nptel.ac.in/courses/106/105/106105175/

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO52.1	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO52.2	3	3	2	-	-	-	-	-	1	1	-	2	-	2
CO52.3	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO52.4	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO52.5	1	1	-	-	-	-	-	-	1	1	-	2	-	3
Average	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**-**	**3**

Low-1: Medium-2: High-3

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SUBJECT: AUTOMATA THEORY AND COMPUTABILITY

Subject Code	**21CSE53**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits:03			

Course Learning Objectives:

The course will enable students to:

CLO1	To provide required theoretical foundation for a computational model.
CLO2	To understand various Computing models like Finite State Machine, Pushdown Automata.
CLO3	To understand different types of grammars.
CLO4	To understand Turing machines as an abstract computational model.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **FINITE AUTOMATA-**Introduction- Basic Mathematical Notation and techniques- Finite State systems –Basic Definitions – Regular Grammars-Finite Automaton – DFA &NDFA – Finite Automaton with ε-moves – Equivalence of NFA and DFA – Equivalence of NDFA's with and without ε-moves –Minimization of DFA	**10** **L1, L2, L3**
MODULE 2 **REGULAR EXPRESSION-**Writing Regular Expressions, Regular Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages, Equivalence of finite Automaton and regular expressions	**6** **L1, L2, L3**
MODULE 3 **GRAMMARS-** Introduction– Types of Grammar - Context Free Grammars and Languages– Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions - Null productions – Greiback Normal form – Chomsky normal form – Problems related to CNF and GNF.	**10** **L1, L2, L3**
MODULE 4 **PUSHDOWN AUTOMATA-** Pushdown Automata- Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL – problems based on pumping Lemma.	**6** **L1, L2, L3**

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MODULE 5	8
TURING MACHINE Introduction – Formal definition of Turing machines – Instantaneous descriptions- Turing Machine as Acceptors – Turing Machine as Transducers Computable Languages and functions – Turing Machine constructions – Modifications of Turing Machines, Variants of Turing Machines	**L1, L2**

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

CO53.1	Derive the proofs for the closure properties of Regular Languages and Context free Languages using Induction Method.
CO53.2	Prepare Finite State Machines, Push Down Automata for a given problem specification.
CO53.3	Write Grammars for Regular and Context Free Languages.
CO53.4	Write Context Free Grammar in their normalized forms.
CO53.5	Understand the usage of Turing machines in computability solutions.

Textbooks:

1. Introduction to Automata Theory, Languages and Computations, Hopcroft J.E., Motwani R. and Ullman J.D, Pearson Education,3rd edition,2013.**ISBN-13:** 978-032145536, **ISBN-10:** 0321455363
2. Automata, Computability and Complexity, Elaine Rich, Pearson education, 1stedition, 2013. **ISBN-13:** 978-0132288064, **ISBN-10:** 0132288060

Reference Books:

1. An Introduction to Formal Languages and Automata, Peter Linz, Jones & Bartlett Learning, 2001.
2. Introduction to Languages and the Theory of Computation, John. C. Martin, McGraw-Hill Education, 2010.
3. Introduction to the Theory of Computation, Michael Sipser, Cengage Learning, 2012.
4. Theory of Computer Science, K L P Mishra, N Chandrasekaran, PhI, 2012.
5. Theory of Computation: Formal Langauges, Automata and Complexity, Pearson Education,1st Edition,2012.

MOOCs

1. https://www.udemy.com/course/formal-languages-and-automata-theory
2. https://www.classcentral.com/course/edx-automata-theory-376

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO53.1	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO53.2	3	2	1	1	-	-	-	-	-	-	-	1	2	-
CO53.3	3	2	1	1	-	-	-	-	-	-	-	1	2	-
CO53.4	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO53.5	3	2	1	-	-	-	-	-	-	-	-	1	2	-
Average	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**

Low-1: Medium-2: High-3

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SUBJECT: DATA SCIENCE

Subject Code	**21CSE541**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

1. Discrete Mathematics and Transform Calculus
2. Graph Theory, Probability and Sampling Techniques

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the basics of data science and its applicability in practice
CLO2	To understand the types of data and its properties
CLO3	To analyze the basics of statistics and apply them in practice
CLO4	To analyze advanced statistical methods and their usage in practice
CLO5	To understand data visualization techniques and their integration in machine learning

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** What is Data Science, Importance of data science in the modern times, Datafication, current landscape of data science, Venn diagram for data science. A data science profile, meta definition, role of data scientist in academia, and Industry.	**8** **L1, L2**
MODULE 2 **Types of data:** Structured Vs unstructured data, Data pre-processing and examples, Quantitative Vs qualitative data, four levels of data. Five steps in data science, asking interesting question, obtaining of data, exploration of data, Model the data, communication, and visualization Examples.	**8** **L1, L2**
MODULE 3 **Basic Statistics:** Introduction, sampling of data - probability Sampling, random Sampling Unequal probability sampling, measures of centre, measures of variation, coefficient of variation, measure of relative Standing, z-score, correlation in data, Empirical rule, Examples	**8** **L1, L2**
MODULE 4 **Advanced statistics:** Point estimates, sampling distribution, confidence intervals hypothesis tests, conducting a hypothesis test, One Sample t-test, type I and type II errors,	**8** **L1, L2**

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hypothesis tests for categorical variables, chi-square test, examples, chi-square independence test.	
MODULE 5 Identifying effective and ineffective visualizations, scatter plots, line graphs, bar charts, histograms, box plots. Machine learning for data science, types of machine learning, supervised learning and its types, regression, classification, unsupervised learning, reinforcement learning.	**8** **L1, L2**

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

CO541.1	Explain the basics of data science and its engineering applications
CO541.2	Discuss the data types with examples
CO541.3	Analyze the basic statistical concepts in application to data science
CO541.4	Analyze data science using advanced statistical methods
CO541.5	Explain the data visualization techniques and machine learning concepts

Textbooks:

1. Ozdemir, Sinan. Principles of data science. Packt Publishing Ltd, 2016.
2. 2. O'Neil, Cathy, and Rachel Schutt. Doing data science: Straight talk from the frontline. " O'Reilly Media, Inc.", 2013.

Reference books:

1. EMC Education Services. Data science and big data analytics: discovering, analyzing, visualizing and presenting data. Wiley, 2015.

E-Books / Web References

1. https://www.coursera.org/specializations/jhu-data-science
2. https://www.coursera.org/professional-certificates/ibm-data-science

MOOCs

1. https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. 2. https://www.udemy.com/course/datascience/

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO541.1	3	3	2	-	-	-	-	1	-	1	-	2	-	1
CO541.2	3	3	2	-	-	-	-	1	-	1	-	2	-	1
CO541.3	3	3	2	-	-	-	-	1	-	1	-	2	-	1
CO541.4	3	3	2	-	-	-	-	1	-	1	-	2	-	1
CO541.5	3	3	2	-	-	-	-	1	-	1	-	2	-	1
Average	**3**	**3**	**2**	-	-	-	-	1	-	1	-	2	-	**1**

Low-1: Medium-2: High-3

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SUBJECT: CRYPTOGRAPHY

Subject Code	**21CSE542**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

Computer Networks

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the basic concepts underlying classical and modern cryptography, and the fundamentals.
CLO2	To Understand how security is defined and proven at the cryptographic level.
CLO3	To Understand common attacks and how to prevent them.
CLO4	To Gain the ability to apply appropriate cryptographic techniques to a security engineering (and management) problem at hand.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 History of cryptography, some background in probability and algorithms, classical cryptography-shift cipher, monoalphabetic substitution cipher, polyalphabetic substitution cipher, encryption with perfect secrecy, one-time pad; implementation aspects: shared secret randomness, perfect secrecy.	**8** **L1, L2**
MODULE 2 Introduction, Information security and cryptography, Basic terminology and concepts, Symmetric key encryption , Digital signatures, Public-key cryptography, Hash functions, Protocols and mechanisms, Key establishment, management, and certification, Pseudorandom numbers and sequences, Classes of attacks and security models.	**8** **L1, L2**
MODULE 3 Mathematical Background -Probability theory , Information theory, Complexity theory, Number theory, Abstract algebra, Finite fields, The integer factorization problem, The RSA problem, The Diffie-Hellman problem, Composite moduli.	**8** **L1, L2**
MODULE 4 Symmetric encryption: block ciphers (DES, Triple-DES, and AES), substitution/permutation networks, Feistel networks, RSA algorithm. Digital 8 AP Signatures, hashing and signing, Hashed RSA, El Gamal and DSA signature schemes,	**8** **L1, L2**

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public-key infrastructures, certificates, cryptography in TLS, IPSec and virtual private networks, NSA Suite B.	
MODULE 5 Key Establishment Protocols Introduction, Key transport based on symmetric encryption, Key agreement based on symmetric techniques, Key transport based on public-key encryption, Key agreement based on asymmetric techniques, Secret sharing, Key Management Techniques, Techniques for distributing public keys, Techniques for controlling key usage, Key management involving multiple domains	**8** **L1, L2**

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

CO542.1	Understand the history of cryptography and various cipher techniques.
CO542.2	Understand the concepts of cryptography, encryption techniques and key management.
CO542.3	Apply the mathematical techniques on cryptographic algorithms.
CO542.4	Implement the different cryptographic algorithms, Digital Signature and hashing techniques.
CO542.5	Discuss the various key establishment and key sharing protocols

Textbooks:

1. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography" CRC Press.
2. William Stallings, Cryptography and Network Security: Principles and Practice (ISBN 0131873164), 4/e

Reference books:

1. Matt Bishop, Computer Security: Art and Science, Addison-Wesley, 2002.
2. Mihir Bellare and Phillip Rogaway, "Introduction to Modern Cryptography"

E-Books / Web References

1. Katz and Y. Lindell, Introduction to Modern Cryptography: Principles and Protocol s, Chapman & Hall/CRC Press, 2nd edition http://www.cs.umd.edu/~jkatz/imc.html
2. A.Menezes, P. Van Oorschot, S. Vanstone, Handbook of Applied Cryptography, CRC Press, August 2001 http://www.cacr.math.uwaterloo.ca/hac/.
3. http://www.freetechbooks.com/information-security-f52.html.

MOOCs

1. https://crypto.stanford.edu/~dabo/courses/OnlineCrypto/
2. 2. https://www.my-mooc.com/en/mooc/basic-cryptography-and-programming-with-crypto-api/

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO542.1	3	-	2	-	-	-	-	3	-	-	-	-	-	3
CO542.2	3	2	2	-	-	-	-	3	-	-	-	-	-	3
CO542.3	3	2	2	-	-	-	-	3	-	-	-	-	-	3
CO542.4	3	3	2	-	-	-	-	3	-	-	-	-	-	3
CO542.5	3	-	2	-	-	-	-	3	-	-	-	-	-	3
Average	**3**	**3**	**2**	-	-	-	-	**3**	-	-	-	-	-	**3**

Low-1: Medium-2: High-3

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SUBJECT: EMBEDDED INTELLIGENT SYSTEMS

Subject Code	**21CSE543**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Assess the genesis and impact of IoT applications, architectures in real world.
CLO2	Illustrate diverse methods of deploying smart objects and connect them to network.
CLO3	Compare different Application protocols for IoT.
CLO4	Infer the role of Data Analytics and Security in IoT.
CLO5	Identify sensor technologies for sensing real world entities.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	**8** **L1, L2**
MODULE 2 Smart Objects: The Things in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	**8** **L1, L2**
MODULE 3 IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	**8** **L1, L2**
MODULE 4 Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security.	**8** **L1, L2**
MODULE 5 **I**oT Physical Devices and Endpoints-Arduino UNO: Introduction to Arduino, Arduino	**8** **L1, L2**

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UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints-RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi.	

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

CO543.1	Discuss the impact and challenges posed by IoT networks leading to new architectural models.
CO543.2	Describe the deployment of smart objects and the technologies to connect them to network
CO543.3	Explain the role of IoT protocols for efficient network communication.
CO543.4	Discuss the need for Data Analytics and Security in IoT.
CO543.5	Describe the different sensor technologies for sensing real world entities and Develop IoT applications using Arduino and Raspberry pi.

Textbooks:

1. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)

Reference books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

MOOCs

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview/
2. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO543.1	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO543.2	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO543.3	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO543.4	3	3	3	-	3	-	-	-	-	-	-	-	-	2
CO543.5	3	3	3	-	3	1	1	-	-	-	-	-	-	2
Average	**3**	**3**	**3**	-	**3**	**1**	**1**	-	-	-	-	-	-	**2**

Low-1: Medium-2: High-3

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SUBJECT: ALGORITHMIC PROBLEM SOLVING

Subject Code	**21CSE544**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

Programming in C and Data Structures

Course Learning Objectives:

The course will enable students to:

CLO1	To apply mathematical concepts and notations to define a problem.
CLO2	To understand and apply algorithms design techniques
CLO3	Ability to solve real life problems using algorithms techniques.
CLO4	To understand the limitations of Algorithmic power.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** What is an Algorithm? Analyzing algorithms, 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 for solving recurrences.	**8** **L1, L2, L3**
MODULE 2 Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.	**8** **L1, L2, L3**
MODULE 3 **Number-Theoretic Algorithms**: Elementary number-theoretic notions, Greatest common divisor, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, The RSA public-key cryptosystem**.**	**8** **L1, L2, L3**
MODULE 4 **String-Matching Algorithms**: The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt	**8** **L1, L2, L3**

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algorithm, Boyer-Moore Algorithms	
MODULE 5 **Red-Black Trees:** Properties of red-black trees, Rotations, Insertion, Deletion. **B-Trees**: Definition of B-trees, Basic operations on B-trees, Deleting a key from a B-tree. **Fibonacci Heaps**: Structure of Fibonacci heaps, Mergeable-heap operations, Decreasing a key and deleting a node.	**8** **L1, L2, L3**

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

CO544.1	Explain the basic techniques of analyzing the algorithms using time & space complexity and asymptotic notations
CO544.2	Demonstrate Graph Algorithms to model Engineering Problems.
CO544.3	Demonstrate Number-Theoretic Algorithms to model real-time Problems.
CO544.4	Devise String-Matching Algorithms in specific applications.
CO544.5	Employ Red-black, B-Tree and Fibonacci heap to solve a given problem.

Textbooks:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition.

Reference Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, 2rd Edition, 2009.Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press

E-Books/Web References:

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

MOOCs:

1. https://nptel.ac.in/courses/106101060/

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO544.1	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO544.2	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO544.3	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO544.4	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO544.5	3	3	3	-	-	-	-	-	-	-	-	2	3	-
Average	**3**	**3**	**3**	-	-	-	-	-	-	-	-	**2**	**3**	-

Low-1: Medium-2: High-3

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SUBJECT: RESEARCH METHODOLOGY

Subject Code	21CSE55	**CIE Marks**	**50**
Hours/Week (L: T: P)	3:0:0	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	03
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand objectives and significance of research.
CLO2	Understand the process of research.
CLO3	Understand concepts of research design.
CLO4	Understand architecture of experimental design for research.
CLO5	Write research reports.

CONTENTS	# of Hours / RBT Levels
MODULE 1 Meaning of research, objectives, motivation and types of research, approaches for research, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done.	**8** **L1, L2**
MODULE 2 Research process, criteria of good research, problem encountered by researches in India, defining the research problem: what is a research problem, selecting the problem, necessity of defining the problem, techniques involved in defining a problem.	**8** **L1, L2**
MODULE 3 Research Design: meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs.	**8** **L1, L2**
MODULE 4 Principles of experimental Designs, Important experimental designs, important experiment designs: informal experimental design, formal experimental design: various architectures.	**8** **L1, L2**
MODULE 5 Interpretation and report writing, meaning of interpretation, why interpretation, techniques of interpretation, precautions in interpretation, significance in report writing, steps in writing reports, layout of the research report, types of reports, oral presentation, mechanics of writing a research report.	**8** **L1, L2**

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

CO55.1	plain meaning, objectives, motivation, types, approaches and significance of research.
CO 55.2	derstand process, criteria, problems, and definition of research
CO55.3	scuss the meaning, need, features and concepts of research design
CO55.4	derstand experimental design, and its approaches in research.
CO55.5	derstand interpretation and writing of a research report.

Text Book:

1. Research Methodology, Methods & Techniques by C R Kothari, 2nd Edition, New Age International Publishers, Reprint 2006.

Reference Book:

1. Introduction to Research Methodology, B L Garg, R Kavdia, Agarwal and Agarwal, RBSA Publishers, Reprint 2019.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO55.1	3	3	3	3	-	-	-	3	-	-	-	2	-	2
CO 55.2	3	3	3	3	-	-	-	3	-	-	-	2	-	2
CO 55.3	3	3	3	3	-	-	-	3	-	-	-	2	-	2
CO 55.4	3	3	3	3	-	-	-	3	-	-	-	2	-	2
CO 55.5	3	3	3	3	-	-	-	3	-	-	-	2	-	2
Average	3	3	3	3	-	-	-	3	-	-	-	2	-	2

Low-1: Medium-2: High-3

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SUBJECT: PHYSICAL ACTIVITY, HEALTH AND WELLNESS

Subject Code	21CSE561	**CIE Marks**	**50**
Hours/Week (L: T: P)	1:0:0	**SEE Marks**	**50**
Total Hours	**12**		
No. of Credits: 1			

Course Learning Objectives:

The course will enable students to:

CLO1	To introduce the fundamental concepts of physical education, health and wellness.
CLO2	To provide a general understanding on nutrition, first aid and stress management.
CLO3	To familiarize the students regarding yoga and other activities for developing fitness.
CLO4	To create awareness regarding hypo-kinetic diseases and various measures of fitness and health assessment.

Module 1	**No. of Hours**	**RBT Level**
Concept of Physical Education and Health: Definition, Aims and Objectives of Physical Education Importance and Scope of Physical Education Modern concept of Health, Physical fitness and Wellness	**03**	**L2**
Module 2		
Components of Physical Fitness: Physical fitness components: Speed, Strength, Endurance, Flexibility and Coordinative abilities. Types of Physical Fitness - Health related Physical Fitness - Performance related Physical Fitness - Cosmetic Fitness Fitness Balance	**03**	**L2**
Module 3		
Principles of Exercise Programme: Activities for developing Physical Fitness Components Principles of First Aid Nutritional Balance	**03**	**L2**
Module 4		
Lifestyle Disease and its Management: Lifestyle Disease, Hypo-kinetic Diseases and its Management - Diabetes - Hypertension - Obesity - Osteoporosis - CHD - Back pain Health related Physical Fitness and Assessment Body Mass Index/ Skin fold Measurement, BMR, Pulse Rate, and Blood Pressure Health Related Physical fitness Test	**03**	**L2**

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

CO561.1	Identify personal health priorities and be able to integrate those priorities with personal behavior choices.
CO561.2	Explain an awareness of fact and fiction with regard to relationships between young people's health,activity and fitness
CO561.3	Explain the importance of nutrition and how to make nutritive plans.
CO561.4	Explain the concept of lifestyle disease, what contributes to it and prevent the same.

Reference Books:

1. AAPHERD, Health Related Physical Fitness Test Manual, 1980,Association Drive, Reston Virginia
2. ACSM Fitness Book, Leisure Press campaign, Illinois, 1986, Leisure Press, Canada, http://

www.pitt.edu./-gsphhome

3. ACSM'S Health Related Physical Fitness Assessment Manual, Lippincott Williams and Walkins, USA,2005
4. B.C.Rai, Health education and Hygiene, Prakashan Kendra, Lucknow.
5. Norman Bezzant, Help, First Aid for everyday emergencies, Jaico Publishing House, Bombay, Delhi.
6. Puri, K. Chandra, S.S. Health and Physical Education, Surjeet Publications, New Delhi, 2005.
7. Dr K.P.Manoj & Dr. K.Sureshkutty, Physical activity, Health and Wellness, Publication Division, University of Calicut, 2011

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO561.1	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO561.2	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO561.3	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO561.4	-	-	3	-	-	-	-	-	-	-	-	3	-	-
Average	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

Low-1: Medium-2: High-3

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SUBJECT: LEADERSHIP AND MANAGEMENT SKILLS

Subject Code	21CSE562	**CIE Marks**	**50**
Hours/Week (L: T: P)	1:0:0	**SEE Marks**	**50**
Total Hours	**12**		
No. of Credits: 1			

Course Learning Objectives:

The course will enable students to:

CLO1	To provide a basic introduction to leadership by focusing on what it means to be a good leader.
CLO2	Emphasis is on developing managerial skills and develop self-awareness
CLO3	Enable student to develop leadership qualities
CLO4	Addressing ethics in leadership and overcoming obstacles.

Module 1	**No. of Hours**	**RBT Level**
Leadership Skills and Understanding Leadership and its Importance: What is Leadership?, Why Leadership required?, Whom do you consider as an ideal leader?, Traits and Models of Leadership, Are Leader born or made?, Key characteristics of an effective leader, Leadership styles, Perspectives of different leaders, Basic Leadership Skills, Motivation, Team work, Negotiation, Networking.	**03**	**L2**
Module 2		
Managerial Skills: Basic Managerial Skills, Planning for effective management, How to organize teams, Recruiting and retaining talent, Delegation of tasks, Learn to coordinate, Conflict management **Self-Management Skills:** Understanding self-concept, Developing self-awareness, Self-examination, Self-regulation.	**03**	**L2**
Module 3		
Innovative Leadership and Design Thinking: Innovative Leadership, Concept of emotional and social intelligence, Synthesis of human and artificial intelligence, Why does culture matter for today's global leaders **Design Thinking:** What is design thinking?, Key elements of design thinking: - Discovery - Interpretation - Ideation - Experimentation – Evolution, How to transform challenges into opportunities?, How to develop human-centric solutions for creating social good?.	**03**	**L2**

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Module 4		
Ethics and Integrity: Learning through Biographies, What makes an individual great?, Understanding the person of a leader for deriving holistic inspiration, Drawing insights for leadership, How leaders sail through difficult situations? **Ethics and Conduct:** Importance of ethics, Ethical decision making, Personal and professional moral codes of conduct, Creating a harmonious life.	**03**	**L2**

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

CO562.1	Develop leadership qualities by taking initiatives and motivating team members to perform.
CO562.2	Identify general knowledge framework and understanding of key functions in management and appreciate the ethical issues in management decision areas.
CO562.3	Describe what leaders and managers do to drive their organizations forward by leading and managing issues and challenges
CO562.4	Recognize ethical and moral issues, identify needed actions, and demonstrate the moral courage to implement them.

Reference Books:

1. SIA Publishers, "Leadership and Management skills".
2. Dale Carnegie, " How to Win Friends and Influence People".
3. Stephen R. Covey, "7 Habits of Highly Effective People".
4. John Maxwell, "The 21 Irrefutable Laws of Leadership"
5. Daniel Goleman." Leadership – The power of Emotional Intelligence
6. Harvard Business School online - How to Become a More Effective Leader

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO562.1	-	-	-	-	-	-	-	3	3	3	3	3	-	-
CO562.2	-	-	-	-	-	-	-	3	3	3	3	3	-	-
CO562.3	-	-	-	-	-	-	-	3	3	3	3	3	-	-
CO562.4	-	-	-	-	-	-	-	3	3	3	3	3	-	-
Average	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**-**

Low-1: Medium-2: High-3

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SUBJECT: ENVIRONMENTAL SCIENCE

Course Code	21CIV57/67	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	1	Examination Hours	1 hour

Course Learning Objectives:

The course will enable students to:

CLO1	The fundamentals of environmental science.
CLO2	The types of natural resources
CLO3	The various global environmental concerns.
CLO4	The types of wastes generated and their handling at a basic level
CLO5	The area of environmental law and policies with a few important acts in the field

Content	No. of Hours/ RBT Levels
Module 1 **Environment:** • Definition, scope & importance • Components of Environment Ecosystem: Structure and function of various types of ecosystems • Human Activities – Food, Shelter, and Economic & Social Security. • Population - Growth, variation among nations – population explosion and impact on environment **Biodiversity:** Types, Value; Hot spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	**04 Hours / L2**
Module 2 **Natural Resources**: Forest, Water, Mineral, Food, Energy, Land Environmental Pollution - Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards.	**04 Hours / L2**
Module 3 **Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.	**04 Hours / L2**
Module 4 **Sources:** Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Solid Waste Management Rules in India Sources and management of E – Waste, Biomedical Waste, Hazardous waste, and construction waste at individual and community level. Socio-economic aspect of waste management Environmental Toxicology.	**04 Hours / L2**
Module 5 **Latest Developments in Environmental Pollution Mitigation Tools** (Concept and Applications): Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship, NGOs.	**04 Hours / L2**

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Course Outcomes:

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

21CIV57.1/67.1	Understand holistically the key concepts "Environment", and "Biodiversity"
21CIV57.2/67.2	Understand the types of natural resources available and the effects of anthropogenic interventions.
21CIV57.3/67.3	Understand the gravity of various global environmental concerns
21CIV57.4/67.4	Understand the types of wastes generated and their handling at a basic level.
21CIV57.5/67.5	Understand the importance of environmental law and policies.

Textbooks:

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018
3. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 2nd edition, Pearson Education, 2004

Reference books:

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of Environmental Science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental Studies, University of science press 1st edition

Web References:

1. https://www.hzu.edu.in/bed/E%20V%20S.pdf
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
3. https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CIV57.1/67.1	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-
21CIV57.2/67.2	2	1	-	-	-	-	3	-	-	-	-	1	1	-	1
21CIV57.3/67.3	2	-	2	-	-	2	3	1	-	-	-	1	1	-	1
21CIV57.4/67.4	2	2	-	-	-	2	3	-	-	-	-	-	-	-	1
21CIV57.5/67.5	2	-	-	-	-	2	3	-	-	-	-	-	-	1	1
Average	**2**	**1.5**	**2**	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	1

Low-1: Medium-2: High-3

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SUBJECT: UNIVERSAL HUMAN VALUES

Course Code	21UHV57/67	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	1	Examination Hours	1 hour

Course Learning Objectives:

The course will enable students to:

CLO1	To create an awareness on Engineering Ethics and Human Values.
CLO2	To understand social responsibility of an engineer.
CLO3	To appreciate ethical dilemma while discharging duties in professional life.

Content	No. of Hours
Module 1 **Introduction to Value Education** • Value Education, Definition, Concept and Need for Value Education. • The Content and Process of Value Education. • Basic Guidelines for Value Education. • Self-exploration as a means of Value Education. • Happiness and Prosperity as parts of Value Education.	**05 Hours**
Module 2 **Harmony in the Human Being** • Human Being is more than just the Body. • Harmony of the Self ('I') with the Body. • Understanding Myself as Co-existence of the Self and the Body. • Understanding Needs of the Self and the needs of the Body. • Understanding the activities in the Self and the activities in the Body.	**05 Hours**
Module 3 **Harmony in the Family and Society and Harmony in the Nature** • Family as a basic unit of Human Interaction and Values in Relationships. • The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love. • Comprehensive Human Goal: The Five Dimensions of Human Endeavour. • Harmony in Nature: The Four Orders in Nature. • The Holistic Perception of Harmony in Existence.	**05 Hours**
Module 4 **Social Ethics** • The Basics for Ethical Human Conduct. • Defects in Ethical Human Conduct. • Holistic Alternative and Universal Order. • Universal Human Order and Ethical Conduct. • Human Rights violation and Social Disparities.	**05 Hours**
Module 5 **Professional Ethics** • Value based Life and Profession. • Professional Ethics and Right Understanding. • Competence in Professional Ethics. • Issues in Professional Ethics – The Current Scenario. • Vision for Holistic Technologies, Production System and Management Models.	**05 Hours**

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

21UHV57.1/67.1	Understand the significance of value inputs in a classroom and start applying them in their life and profession
21UHV57.2/67.2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
21UHV57.3/67.3	Understand the role of a human being in ensuring harmony in society and nature.
21UHV57.4/67.4	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Textbooks:

1.A.N Tripathy, New Age International Publishers, 2003.
2.Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004
3.Bertrand Russell Human Society in Ethics & Politics

Reference books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education, Excel Books, 2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO57.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-
CO57.2	-	-	-	-	-	-	-	2	-	-	-	1	-	-
CO57.3	-	-	-	-	-	-	-	2	-	-	-	1	-	-
CO57.4	-	-	-	-	-	-	-	2	-	-	-	1	-	-
Average	-	-	-	-	-	-	-	2	-	-	-	1	-	-

Low-1: Medium-2: High-3

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SUBJECT: DATABASE MANAGEMENT SYTEMS LABORATORY

Subject Code	**21CSEL58**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
Total Hours	**16**	**Examination Hours**	**03**
No. of Credits: 01			

Course Learning objectives:

The course will enable students to:

CLO1	Understand fundamentals of database programming such as tables, constraints and queries.
CLO2	Understand fundamentals of database programming using SQL, including Data definition languages, Data manipulation languages, Transaction control and data control.
CLO3	A deep understanding of data retrieval language to solve complex queries.
CLO4	Design and build database applications for real world problems.

Program No.	Lab Experiments
1	Consider the schema for College Database: STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) SUBJECT (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to 1. List all the student details studying in fourth semester 'C'section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1GA21CS001' in all subjects. 4. Find the number of courses enrolled by each student 5. Update credits of the subject with the code '21CSE52'
2	Consider the schema for Company Database: EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN,DNo) DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION (DNo,DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN, PNo, Hours) 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that

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	controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.
3	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) Write SQL queries to 1. Count the customers with grades above Bangalore'saverage. 2. Find the name and numbers of all salesmen who had more than onecustomer. 3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNIONoperation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
4	The commercial bank wants keep track of the customer's account information. Each customer may have any number of accounts and account can be shared by any number of customers. The system will keep track of the date of last transaction. We store the following details. a) Account: unique account-number, type and balance b) Customer: unique customer-id, name and several addresses composed of street, city and state 1. Write SQL insertion query to insert few tuples to all the relations 2. Add 5% interest to the customer who have less than 10000 balances 3. List joint accounts involving more than three customers
5	The commercial Book shop wants keep track of orders of the book. The book is composed of unique id, title, year of publication, single author and single publisher. Each order will be uniquely identified by order-id and may have any number of books. We keep track of quantityof each book ordered. We store the following details for author and publisher. AUTHOR: unique author-id, name, city, country PUBLISHER: unique publisher-id, name,city, country. 1. Write SQL insertion query to insert few tuples to all the relations 2. Find the author who has published highest number of books 3. List the books published by specific publisher during the year 2011.

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Course Outcomes

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

CO58.1	Design and implement a database schema for a given problem description.
CO58.2	Create, insert, update a database using SQL DDL commands. Write query statements using SQL for a given database.
CO58.3	Develop a database case study for a real time application.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.
2. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGraw Hill, New Delhi,India.

Reference Books:

1. Silberschatz, Korth and Sudharshan: Database System Concepts, 6th Edition, Mc-GrawHill, 2010.
2. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson Education, 2006.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO58.1	3	3	-	-	3	2	-	2	2	2	-	2	-	2
CO58.2	3	3	3	3	3	2	-	2	2	2	-	2	-	3
CO58.3	3	3	3	3	3	2	-	2	2	2	-	2	-	3
Average	3	3	3	3	3	2	-	2	2	2	-	2	-	3

Low-1: Medium-2: High-3

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SEMESTER – VI

SUBJECT: BIG DATA ANALYTICS

Subject Code	**21CSE61**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites: Database Management Systems

Course Learning Objectives:

The course will enable students to:

CLO1	Understand fundamentals of Big Data analytics
CLO2	Explore the Hadoop framework and Hadoop Distributed File system
CLO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
CLO4	Employ MapReduce programming model to process the big data and understand various machine learning algorithms for Big Data Analytics

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction to Big Data Analytics**: Big Data, , Designing Data Architecture, Hadoop **Distributed File System Basics** : HDFS Design Features, Components, HDFS User Commands, Map Reduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools ,Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures	**8** **L1, L2**
MODULE 2 **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** **L1, L2**
MODULE 3 **MapReduce, Hive and Pig:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig	**8** **L1, L2**
MODULE 4 **Machine Learning Algorithms for Big Data Analytics:** Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression	**8** **L1, L2**

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analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Item sets and Association Rule Mining	
MODULE 5 **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** **L1, L2**

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

CO61.1	Understand the fundamentals of Big Data Analytics.
CO61.2	Use Hadoop frame work and HDFS for Big Data Processing.
CO61.3	Illustrate the concepts of NOSQL using MongoDB and Cassandra .
CO61.4	Demonstrate MapReduce Programming model using Hadoop Tools.
CO61.5	Utilize Machine Learning algorithms for real time Big Data Applications.

Textbooks:

1. Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning, Raj Kamal and Preeti Saxena, McGraw Hill Education, 2018 .ISBN: 9789353164966, 9353164966
2. Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem,, Douglas Eadline, Pearson Education, , 1st Edition, 2016. ISBN-13: 978-9332570351

Reference Books:

1. Hadoop: The Definitive Guide, Tom White, O‟Reilly, 4th Edition,2015. ISBN-13: 978-9352130672
2. Professional Hadoop Solutions, Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, Wrox Press, 1stEdition,2014. ISBN-13: 978-8126551071
3. Hadoop Operations: A Guide for Developers and Administrators, Eric Sammer, O'Reilly Media, 1stEdition, 2012.ISBN-13: 978-9350239261
4. Big Data Analytics: A Hands-On Approach, Arshdeep Bahga, Vijay Madisetti, VPT Publications, 1st Edition,2018. ISBN-13: 978-0996025577

MOOCs:

1. https://www.coursera.org/specializations/big-data
2. https://www.edx.org/course/big-data-analytics-2

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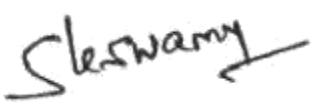
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO61.1	3	2	-	-	-	-	-	-	-	1	-	1	3	-
CO61.2	3	2	-	-	2	-	-	-	-	1	-	1	3	-
CO61.3	3	3	-	-	2	-	-	-	-	1	-	1	3	-
CO61.4	3	3	-	-	2	-	-	-	-	1	-	1	3	-
CO61.5	3	3	-	-	2	-	-	-	-	1	-	1	3	-
Average	**3**	**3**	-	-	**2**	-	-	-	-	**1**	**-**	**1**	**3**	**-**

Low-1: Medium-2: High-3



SUBJECT: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject Code	**21CSE62**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites: Python programming

Course Learning Objectives:

The course will enable students to:

CLO1	Define AI, machine learning and problems relevant to machine learning.
CLO2	Differentiate between supervised and unsupervised learning
CLO3	Apply neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning.
CLO4	Perform statistical analysis of machine learning techniques.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction**: What is artificial intelligence? Problems, problem spaces and search, Heuristic search techniques **(Text book -2)**	**8** **L1, L2**
MODULE 2 **Introduction**: A brief introduction to machine learning, Examples of Machine learning Applications. **(Text book -3)** **Regression**: Linear Regression, Polynomial Regression. **Decision Tree Learning**: Decision tree representation, Basic decision tree learning algorithm, Issues in decision tree learning **(Text book -1)**	**8** **L1, L2, l3**
MODULE 3 **Support Vector Machine**: Introduction to Support Vector Machine, Linear, Soft margin, Nonlinear, characteristics of SVM. **(Text book - 4)** **K-nearest neighbour**: Introduction, advantage, and applications **(Text book -1)** **Artificial Neural Networks**: Introduction, Neural Network representation, Appropriate problems, Perceptron, Back propagation algorithm, Introduction to deep neural network. **(Text book -1)**	**8** **L1, L2, L3**
MODULE 4 **Bayesian Learning**: Introduction to Conditional probability, Bayes theorem, ML for predicting probabilities, Bayes optimal classifier, Naive Bayes classifier **(Text book -1)** **Clustering**: k-means, Hierarchical Clustering **(Text book -3)**	**8** **L1, L2, L3**

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MODULE 5 **Evaluating Hypothesis**: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, **(Text book -1)** **AI/ML Case Study**: Introduction to GUI- Flask, Artificial Intelligence Powering Google Products, Recent AI Tools leveraged by Tesla, AI for Facebook, Robo-Banking: Artificial Intelligence at JPMorgan Chase, Audio AI, A Machine Learning Approach — Building a Health care predictive model	**8** **L1, L2, L3**

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

CO62.1	Understand the fundamental of AI and searching techniques
CO62.2	Illustrate Regression Techniques and Decision Tree Learning Algorithm
CO62.3	Apply SVM, ANN and KNN algorithm to solve appropriate problems
CO62.4	Apply Bayesian Techniques and derive effective learning rules
CO62.5	Illustrate performance of AI and ML algorithms using evaluation techniques.

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.
2. Elaine Rich, Kevin K and S B Nair, Artificial Intelligence, 3rd Edition, McGraw Hill Education, 2017.
3. Ethem Alpaydın, Introduction to machine learning, MIT press, second edition.
4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson, First Impression, 2014.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer series in
1. statistics, 2nd edition.
2. Dipanjan Sarkar,Raghav Bali ,Tushar Sharma, "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems",APress,2018
3. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology,2012
4. Anil Maheswari, Data Analytics, McGraw Hill, India, 2017

E-Books/Web References:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press.
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92

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3. https://digital.hbs.edu/platform-digit/submission/robo-banking-artificial-intelligence-at-jpmorgan-chase/
4. https://towardsdatascience.com/a-machine-learning-approach-building-a-hotel-recommendation-engine-6812bfd53f50
5. https://www.udemy.com/topic/artificial-intelligence (https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html)
6. A Brief Introduction to Neural Networks, David Kriesel (http://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-2col-dkrieselcom.pdf)
7. http://gael-varoquaux.info/scikit-learn-tutorial/

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO62.1	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO62.2	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO62.3	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO62.4	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO62.5	3	3	2	-	1	1	-	-	-	-	-	2	-	3
Average	**3**	**3**	**2**	-	**1**	**1**	-	-	-	-	-	**2**	-	**3**

Low-1: Medium-2: High-3

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SUBJECT: FULL STACK DEVELOPMENT

Subject Code	**21CSE63**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 4			

Course Learning Objectives:

The course will enable students to:

CLO1	Building Strong expertise to develop front end application using HTML
CLO2	Building Strong expertise to develop front end application using CSS
CLO3	To develop a web pages based on Bootstrap and JavaScript along with jQuery
CLO4	Implement web application and deployment using NodeJS and ReactJS
CLO5	Implement frontend and backend scenarios to read, write and update data stored in MongoDB

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction to HTML:** HTML syntax, HTML elements, HTML document structure, CSS selectors, properties, and values, Build your first web page, Semantics of HTML, Block and inline elements, Hyperlinks, Lists, Tables, Forms, Create a basic multi page website, Cascading effect, Advanced selectors, CSS resets, Positioning	**10** **L1, L2, L3, L4**
MODULE 2 **Introduction to CSS:** CSS syntax ,Cascading effect, Specificity, Combining and layering selectors, Backgrounds and gradients, CSS resets, The box model, Positioning with floats, Creating a grid structure, Precise Positioning, Basic website clone.	**10** **L1, L2, L3, L4**
MODULE 3 **Bootstrap and JavaScript Basics:** Introduction to Bootstrap, Bootstrap Basics ,Bootstrap Grids, Bootstrap Themes, Bootstrap CSS, Bootstrap JS, Fundamentals Of JavaScript, Fundamentals of jQuery, Fundamentals of Ajax Development, Document Object Model, DOM Manipulation, DOM Events, JavaScript Libraries (jQuery and Underscore), Simple HTML CSS JavaScript Project with AJAX	**10** **L1, L2, L3, L4**
MODULE 4 **ReactJS and NodeJS Development:** Introduction and Foundation, Node Projects, Working with shrink-wrap to lock the node modules versions, Working with asynchronous programming, Building a HTTP Server with Node.JS using HTTP APIs, React Components, React State and Props, React Event Handling, Routing in React React	**10** **L1, L2, L3, L4**

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flux, Styling React	
MODULE 5 **MongoDB Development:** Introduction to NoSQL databases, MongoDB A Database for the Modern Web, CRUD Operations in MongoDB, Indexing and Aggregation, Replication and Sharding, Developing Java and Node JS Application with MongoDB	**10** **L1, L2, L3, L4**

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

CO63.1	Structure and implement HTML/CSS
CO63.2	Apply intermediate and advanced web development practices
CO63.3	Implement basic JavaScript to create webpages that function using external data
CO63.4	Develop a fully functioning website and deploy on a web server
CO63.5	Develop frontend and backend using MongoDB

Textbooks:

1. **Riaz Ahmed**-Full Stack Web Development For Beginners,2021

Reference books:

1. **Ahmed Bouchefra,-** Full Stack Development with Angular and GraphQL, 2022
2. **Chris Northwood** - The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer,2018, Oreilly
3. **Valerio De Sanctis**-ASP.NET Core 5 and Angular,2021
4. **David Choi** -Full-Stack React, TypeScript, and Node,2020
5. **Edwin Ross Torres -**Full Stack Web Development,2020

E-Books / Web References

1. Manu Sharma, Full Stack Development with MongoDB, bpb publishers
2. Apress Modern Full-Stack Development by Zammetti

MOOCs:

1. https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer
2. https://www.coursera.org/specializations/full-stack-react

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO63.1	3	3	3	1	3	2	1	3	-	-	-	3	2	3
CO63.2	3	3	3	-	3	1	1	2	-	-	-	2	2	3
CO63.3	3	1	3	1	3	2	-	1	-	-	-	2	2	3
CO63.4	3	1	3	3	3	2	-	1	-	-	3	3	2	3
CO63.5	3	2	3	3	3	2	-	1	-	-	3	2	2	3
Average	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2**	-	-	**3**	**2**	**2**	**3**

Low-1: Medium-2: High-3

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Lab Component

1. Explore Basic HTML Tags and Elements.
2. Familiarize with JS, and CSS, Animation using sample webpage.
3. Design a Webpage using advance HTML Form tags input–date, time, number, email, HTML5 Header And Footer, spell check and editable areas.
4. Design a Webpage Demonstrating Drag and Drop Functionality. Implement program demonstrating Local Storage and session storage.
5. Design a Webpage using Basic CSS Tags. Demonstrate Inline, Internal and External Style sheets using advanced CSS.
6. Design signup form to validate username, password, and phone numbers etc using Java script. Write a program to demonstrate Event Handling using JavaScript. (Minimum 3Events).
7. Design a Form using HTML and CSS and accept the data from it and insert it into Database using PHP.
8. Create a form with a text box asking to enter your favorite city with a submit button when the user enters the city and clicks the submit button another PHP page should be opened displaying“Welcome to the city”.
9. Change a Content of webpage using AJAX. Perform Different Operations using JQUERY Selectors.

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SUBJECT: SOCIAL NETWORK ANALYSIS

Subject Code	**21CSE641**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Prerequisites: Data communication, Computer networks

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the concept of semantic web and related applications.
CLO2	To learn knowledge on Online Identities and Detecting Communities in Social Networks
CLO3	To understand Decentralized Online Social Networks and Human behaviour in social web and related communities.
CLO4	To explain Security objectives and Optimization in Online Social Networks
CLO5	To learn visualization of social networks.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** The Semantic Web: Limitations of current Web, The Semantic Solution, Development of Semantic Web, Emergence of the Social Web **Social Network Analysis:** What is network analysis? Social Network Analysis Definition and features, The Development of Social Network Analysis: Key concepts and measures in network analysis. **Electronic sources for network analysis:** Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis	**8** **L1, L2**
MODULE 2 **Online Identities and Social Networking**: Introduction to Online Identities, Background on Digital Identities, Putting Social Relations to Work, Social Digital Identity, Information and Threats in Social Networks **Detecting Communities in Social Networks:** Introduction, Definition of Community, Evaluating Communities, Methods for Community Detection, Tools for Detecting Communities.	**8** **L1, L2**
MODULE 3 **Decentralized Online Social Networks:** Introduction, Challenges for DOSN, TheCase for Decentralizing OSNs, General Purpose DOSNs, Specialized Application Centric	**8** **L1, L2**

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DOSNs, Delay-Tolerant DOSN **Understanding and Predicting Human Behavior for Social Communities:** Introduction, User Data Management, Inference and Distribution, Enabling New Human Experiences, The Social Enabler, Applications	
MODULE 4 **Security and Privacy in Online Social Networks:** Introduction, Security Objectives: Privacy, Integrity, and Availability, Attack Spectrum and Countermeasures. **Optimizing Targeting of Intrusion Detection Systems in Social Networks:** Introduction, Background, Epidemic Propagation in Social Networks. Security Requirements for Social Networks in Web 2.0: Introduction, Context, Threats, and Incidents, Two patterns.	**8** **L1, L2**
MODULE 5 **Visualization and applications of social networks analysis:** Graph theory, Centrality, Clustering, Node-Edge Diagrams, Matrix representation, Visualizing online social networks, Visualizing social networks with matrix-based representations, Matrix and Node-Link Diagrams, Hybrid representations, Applications, Cover networks, Community welfare, Collaboration networks , Co- Citation networks, **Social Network Analysis in the classroom:** a case study.	**8** **L1, L2**

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

CO641.1	Develop semantic web related applications and understand basic notation, concepts and terminology used in network science.
CO641.2	Explain Online Identities and Communities in Social Networks.
CO641.3	Illustrate Decentralized Online Social Networks and Human Behavior for Social Communities.
CO641.4	Explain Security objectives and Optimization in Online Social Networks.
CO641.5	Visualize social networks.

Textbooks:

1. Social Networks and the Semantic Web, Peter Mika, First Edition, Springer. ISBN-13: 978-0-387-71000-6
2. Handbook of Social Network Technologies and Applications, BorkoFurht, 1st Edition, 2010,Springer, ISBN 978- 1-4419-7141-8

Reference Books:

1. Computational Social Network Analysis- Trends, Tools and Research Advances, Ajith Abraham ,Aboul-Ella Hassanien, Springer, ISBN 978-1-84882-228
2. Social Network Data Analytics , Charu C. Aggarwal, 2014, Springer; ISBN 978-1-4419- 8462-3
3. Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking –Techniques and applications, First Edition, Springer, 2011

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E-Books / Web References:

1. https://link.springer.com/book/10.1007%2F978-0-387-71001-3
2. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.331.109&rep=rep1&type=pdf
3. https://mylifemynotes.files.wordpress.com/2012/03/handbook-of-social-network-technologies-and- applns-b-furht-springer-2010-bbs.pdf
4. https://core.ac.uk/download/pdf/301067043.pdf

MOOCs:

1. https://www.coursera.org/learn/social-network- analysis2.
   2. https://nptel.ac.in/courses/106/106/106106169/
2. https://www.udemy.com/course/social-network-analysissna-and-graph-analysis-using-python/

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO641.1	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO641.2	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO641.3	2	3	3	-	-	-	-	-	-	-	-	-	-	3
CO641.4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO641.5	2	3	3	-	-	-	-	-	-	-	-	-	-	3
Average	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**3**

Low-1: Medium-2: High-3

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SUBJECT: UNIX NETWORK PROGRAMMING

Subject Code	**21CSE642**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites: Operating Systems

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the basic concepts of inter process and inter-system communication.
CLO2	To learn the basics of Socket Programming.
CLO3	To understand the I/O functions and Socket options.
CLO4	To study familiar with the Elementary UDP sockets.
CLO5	To understand the usage of IPC and Remote Login.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Network Programming:** OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application. **Sockets:** Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.	**8** **L1, L2**
MODULE 2 **TCP client server:** Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host. **Elementary UDP sockets:** Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP.	**8** **L1, L2, L3**
MODULE 3 **Sockets:** Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function. **I/O Multiplexing and socket options:** I/O Models, select function, Batch input,	**8** **L1, L2**

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shutdown function, poll function, TCP Echo server, get-sockopt and set-sockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.	
MODULE 4 **Elementary UDP sockets:** Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. **Elementary name and Address conversions:** DNS, get-host by Name function, Resolver option, Function and IPV6 support, uname function, othernetworking information.	**8** **L1, L2**
MODULE 5 **IPC-** Introduction, File and record locking, Pipes, FIFOs streams and messages, Name spaces, system IPC, Message queues, Semaphores. **Remote Login:** Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.	**8** **L1, L2, L3**

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

CO642.1	Explain the basics of OSI Model and Standard Internet Services and Protocols
CO642.2	To design and implement client-server applications using TCP and UDP sockets.
CO642.3	Acquire the knowledge of Elementary TCP sockets and I/O Multiplexing and socket options.
CO642.4	Describe the UDP Sockets and Elementary name and Address conversions.
CO642.5	Demonstrate the concepts of FIFOs streams messages and Remote logins.

Textbooks:

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education.
2. UNIX Network Programming, 1st Edition, - W. Richard Stevens. PHI.

Reference Books:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education.
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education.

E-Books / Web References:

1. https://www.worldcat.org/title/unix-network-programming/oclc/20631405
2. https://freecomputerbooks.com/UNIX-Network-Programming-with-TCP-IP.html
3. https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxyYWdodXNpdGNzZXxneDo2NzU3YWQ4NDNmZTU5M2Yz

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MOOCs:

1. https://nptel.ac.in/courses/117106113
2. https://nptel.ac.in/courses/106108101

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO642.1	3	2	2	-	-	1	-	-	-	-	-	-	3	-
CO642.2	3	3	2	-	-	1	-	-	-	-	-	-	3	-
CO642.3	3	3	2	-	-	2	-	-	-	-	-	-	3	-
CO642.4	3	3	2	-	-	2	-	-	-	-	-	-	3	-
CO642.5	3	3	2	-	-	2	-	-	-	-	-	-	3	-
Average	**3**	**3**	**2**	-	-	**2**	-	-	-	-	-	-	**3**	-

Low-1: Medium-2: High-3

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SUBJECT: MODEL THINKING

Subject Code	**21CSE643**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Develop knowledge and skills in theory and methodology of modeling that are commonly used in Economics, Statistics, Politics, Sociology .
CLO2	Develop knowledge and skills in design and running of social studies.
CLO3	Gain insight into the 'evaluation loop from identifying policy needs for evidence to commissioning social research .
CLO4	Conducting research to feeding new evidence back into policies and programmes

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Why Model & Segregation/Peer Effects. Intelligent Citizens of the World. Thinking More Clearly. Using and Understanding Data. Using Models to Decide, Strategize, and Design. Sorting and Peer Effects Introduction. Schelling's Segregation Model. Measuring Segregation. Peer Effects. The Standing Ovation Model. The Identification Problem.	**8** **L1, L2**
MODULE 2 Aggregation & Decision Models. Aggregation. Central Limit Theorem. Six Sigma. Game of Life. Cellular Automata. Preference Aggregation. Introduction to Decision Making. Multi-Criterion Decision	**8** **L1, L2**
MODULE 3 Thinking Electrons: Modeling People & Categorical and Linear Models. Thinking Electrons: Modeling People. Rational Actor Models. Behavioral Models. Rule Based Models. When Does Behavior Matter? Introduction to Linear Models. Categorical Models. Linear Models. Fitting Lines to Data. Reading Regression Output. From Linear to Nonlinear. The Big Coefficient vs The New Reality.	**8** **L1, L2**
MODULE 4 Tipping Points & Economic Growth. Tipping Points. Percolation Models. Contagion Models 1: Diffusion. Contagion Models 2: SIS Model. Classifying Tipping Points. Measuring Tips. Introduction To Growth. Exponential Growth. Basic Growth Model. Solow Growth Model. Will China Continue to Grow. Why Do Some Countries Not Grow? Piketty's Capital: The Power of Simple Model	**8** **L1, L2**

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MODULE 5	8
Diversity and Innovation & Markov Processes. Problem Solving and Innovation. Perspectives and Innovation. Heuristics. Teams and Problem Solving. Recombination. Markov Models. A Simple Markov Model. Markov Model of Democratization. Markov Convergence Theorem. Exapting the Markov Model	**L1, L2, L3**

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

CO643.1	Identify the scientific essence of given problems in one's professional area of focus.
CO643.2	Solve problems in one's professional area of focus on the basis of analysis and synthesis
CO643.3	Evaluate and use information from different sources, as required for solving research and professional tas
CO643.4	Identify and establish an issue/problem for the analysis of political phenomena

Textbooks:

1. "Engineering Design",, John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson,. Second Edition, 2013.
2. The Design of Business: Why Design Thinking is the Next Competitive AdvantageRoger Martin., Harvard Business Press , 2009

Reference Books:

1. "Design Thinking: Understand – Improve – Apply", Hasson Plattner, Christoph Meinel and Larry Leifer (eds), Springer, 2011
2. "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Idris Mootee, John Wiley & Sons 2013.
3. "Engineering Design Process", Cengage Learning Yousef Haik and Tamer M. Shahin, Second Edition, 2011.

MOOCs:

1. https://www.coursera.org/learn/model-thinking
2. https://online.umich.edu/courses/model-thinking/
3. https://www.classcentral.com/course/modelthinking-317

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO643.1	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO643.2	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO643.3	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO643.4	3	3	-	-	3	-	-	-	3	-	-	3	3	-
Average	**3**	**3**	-	-	**3**	-	-	-	**3**	-	-	**3**	**3**	-

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SUBJECT: ADVANCED JAVA

Subject Code	**21CSE644**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Identify the need for advanced Java concepts like Enumerations, auto boxing and annotations
CLO2	Understand hierarchy of interfaces and classes for managing groups of objects
CLO3	Adapt servlets & JSP to build server side programs
CLO4	Make use of JDBC to access database through Java Programs

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Enumerations and Autoboxing:** Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning	**8** **L1, L2, L3**
MODULE 2 **Annotations(metadata):** Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.	**6** **L1, L2, L3**
MODULE 3 **The collections and Framework:** Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.	**10** **L1, L2, L3**
MODULE 4 **Servlets:** Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and	**8** **L1, L2, L3**

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Responses; Using Cookies; Session Tracking. **Java Server Pages (JSP):** JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects	
MODULE 5 **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; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.	**8** **L1, L2, L3**

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

CO644.1	Interpret the need for advanced Java concepts like enumerations and auto-boxing in developing modular and efficient programs
CO644.2	Understand the usage of annotations in Java Programming.
CO644.3	Explain the usage of Collection framework for developing Java applications.
CO644.4	Implement Servlets and JSP in Server-side Java Programming.
CO644.5	Use JDBC API to connect Java Application with Database

Textbooks:

1. " **Herbert Schildt**, JAVA the Complete Reference, McGraw Hill, 12th Edition, 2021.
2. **Jim Keogh**, J2EE The Complete Reference, McGraw Hill Education; 1st edition (1 July 2017)

Reference Books:

1. **Y. Daniel Liang**, Introduction to JAVA Programming, Addison Wesley; 12th edition (4 December 2019)
2. **Stephanie Bodoff et al**, The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.
3. **Uttam K Roy**, Advanced JAVA programming, Oxford University press, 2015.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO644.1	3	3	3	-	3	-	-	-	3	-	-	3	3	-
CO644.2	3	3	3	-	3	-	-	-	3	-	-	3	3	-
CO644.3	3	3	3	-	3	-	-	-	3	-	-	3	3	-
CO644.4	3	3	3	-	3	-	-	-	3	-	-	3	3	-
CO644.5	3	3	3	-	3	-	-	-	3	-	-	3	3	-
Average	**3**	**3**	**3**	-	**3**	-	-	-	**3**	-	-	**3**	**3**	-

Low-1: Medium-2: High-3

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SUBJECT: INTRODUCTION TO AI & ML

Subject Code	**21CSE651**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites: Data Mining

Course Learning Objectives:

The course will enable students to:

CLO1	Define AI, machine learning and problems relevant to machine learning.
CLO2	Differentiate between supervised and unsupervised learning
CLO3	Apply neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning.
CLO4	Perform statistical analysis of machine learning techniques.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** What is Artificial Intelligence? Problems, problem spaces andsearch, Heuristic search techniques (Text book - 2)	**8** **L1, L2**
MODULE 2 **Introduction:** A Brief Introduction To Machine Learning, Examples of Machine learning Applications. (Text book -3) **Regression:** Linear Regression, Polynomial Regression. **Decision Tree Learning:** Decision tree representation, Appropriate problems fordecision tree learning, Basic decision tree learning algorithm(Text book -1)	**8** **L1, L2**
MODULE 3 **Support Vector Machine:** Introduction to Support Vector Machine, characteristics of SVM. (Text book - 4) **K-nearest neighbor:** Introduction, advantage, and applications (Text book -1) **Artificial Neural Networks:** Introduction, Neural Network representation, Perceptron, Back propagation algorithm, Introduction to deep neural network.(Text book -1)	**8** **L1, L2**
MODULE 4 **Bayesian Learning:** Introduction to Conditional probability, Bayes theorem, ML and LS error hypothesis, Naive Bayes classifier (Text book -1) Clustering: k-means, Hierarchical Clustering (Text book -3)	**8** **L1, L2**

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MODULE 5	8
Evaluating Hypothesis: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in errorof two hypotheses (Text book -1) **AI/ML Case Study:** Artificial Intelligence Powering Google Products, Recent AI Tools leveraged by Tesla, AI for Facebook, Robo-Banking: Artificial Intelligence at JPMorgan Chase, Audio AI, A Machine Learning Approach — Building a Hotel Recommendation Engine	**L1, L2**

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

CO651.1	Understand the fundamental of AI and searching techniques
CO651.2	Illustrate Regression Techniques and Decision Tree Learning Algorithm
CO651.3	Apply SVM, ANN and KNN algorithm to solve appropriate problems
CO651.4	Apply Bayesian Techniques and derive effective learning rules
CO651.5	Illustrate performance of AI and ML algorithms using evaluation techniques.

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, India Edition 2013.
2. Elaine Rich, Kevin K and S B Nair, Artificial Intelligence, 3rd Edition, McGraw Hill Education, 2017.
3. Ethem Alpaydın, Introduction to machine learning, MIT press, Second edition.
4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson, FirstImpression, 2014.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer series in statistics, 2nd edition.
2. Dipanjan Sarkar, Raghav Bali ,Tushar Sharma, "Practical Machine Learning with Python-A Problem- Solver's Guide to Building Real-World Intelligent Systems",APress,2018
3. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology,2012
4. Anil Maheswari, Data Analytics, McGraw Hill, India, 2017

E-Books/Web References:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press.
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92
3. https://digital.hbs.edu/platform-digit/submission/robo-banking-artificial-intelligence-at-jpmorgan-chase/
4. https://towardsdatascience.com/a-machine-learning-approach-building-a-hotel-recommendation-engine-6812bfd53f50
5. https://www.udemy.com/topic/artificial-intelligence

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(https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html)
6. A Brief Introduction to Neural Networks, David Kriesel (http://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-2col-dkrieselcom.pdf)
7. http://gael-varoquaux.info/scikit-learn-tutorial/

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO651.1	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO651.2	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO651.3	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO651.4	3	3	2	-	1	1	-	-	-	-	-	2	-	3
CO651.5	3	3	2	-	1	1	-	-	-	-	-	2	-	3
Average	**3**	**3**	**2**	-	**1**	**1**	-	-	-	-	-	**2**	-	**3**

Low-1: Medium-2: High-3

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SUBJECT: SEMANTIC WEB

Subject Code	**21CSE652**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3**
No. of Credits: 3			

Prerequisites: Database management system

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the concepts of Semantic Web.
CLO2	To understand the characteristics of the agents.
CLO3	To understand design and implementation of Agents.
CLO4	To understand the implementation described in the architecture level.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **INTRODUCTION** The world of the semantic web-WWW-meta data-Search Engine-Search engine for traditional web-Semantic Web-Search engine for semantic web-Traditional web to semantic web.	**8** **L1, L2, L3**
MODULE 2 **SEMANTIC WEB TECHNOLOGY** RDF-Rules of RDF-Aggregation-Distributed information-RDFS-core elements of RDFS Ontology-Taxonomy-Inferencing based on RDF schema	**8** **L1, L2, L3**
MODULE 3 **OWL** OWL-Using OWL to define classes-Set Operators-Enumerations-Define properties ontology matching-Three faces of OWL-Validate OWL.	**8** **L1, L2, L3**
MODULE 4 **SWOOGLE** Swoogle-FOAF-Semantic Markup-Issues-prototype system-Design of Semantic web search engine-Discovery and indexation-prototype system-case study.	**8** **L1, L2, L3**
MODULE 5 **SEMANTIC WEB SERVICES** Semantic web services-OWL-S-Upper ontology-WSDL-S, OWL-S to UDDI mapping, Design of the search engine, implementations.	**8** **L1, L2, L3**

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

CO652.1	Discuss about the basics of semantic web and search engine
CO652.2	Explain RDFS and its process
CO652.3	Understand the owl and its operation
CO652.4	Explain semantic issue and prototype system
CO652.5	Discuss the various semantic web services and its design

Textbooks:

1. Liyang Yu , "Introduction to the Semantic Web and Semantic web services" Chapman & Hall/CRC, Taylor & Francis group, 2007.

Reference books:

1. Johan Hjelm, "Creating the Semantic Web with RDF", Wiley,2001
2. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", MIT Press, 2012.
3. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, "A Semantic Web Primer", third edition, MIT Press, 2012.
4. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph "Foundations of Semantic Web Technologies" (Chapman & Hall/CRC Textbooks in Computing) 1st Edition

E-Books / Web References

1. Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, "A Semantic Web Primer", third edition, MIT Press, 2012.
   http://mitpress.mit.edu/books/semantic-web-primer-0
2. http://www.w3.org/standards/semanticweb/
3. http://www.w3.org/2001/sw/
4. http://semanticweb.org/wiki/Main_

MOOCs

1. https://www.classcentral.com/subject/semantic-web
2. https://www.mooc-list.com/tags/semantic-web
3. https://www.youtube.com/watch?v=RTmafl2rzEw

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO652.1	2	-	1	-	1	-	-	-	-	-	-	-	-	-
CO652.2	2	-	1	-	2	-	-	-	-	-	-	-	-	-
CO652.3	2	-	2	-	2	-	-	-	-	-	-	-	-	-
CO652.4	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO652.5	2	-	-	-	2	-	-	-	-	-	-	-	-	-
Average	**2**	-	**1**	-	**2**	-	-	-	-	-	-	-	-	-

Low-1: Medium-2: High-3

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SUBJECT: CYBER SECURITY

Subject Code	**21CSE653**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Outline the basic knowledge on Computer Forensics.
CLO2	Distinguish between cybercrime and the laws governing cybercrime.
CLO3	Comprehend the contextual need of cybercrime investigations.
CLO4	Demonstrate the use of tools used in cyber forensics.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Understanding Cyber Crime** –Cyber Security –the need of the hour, history of internet,impact of internet , internet in India,CIA triad, Reasons for cyber crime, Classifcation of cyber crimes , Cyber crimes –Legal Perspective	**8** **L1, L2**
MODULE 2 **Cyber Offenses** –Attacks Plan,Social Engineering, Cyber Stalking, Cyber café and Cybercrimes ,Botnets, Cloud computing and cyber crime	**6** **L1, L2**
MODULE 3 **Cyber Crime in Devices**-Introduction, Proliferation of mobile and wireless devices, Credit card fraud in the mobility era, Challenges posed by mobile devices, Registry settings, Attacks on mobile/cell phones, Security implications and Measures for organizations in handling mobile devices, Organizational security policies and measures in mobile computing era, Laptops.	**8** **L1, L2**

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MODULE 4 **Tools and Methods**-Introduction, proxy servers and Anonymizers, Phishing, Password cracking, Keyloggers and spywares, virus and worms, Trojan Horses and back doors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer overflow, Identity Theft	**8** **L1, L2**
MODULE 5 **Cyber Crimes and Cyber Security –The Legal Perspective –** The Indian IT Act 2000, challenges , Digital Signatures, Amendments in the Indian IT Act, Punishments, Cyberlaw	**8** **L1, L2**

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

CO653.1	Discuss the need of cyber security.
CO653.2	Distinguish different methods of cyber crimes.
CO653.3	Describe the organizational methods and policies for cyber crime handling in mobile and wireless devices.
CO653.4	Describe the computer forensic tools and their usage.
CO653.5	Understand the Legal Perspective of cyber crimes in India

Textbooks:

1. Cyber Security: Understanding Cyber crime, computer forensics and legal perspectives, Sunith Belapure and Nina Godbole, Wiley India,2013.ISBN:978-81-265-21791

2. Introduction to Cyber Security :Guide to the world of cyber security,Anand Shinde,Notion Press,2021,eISBN: 978-1-63781-643-1

Reference books:

1. Computer Forensics and Cyber Crime –An Introduction, Marjie T Britz, Pearson Education, 2ndedition,2012.
2. Cyber Laws and IT Protection, Harish Cahnder, PHI, 2012.
3. Cyber Security: Managing Systems, Conducting Testing and Investigating Inrusions, Thomas JMoubray, John Wiley ,2014..
4. Guide to Computer Forensics and Investigations, Nelson, Philips, Frank, Enfinger and Steuart,Cengage Learning,2008

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MOOCs

1. https://www.cyberdegrees.org
2. https://www.udemy.com/course/complete cybersecurity

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO653.1	1	2	-	-	-	-	-	1	-	1	-	1	-	-
CO653.2	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO653.3	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO653.4	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO653.5	2	2	1	1	-	-	-	1	-	1	-	1	-	1
Average	**2**	**2**	**1**	**1**	**-**	-	-	**1**	-	**1**	-	**1**	-	**1**

-

Low-1: Medium-2: High-3

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SUBJECT: CLOUD COMPUTING

Subject Code	**21CSE654**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites: Computer Networks

Course Learning Objectives:

The course will enable students to:

CLO1	Illustrate the core concepts of the cloud computing paradigm and reference models
CLO2	Discuss system virtualization and outline its role in enabling the cloud computing system model.
CLO3	Learn the key and enabling technologies that help in the development of cloud.
CLO4	Be able to install and use current cloud technologies

CONTENTS	# of Hours / RBT Levels
MODULE 1 **INTRODUCTION:** Defining Cloud Computing, Cloud Types, Examining the Characteristics of Cloud Computing Historical Developments, Virtualization, Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples: VMware: Full Virtualization	**8** **L1, L2**
MODULE 2 **Cloud Computing Architecture:** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects, Aneka application framework overview	**8** **L1, L2**
MODULE 3 **Cloud Computing and Big Data:** Introduction to Bigdata, Characteristics, Cloud computing role for Bigdata, Data Intensive Computing, Map-Reduce Programming, Characterizing Data-Intensive Computations, Challenges Ahead, Technologies for Data-Intensive Computing, Storage Systems, Introducing the MapReduce Programming Model.	**8** **L1, L2**
MODULE 4	**8**

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Cloud Computing Software Security Fundamentals: Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing Security Challenges, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.	**L1, L2**
MODULE 5 **Case Study on Open Source & Commercial Clouds:** Working with AWS cloud platform- EC2, S3, Cloud watch, Cloud Front, hosting a static web app, Lambda, AWS SageMaker, Elastic Beanstalk. Amazon Glacier, Serverless computing	**8** **L1, L2**

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

CO654.1	Explain the concepts and terminologies of cloud computing
CO654.2	Identify the architecture and infrastructure of cloud computing depending on application
CO654.3	Discuss data intensive computing and its technologies.
CO654.4	Explain the core issues of cloud computing such as security, privacy, and interoperability.
CO654.5	Describe the use of AWS, Azure and Google cloud platform to develop applications

Textbooks:

1. Cloud Computing Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publishers,2011
2. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Reference books:

1. Thomas Erl, Cloud Computing: Concepts, Technology & Architecture, Pearson.
2. John Rhoton, Cloud Computing Explained: Handbook for Enterprise Implementation.
3. Cloud Computing (Wind) by Dr. Kumar Saurabh, 2nd Edison, Wiley India
4. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
5. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

E-Books / Web References

1. https://www.udemy.com/topic/cloud-computing/https://www.udemy.com/topic/artificial-intelligence
2. https://www.youtube.com/watch?v=EN4fEbcFZ_E&ab_channel=Simplilearn

MOOCs

1. https://onlinecourses.nptel.ac.in/noc21_cs14

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO654.1	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO654.2	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO654.3	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO654.4	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO654.5	3	2	1	1	2	-	-	-	-	-	-	2	2	-
Average	3	2	1	1	2	-	-	-	-	-	-	2	2	-

Low-1: Medium-2: High-3

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SEMESTER – VI

SUBJECT: SOCIETY CULTURE AND HUMAN BEHAVIOUR

Semester:	**6**	**CIE Marks**	**50**
Course Code	**21CSE661**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**Duration of SEE (hours):**	**3**
Type of Course	**AEC**	**Credits**	**1**

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	To provide the knowledge of Society as the base of Social Work.
CLO2	Understand the concept and meaning of culture; its importance and characteristics
CLO3	Understand the concept and meaning of culture; and establish relationship between culture and civilization
CLO4	Explore the Person in Environment Approach

Module 1	No. of Hours	RBT Level
SOCIETY: Introduction, Types of Societies, Origin of Society, Characteristics of Society, Association, Difference between society and association.	**03**	**L2**
Module 2		
CULTURE: Introduction, Concept of culture, Origin of culture, Components of Culture, culture and civilization, culture and heritage, Characteristics of culture, importance of cultural in human life, Beliefs, Values, Globalization and Cultural Diversity.	**03**	**L2**
Module 3		
INDIAN CULTURE: Introduction, Characteristics of Indian culture, cultural identity, religion, region and ethnicity, Ancient India, Religious reforms, tribal communities of India, spread of Indian Culture	**03**	**L2**
Module 4		
HUMAN BEHAVIOR: Understanding human behavior, heredity and environment in shaping human behavior. Introduction to Psychology – Meaning, Goals. Basic psychological Process: Perception, Motivation and Intelligence. Nature and principles of human growth and development – stages of life span from conception to old age.	**03**	**L2**

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

CO661.1	Explain types of societies and its characteristics.
CO661.2	Explain Globalization and Cultural Diversity.
CO661.3	Explain various aspects of Indian Culture
CO661.4	Explain various psychological process along with shaping of the human behavior.

Reference Books:

1. Dr. Dilip Mishra, "Man and Society".
2. Lewis Holloway and Moya Kneafsey, "Geographies of Rural Cultures and Societies (Perspectives on Rural Policy and Planning)
3. Margarete Parrish, "Social Work Perspectives on Human Behaviour".
4. Anissa Rogers, " Human Behavior in the Social Environment: Perspectives on Development and the Life Course (New Directions in Social Work)"
5. Attkinson and Hillgard, "Psychology: An introduction", Cengage Press
6. Cacioppo, J, "Discovering Psychology", Cengage Learning
7. Morgan, King, Weiz and Schopler, "Introduction to Psychology", 7th Edition, New Delhi, TATA McGraw Hill.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO661.1	-	-	-	-	-	3	3	-	-	-	3	3	-	-
CO661.2	-	-	-	-	-	3	3	-	-	-	3	3	-	-
CO661.3	-	-	-	-	-	3	3	-	-	-	3	3	-	-
CO661.4	-	-	-	-	-	3	3	-	-	-	3	3	-	-
Average	-	-	-	-	-	**3**	**3**	-	-	-	**3**	**3**	-	-

Low-1: Medium-2: High-3

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SEMESTER – VI

SUBJECT: FINANCIAL LITERACY AND BANKING

Semester:	**6**	**CIE Marks**	**50**
Course Code	**21CSE662**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**Duration of SEE (hours):**	**3**
Type of Course	**AEC**	**Credits**	**1**

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	Create a plan to create good money habits based on personality type and common external forces
CLO2	Compare features and costs of different banks and banking products (checking accounts, savings accounts, banks, credit unions, online banks)
CLO3	Recognize the importance of saving money for emergencies
CLO4	Explain the concept of insurance and identity different types of insurances

Module 1	No. of Hours	RBT Level
Basics of Savings and Investment: Why are investing and savings important? Savings Vs Investment, Power of Compounding, What should be the investment objectives? Risk and Return, Inflation effects on Investment, Investor's Age and Assets Allocation. Tax saving SchemesGovernment Schemes-National Saving Certificates, Public Provident Fund, Post Office Schemes, Equity Linked Savings Schemes, Retirement Benefits Schemes- NPS (New Pension System)	**03**	**L2**
Module 2		
Banking Activities: Deposits and Types of Deposits-Saving Bank Accounts, Fixed Deposit Accounts, Recurring Deposit Account, Special Term Deposit Schemes, Loans and Types of loan advanced by Banks and Other secondary functions of Bank. Banking structure in India and Role of Reserve Bank of India	**03**	**L2**
Module 3		
Financial Markets: Capital Market Vs Money Market, Securities and its types, i.e., Equity, Debentures or Bonds, IPOs and FPOs, Mutual Funds, Types of Mutual Funds, Brokers, sub-brokers, Process for becoming a capital market investor.	**03**	**L2**
Module 4		
Protection Related products: Insurance Policies, Life Insurance, Term Life Insurance, Endowment Policies, Pension Policies, ULIP, Health Insurance and its Plans, Understanding of Ponzi Scheme	**03**	**L2**

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

CO662.1	Understand the importance of savings and investment
CO662.2	Explain various banking activities and role of RBI.
CO662.3	Understand the money management industry and its key players: pension funds, mutual funds etc
CO662.4	Compare and contrast the types of life assurance available in the market

Reference Books:

1. Investment Planning by SEBI
2. Indian financial System, by T. R. Jain and R. L .Sharma, VK Global Publisher
3. Money and Banking by T. R. Jain and R. K. Kaundal, VK Global Publisher

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO662.1	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO662.2	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO662.3	-	-	-	-	-	-	-	-	-	-	3	3	-	-
CO662.4	-	-	-	-	-	-	-	-	-	-	3	3	-	-
Average	-	-	-	-	-	-	-	-	-	-	**3**	**3**	-	-

Low-1: Medium-2: High-3

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SUBJECT: MINI PROJECT

Subject Code	**21MPT68**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2 Contact hours/week**	**SEE Marks**	**50**
Examination Hours :3 Hours			
No. of Credits: 2			

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 2 students.

CIE procedure for Mini-Project:

(i) **Single discipline**: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) **Interdisciplinary**: Continuous lnternal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini Project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-Project:

(i) **Single discipline**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.

(ii) **Inter disciplinary**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation

Components	**Marks**	**Total**	
CIE			
Review 1	-	50	**100**
Review 2	50		
SEE			
Semester End Examination	50	50	

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SUBJECT: MACHINE LEARNING LABORATORY

Subject Code	**21CSEL69**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
Total Hours	**16**	**Examination Hours**	**3**

Prerequisites:

Basic knowledge of python programming

Course Learning objectives:

The course will enable students to:

CLO1	Apply machine learning algorithms to solve appropriate problems
CLO2	Implement supervised learning algorithm using python
CLO3	Implement unsupervised learning algorithms in python.
CLO4	Apply Bayesian learning concepts for solving machine learning problems

Program No.	Lab Experiments
1	Consider a dataset containing large number of missing data and develop a program to use pre-processing technique to handle those.
2	Develop a program to demonstrate linear and polynomial regression using appropriate data set.
3	Develop a program to demonstrate logistic regression using appropriate data set.
4	Develop a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5	Develop a program to implement the random forest Classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Develop a program to construct Support Vector Machine considering a Sample Dataset.
7	Develop a program to implement K-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
8	Build an Artificial Neural Network using the Back propagation algorithm and test the same using appropriate data sets.
9	Develop a program to implement the naïve Bayesian Classifier model. Calculate the accuracy, precision, and recall, ROC curve for your data set.
10	Implement K Means algorithmm using appropriate Data sets.

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Course Outcomes

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

CO69.1	Understand the basic concepts of Machine Learning Algorithms
CO69.2	Understand the implementation procedures for the machine learning algorithms.
CO69.3	Design Python programs for various Learning algorithms.
CO69.4	Apply appropriate data sets to the Machine Learning algorithms.
CO69.5	Identify and apply Machine Learning algorithms to solve real world problems.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education,India Edition 2013.
2. Ethem Alpaydın, Introduction to machine learning, MIT press,second edition.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer series in
2. statistics, 2nd edition.
3. Dipanjan Sarkar,Raghav Bali , Tushar Sharma, "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems",APress,2018
4. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology,2012

E-Books/Web References:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press.
2. (https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/index.html)
3. A Brief Introduction to Neural Networks, David Kriesel (http://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-2col-dkrieselcom.pdf)
4. http://gael-varoquaux.info/scikit-learn-tutorial/

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2. https://www.udemy.com/course/machinelearning/
3. https://www.coursera.org/learn/machine-learning

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO69.1	3	3	2	3	3	1						3		3
CO69.2	3	3	2	3	3	1						3		3
CO69.3	3	3	2	3	3	1						3		3
CO69.4	3	3	2	3	3	1						3		3
CO69.5	3	3	2	3	3	1						3		3
Average	3	3	2	3	3	1						3		3

High-3: Medium-2: Low-1

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VII & VIII Semester
Scheme & Syllabus
(2021-22)
Department of
Computer Science and
Engineering

SCHEME AND SYLLABUS

Department of Computer Science and Engineer

GLOBAL ACADEMY OF TECHNOLOGY
Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH and IS branches
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

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VII SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21CSE71	Augmented Reality and Virtual Reality	PC	CSE	3	0	0	50	50	100	3
2	21CSE72	Digital Image Processing	IPC		3	0	2	50	50	100	4
3	21CSE73	Robotic Process Automation Design and Development	IPC		3	0	2	50	50	100	4
4	21CSE74X	**Program Elective 3** 1. Natural language Processing 2. Ethical Hacking 3. Parallel Computer Architecture 4. NOSQL	PEC		2	2	0	50	50	100	3
5	21CSE75X	**Open Elective 2** 1. R Programming 2. React native 3. Programming skills for Employment 4. Internet of Everything	OEC	CSE	3	0	0	50	50	100	3
6	21CSE76	Project Phase 1	MP	Two Contact hours per Week				100	-	100	2
							TOTAL	**350**	**250**	**600**	**19**

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VIII SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21CSE81X	**Program Elective 4** 1. Genetic and Evolutionary Algorithm 2. Digital Forensic & Cyber Security 3. Green Computing 4. Game programming	PEC	CSE	3	0	0	50	50	100	3
2	21CSE82X	**Program Elective 5** 1. Human Computer Interaction 2. DevOps 3. Quantum Computing 4. Big Data Visualization	PEC	CSE	3	0	0	50	50	100	3
3	21CSE83	Project work phase – II	MP	Two Contact hours per week				100	100	200	12
4	21CSE84	Technical Seminar	MP	One Contact hours per week				100	--	100	1
5	21CSE85	Internship	INT	Completed during the intervening period of VI and VII Semester				100	--	100	2
				TOTAL				**400**	**200**	**600**	**21**

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SEMESTER – VII

SUBJECT: AUGMENTED REALITY AND VIRTUAL REALITY

Subject Code	**21CSE71**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites: C Programming Language

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the fundamentals of Virtual Reality.
CLO2	Understand Computer Graphics and Geometric Modelling
CLO3	Identify the Virtual Environment
CLO4	Identify and apply Augmented Reality into various gaming applications.
CLO5	Build simple AR/VR applications using the frameworks

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Virtual Reality:** Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.	**8** **L1, L2**
MODULE 2 **Computer Graphics and Geometric Modelling:** Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection	**8** **L1, L2**
MODULE 3 **Virtual Environment:** Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output: Visual /Auditory / Haptic	**8** **L1, L2**

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Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems. Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and nonlinear 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.	
MODULE 4 **Augmented Reality:** Taxonomy, technology and features of augmented reality,difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	**8** **L1, L2**
MODULE 5 **Development Tools and Frameworks:** Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. **Software:** Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML AR / VR Applications: Introduction, Engineering, Entertainment, Science, Training.	**8** **L1, L2**

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

CO71.1	Understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR.
CO71.2	Understand geometric modeling and Virtual environment.
CO71.3	Relate and differentiate VR/AR technology
CO71.4	Use various types of Hardware and software in virtual Reality systems
CO71.5	Implement Virtual/Augmented Reality applications

Textbooks:

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016. 2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

Reference Books:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
2. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
3. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

MOOCs

1. https://nptel.ac.in/courses/121/106/121106013
2. https://nptel.ac.in/courses/106/106/106106138/
3. https://stanford.edu/class/ee267/syllabus.html

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO71.1	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO71.2	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO71.3	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO71.4	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO71.5	3	3	3	-	1	-	-	-	-	-	-	1	1	-
Average	**3**	**3**	**3**	-	**1**	-	-	-	-	-	-	**1**	**1**	-

Low-1: Medium-2: High-3

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SUBJECT: DIGITAL IMAGE PROCESSING

Subject Code	**21CSE72**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**03**
No. of Credits:04			

Course Learning Objectives:

The course will enable students to:

CLO1	To provide the basic knowledge on image processing concepts.
CLO2	To develop the ability to apprehend and implement various image processing algorithms
CLO3	To facilitate the students to comprehend the contextual need pertaining to various image processing applications.
CLO4	To learn various image compression techniques

Module 1	**No. of Hours**	**RBT level**
Introduction and Fundamentals: What is digital image processing, example fields that use digital image processing, fundamental steps in digital image processing, components of an image processing system. Elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition.	8	L2
Module 2		
Image representation and properties: Image sampling and quantization, representing digital images, spatial and intensity resolution, image interpolation. Pixel Relationships: Neighborhood, adjacency, connectivity, regions and boundary of pixels, Distance measures, set and logical operations.	8	L2
Module 3		
Spatial Processing of an image: Spatial operations, geometric spatial transformations and image registration, intensity transformations and spatial filtering, Image negatives, log-transformations. Contract stretching, intensity level slicing, bit-plane slicing, examples.	8	L3
Module 4		
Histogram processing and spatial filtering: Histogram equalization, histogram matching (Specification) histogram statistics for image enhancement, Spatial filtering: spatial correlation and convolution	8	L3

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Module 5		
Smoothing spatial filters, smoothing linear filters, order statistic (nonlinear) filters, sharpening spatial filters, Laplacian based image sharpening, gradient based image sharpening.	8	L3

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

CO72.1	Understand the fundamentals of digital image processing
CO72.2	Understand the representation and properties of digital images
CO72.3	Interpret the properties of a digital image using spatial processing
CO72.4	Analyse the images using histogram processing techniques
CO72.5	Interpret digital images using various smoothing and sharpening techniques

Textbooks:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Pearson education, 4th edition ,2018.
2. Digital Image Processing, S.Jayaraman, S.Essakirajan,T.Veerakumar, TataMcGramHill,5th edition, TataMcGrawHill ,2015.ISBN:13:9780070144798

Reference Books:

1. Computer Vision and Image Processing, Scott. E. Umbaugh, Prentice Hall, 1997.
2. Fundamentals of Digital Image Processing, Anil K. Jain, PHI, 2008.
3. Digital Image Processing, William K. Pratt, John Wiley, 4th Edition, 2007
4. Digital Image Processing and Analysis, Chanda D, Datta Majumdar,2nd edition, PHI,2011

MOOCs

1. https://onlinecourses.nptel.ac.in/noc19_ee55 2. https://www.classcentral.com/course/swayam-digital-image-processing-14005

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO72.1	3	3	-	-	-	-	-	-	-	1	-	1	2	-
CO72.2	3	3	1	1	-	-	-	-	-	1	-	1	2	-
CO72.3	3	3	1	1	-	-	-	-	-	1	-	1	2	-
CO72.4	3	3	1	1	-	-	-	-	-	1	-	1	2	-
CO72.5	3	3	1	1	-	-	-	-	-	1	-	1	2	-
Average	**3**	**3**	**1**	**1**	-	-	-	-	-	**1**	-	**1**	**2**	-

Low-1: Medium-2: High-3

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Lab Component

1. Read a color image, convert it into gray scale image, using binary threshold operation obtain binary image.
2. Write a program for Image Enhancement using Zero memory point operations
3. Write a program for Image Enhancement using Histogram Processing Technique.
4. Write a program to implement histogram based image segmentation
5. Write a program for image compression and decompression using arithmetic coding and decoding**.**

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SUBJECT: ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT

Subject Code	**21CSE73**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Total Hours	**50**	**Examination Hours**	**3**
No. of Credits:4			

Prerequisites: Basics of Programming Concepts

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the basic concepts of RPA
CLO2	To Describe IPA, where it can be applied and how it implemented
CLO3	To Describe the different types of variables, Control Flow, and data manipulation techniques
CLO4	To Understand Image, Text, and data Tables Automation
CLO5	To Describe various types of Exceptions and strategies to handle

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **RPA Foundations**- What is RPA - Flavours of RPA- History of RPA- The 0B 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- 0CR-Databases- APls-Al-Cognitive Automation-Agile, Scrum, Kanban, and Waterfall DevOps-Flowcharts.	**10** **L1, L2, L3**
MODULE 2 **RPA Platforms**- What can RPA do? Benefits of RPA, Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and PIay - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by-step examples using the recorder.	**10** **L1, L2, L3**
MODULE 3 **Sequence, Flowchart, and Control Flow**-sequencing the Workflow-Activities-Control flow, various types of loops, and decision Making-Step-bystep example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and ScopeCollections-Arguments - Purpose and use-Data table	**10** **L1, L2, L3**

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usage with examplesClipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa [with a step-by-step example).	
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. **Handling User Events and Assistant Bots-** What are assistant bots? Monitoring system event triggers, Monitoring image and element triggers and Launching an assistant bot on a keyboard event	**10** **L1, L2, L3**
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 **Managing and Maintaining the Code** **Future of RPA**.	**10** **L1, L2, L3**

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

CO73.1	Understand the basic concepts of RPA
CO73.2	Discuss various components and platforms of RPA
CO73.3	Summarize the different types of variables, control flow and data manipulation techniques
CO73.4	Understand various control techniques and OCR in RPA
CO73.5	Describe different types and strategies to handle exceptions

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, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9787788470940

Reference Books:

1. Frank Casale, Rebecca Dilla, Hieidi Jaynes, Lauren Livingston, "lntroduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation, 1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.

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4. Lim Mei Ying, “Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes”, Packt Publishing, 1st Edition 2018.

E-Books / Web References:

1. https://www.uipath.com/rpa/robotic-process-automation
2. http://www.academy.uipath.com/

MOOCs:

1. https://www.mooc-list.com/course/automation-techniques-rpa-coursera
2. https://www.coursera.org/specializations/roboticprocessautomation
3. https://www.uipath.com/rpa/academy
4. https://www.udemy.com/topic/robotic-process-automation/
5. https://www.classcentral.com/subject/rpa

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO73.1	2							1			1	1	2	
CO73.2	2	2	2		3			1			1	1	2	
CO73.3	2	2	2	1	3			1			1	1	2	
CO73.4	2	2	2	1	3			1			1	1	2	
CO73.5	2	2	2	1	3			1			1	1	2	
Average	2	2	2	1	3			1			1	1	2	

Low-1: Medium-2: High-3

Lab Component

1. Develop a bot to get the movie rating.
2. Demonstrate Gmail trash emptying using bot.
3. Automate Recycle Bin emptying using UiPath Bot.
4. Build a Shopping Robot.
5. Demonstrate the MS Excel automation using bot.
6. Automate PDF automation.
7. Build an E-Mail Automation using bot.
8. Demonstrate the Data Reconciliation using robots.
9. Generate a bot for HR use case to generate offer letters.
10. Use Case: Hello Doctor using UiPath robot.

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SUBJECT: NATURAL LANGUAGE PROCESSING

Subject Code	**21CSE741**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	To understand natural language processing models
CLO2	To analyze the concepts of word level analysis
CLO3	To apply the concepts of extracting relations from text and mining diagnostic text reports
CLO4	To evaluate self-explanations in iSTART and contextual signatures
CLO5	To apply the concepts behind information retrieval models and lexical resources

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Introduction: Natural language processing (NLP), origins of NLP, language and knowledge, challenges of NLP, language and grammar, processing of Indian languages, applications, examples of early NLP systems, information retrieval, language modelling, grammar-based language models, statistical language model.	**8** **L1, L2**
MODULE 2 Word level Analysis: Introduction, regular expressions, finite state automata, morphological parsing, spelling error detection and correction, words and word classes, part of speech tagging, syntactic analysis, context free grammar, constituency, parsing, probabilistic parsing.	**8** **L1, L2, L3**
MODULE 3 Extracting relations from text: Introduction, subsequence kernels for relation extraction, a dependency path kernel for relation extraction, experimental evaluation, miningdiagnostic text reports by learning to annotate knowledge roles, domain knowledge and knowledge roles, frame semantics and semantic role labelling, learning to annotate cases with knowledge roles, Evaluations.	**8** **L1, L2, L3**
MODULE 4 Evaluating Self-Explanations in iSTART: Introduction, iSTART -feedback systems, iSTART- evaluation of feedback systems. Textual signatures: Introduction, Cohesion,	**8** **L1, L2, L3**

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Coh- Metrix, approaches to analysing texts, latent Symantec analysis, predictions. Automatic document separation: Introduction, related work, data preparation, document separation as a sequence mapping problem.	
MODULE 5 Information Retrieval: Introduction, design features of information retrieval systems, Information retrieval models, classical, non-classical, alternative models of information retrieval, Evaluation of the information retrieval system. Lexical Resources: Introduction, WordNet, FrameNet, Stemmers, Part of speech Tagger, research corpora.	**8** **L1, L2, L3**

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

CO741.1	Understand natural language processing models
CO741.2	Apply the concepts of word level analysis
CO741.3	Analyze the concepts of extracting relations from text and mining diagnostic text reports
CO741.4	Evaluate self-explanations in iSTART and contextual signatures
CO741.5	Develop the concepts behind information retrieval models and lexical resources

Textbooks:

1. Tanveer Siddiqui, U. S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, Sixth Impression, 2018.
2. Anne Kao, Stephen R Poteet, "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007

Reference Books:

1. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Publisher, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1996.
3. Jurafsky, Daniel and Martin, James, "Speech and Language Processing: An introduction to Computational Linguistics and Speech Recognition" Second Impression, Pearson Education, 2009.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
5. Charu C. Aggarwal, "Machine Learning for Text", Springer, 2018.

E-Books / Web References:

1. https://www.coursera.org/learn/language-processing
2. https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-i-processing-understanding-text-9f4abfd13e72
3. https://www.tutorialspoint.com/natural_language_processing/index.htm

MOOCs:

1. https://nptel.ac.in/courses/106/105/106105158/
2. https://onlinecourses.nptel.ac.in/noc19_cs56/preview

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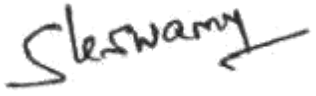
3. https://nptel.ac.in/courses/106/101/106101007/
4. https://www.coursera.org/specializations/natural-language-processing
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-864-advanced-natural-language-processing-fall-2005/

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO741.1	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO741.2	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO741.3	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO741.4	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO741.5	3	3	2	-	-	-	-	1	-	1	-	-	2	1
Average	**3**	**3**	**2**	-	-	-	-	**1**	-	**1**	-	-	**2**	**1**

Low-1: Medium-2: High-3



SUBJECT: ETHICAL HACKING

Subject Code	**21CSE742**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Explain the web application and identify it weaknesses
CLO2	Explain vulnerabilities in authentication, access control, session management, access control and data sources.
CLO3	Explain attacking authentication, access control, session management, access control and data sources

CONTENTS	# of Hours / RBT Levels
MODULE 1 Web Application (In)security: The Evolution of Web Applications, Common Web Application Functions,Benefits of Web Applications, Web Application Security, "This Site Is Secure", The Core Security Problem:Users Can Submit; Arbitrary Input, Key Problem Factors, The New Security Perimeter, The Future of Web, Application Security. Core Defense Mechanisms: Handling User Access, Authentication, Session Management, Access Control, Handling User Input, Varieties of Input, Approaches to Input Handling, Boundary Validation, Multistep Validation and Canonicalization, Handling Attackers, Handling Errors, Maintaining Audit Logs, Alerting Administrators, Reacting to Attacks **Textbook 1: Ch 1, 2**	**8** **L1, L2**
MODULE 2 **Attacking Authentication:** Authentication Technologies, Design Flaws inAuthentication Mechanisms, Bad Passwords, Brute-Forcible Login, Verbose Failure Messages, Vulnerable Transmission of Credentials, Password Change Functionality, Forgotten Password Functionality, "Remember Me" Functionality, User Impersonation Functionality, Incomplete Validation of Credentials, Nonunique Usernames, Predictable Usernames, Predictable Initial Passwords, Insecure Distribution of Credentials, Implementation Flaws in Authentication, Fail-Open Login Mechanisms, Defects in Multistage Login Mechanisms, Insecure Storage of Credentials, Securing Authentication, Use Strong Credentials, Handle Credentials Secretively, Validate Credentials Properly, Prevent Information Leakage, Prevent Brute-Force Attacks, Prevent Misuse of the	**8** **L1, L2**

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Password Change Function, Prevent Misuse of the Account Recovery Function, Log, Monitor, and Notify **Textbook 1: Ch 6**	
MODULE 3 **Attacking Session Management:** The Need for State, Alternatives to Sessions, Weaknesses in Token Generation, Meaningful Tokens, Predictable Tokens, Encrypted Tokens, Weaknesses in Session Token Handling, Disclosure of Tokens on the Network, Disclosure of Tokens in Logs, Vulnerable Mapping of Tokens to Sessions, Vulnerable Session Termination, Client Exposure to Token Hijacking, Liberal Cookie Scope, Securing Session Management, Generate Strong Tokens, Protect Tokens Throughout Their Life Cycle, Log, Monitor, and Alert **Textbook 1: Ch 7**	**8** **L1, L2**
MODULE 4 Attacking Access Controls: Common Vulnerabilities, Completely Unprotected Functionality, IdentifierBased Functions, Multistage Functions, Static Files, Platform Misconfiguration, Insecure Access Control Methods, Attacking Access Controls, Testing with Different User Accounts, Testing Multistage Processes, Testing with Limited Access, Testing Direct Access to Methods, Testing Controls Over Static Resources, Testing Restrictions on HTTP Methods, Securing Access Controls, A Multilayered Privilege Model **Textbook 1: Ch 8**	**8** **L1, L2**
MODULE 5 Injecting into Interpreted Contexts, Bypassing a Login, Injecting into SQL, Exploiting a Basic Vulnerability, Injecting into Different Statement Types, Finding SQL Injection Bugs, Injecting into XPath, Injecting into LDAP **Textbook 1: Ch 9**	**8** **L1, L2, L3**

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

CO742.1	Explain the problem of security in web application. List and discuss on the core defense mechanism.
CO742.2	Identify the flaws in authentication and explain the conduct test for attacking authentication.
CO742.3	Explain the weakness in tokens and methods for attacking session management
CO742.4	Identify vulnerabilities in access controls and discuss methods to attack
CO742.5	Illustrate inject methods for attacking data stores

Textbooks:

1. Dafydd Stuttard, Marcus Pinto, The web application hacker's handbook: finding and exploiting security flaws, Wiley, Year: 2011
2. Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers, 2010.
3. Bensmith, and Brian Komer, Microsoft Windows Security Resource Kit, Prentice Hall of India,6. 2010.

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Reference Books:

1. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Publisher, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1996.
3. Jurafsky, Daniel and Martin, James, "Speech and Language Processing: An introduction to Computational Linguistics and Speech Recognition" Second Impression, Pearson Education, 2009.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
5. Charu C. Aggarwal, "Machine Learning for Text", Springer, 2018.

E-Books / Web References:

1. https://www.coursera.org/learn/language-processing
2. https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-i-processing-understanding-text-9f4abfd13e72
3. https://www.tutorialspoint.com/natural_language_processing/index.htm

MOOCs:

1. https://nptel.ac.in/courses/106/105/106105158/
2. https://onlinecourses.nptel.ac.in/noc19_cs56/preview
   https://nptel.ac.in/courses/106/101/106101007/
3. https://www.coursera.org/specializations/natural-language-processing
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-864-advanced-natural-language-processing-fall-2005/

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO742.1	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO742.2	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO742.3	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO742.4	3	3	2	-	-	-	-	1	-	1	-	-	2	1
CO742.5	3	3	2	-	-	-	-	1	-	1	-	-	2	1
Average	**3**	**3**	**2**	-	-	-	-	**1**	-	**1**	-	-	**2**	**1**

Low-1: Medium-2: High-3

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SUBJECT: PARALLEL COMPUTER ARCHITECTURE

Subject Code	**21CSE743**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Explain the operation of uniprocessor computer components including describe current approaches to parallel computing.
CLO2	Explain the design principles of the hardware support for the shared memory and message passing programming models
CLO3	Design scalable parallel software and analyze its performance
CLO4	Implement synchronization methods for shared memory and message passing parallel computers
CLO5	Describe the implementation of different models of thread-level parallelism, such as core multithreading, chip multiprocessors, many-cores or GPGPU

CONTENTS	# of Hours / RBT Levels
MODULE 1 Uniprocessor computer architecture and C programming – Before you can write efficient parallel programs. Understanding the computer architecture (i.e., pipelining andsuperscalar processor design and memory hierarchy) are key in achieving high performance.	**8** **L1, L2**
MODULE 2 Parallel hardware and parallel software design.The parallel hardware on which your parallel programs will execute. General parallel program design techniques and patterns.	**8** **L1, L2**
MODULE 3 Shared-memory programming with pthreads – For a relatively small number (< 64) of processors (e.g., current multi-core computers), shared memory design is common. Parallel program design skills by writing several C programs. Threads running on multiple processor cores	**8** **L1, L2**
MODULE 4 Distributed-memory programming with MPI. A parallel program running across multiple computers, communicate data and synchronize tasks using the network. Parallel program design utilizing MPI (Message-Passing Interface) function. The standard distributed-memory programming tool.	**8** **L1, L2**

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MODULE 5	8
General-purpose GPU programming with CUDA – Driven by 3D computer games, graphics accelerator cards (i.e., GPU—Graphics Processing Unit) , real-time 3D graphical rendering. The computational power of GPUs for general purpose (i.e., non-graphics) computing tasks, NVIDIA modified GPU architecture. CUDA extensions and massively parallel GPU.	**L1, L2**

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

CO743.1	Explain the operation of uniprocessor computer components including the processor and memory hierarchy.
CO743.2	Demonstrate an understanding of uniprocessor computer architecture.
CO743.3	Explain the operation of parallel hardware including cache-coherence and mutexes on shared-memory machines, and interconnect performance.
CO743.4	Understand design techniques of parallel hardware and general parallel program.
CO743.5	Analyze the pthread module that make efficient use of multiple cores.

Textbooks:

1. Parallel Computer Architecture: A Hardware/Software Approach, D. Culler and J. Singh, Morgan Kaufmann, 1999
2. An Introduction to General-Purpose GPU Programming, Jason Sanders and Edward Kandrot, 2011, 1st Edition.

Reference Books:

1. An Introduction to Parallel Programming, Peter S. Pacheco, 2011, 1st Edition
2. Parallel Computer Architecture: A Hardware/Software Approach, D. Culler and J. Singh, Morgan Kaufmann, 1999
3. Introduction to Parallel Computing ,A. Grama, A. Gupta, G. Karypis, and V. Kumar, 2nd Edition, Pearson: Addison-Wesley, 2003
4. An Introduction to Parallel Programming, P. Pacheco, Morgan Kaufmann, 2011
5. Heterogeneous Computing with OpenCL, B. Gaster, L. Howes, D. Kaeli, P. Mistry, and D. Schaa, Morgan Kaufmann, 2011.
6. Parallel Scientific Computation: A Structured Approach using BSP and MPI, • R. Bisseling, Oxford Univ. Press, 2004.

E-Books / Web References:

1. https://www.ece.ufl.edu/wp-content/uploads/syllabi/Spring2017/EEL6763_Spring_2017.pdf
2. https://www.dso.ufl.edu/sccr/honorcodes/conductcode.php
3. https://www.tutorialspoint.com/parallel_computer_architecture/.
4. https://ipcc.cs.uoregon.edu/lectures/lecture-2-architecture.pdf
5. https://www.youtube.com/watch?v=eanvgGt-D1o

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6. https://en.wikipedia.org/wiki/Parallel_computing
7. https://learn.saylor.org/course/view.php?id=71

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO743.1	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO743.2	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO743.3	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO743.4	3	3	-	-	3	-	-	-	3	-	-	3	3	-
CO743.5	3	3	-	-	3	-	-	-	3	-	-	3	3	-
Average	3	3	-	-	3	-	-	-	3	-	-	3	3	-

Low-1: Medium-2: High-3

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SUBJECT: NOSQL

Subject Code	**21CSE744**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Explore the emergence, requirements and benefits of a NoSQL database
CLO2	Site principles behind the NoSQL databases, such as chapters from modern distributed database theory, P2P indexing or the Map Reduce programming model;
CLO3	Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores, graph databases)

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Define what a NoSQL database is, The Value of Relational Databases, getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Why we need NoSQL and how it is different from traditional databases. Learn about the various tools available such as MongoDB, Cassandra. Explore the principles of NoSQL using elementary examples in MongoDB.	**8** **L1, L2, L3**
MODULE 2 Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency,Read Consistency, Relaxing Consistency, The CAP Theorem.	**8** **L1, L2, L3**
MODULE 3 Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data.	**8** **L1, L2, L3**
MODULE 4 Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications Graph Databases, What Is a Graph Database?,	**8** **L1, L2, L3**

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Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines.	
MODULE 5 The set of essential operations – CRUD refers to Create, Read, Update and Delete operations in the context of a NoSQL database environment. Practical experience of CRUD operations for document databases using MongoDB. Learn to query using MongoDB.	**8** **L1, L2, L3**

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

CO744.1	Define the emergence of NOSQL
CO744.2	Explain the data distribution models
CO744.3	Define, compare and use the key value database
CO744.4	Define, compare and use the key value database
CO744.5	Demonstrate the essential CRUD operations using MongoDB

Textbooks:

1. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.
2. Pramod J. Sadalage, Martin Fowler. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

Reference Books:

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978- 9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO744.1	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO744.2	3	3	2	-	-	-	-	-	1	1	-	2	-	2
CO744.3	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO744.4	3	3	1	-	2	-	-	-	1	1	-	2	-	3
CO744.5	1	1	-	-	-	-	-	-	1	1	-	2	-	3
Average	**3**	**3**	**1**	-	**2**	-	-	-	**1**	**1**	-	**2**	-	**3**

Low-1: Medium-2: High

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SUBJECT: R PROGRAMMING

Subject Code	**21CSE751**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Learn Fundamentals of R.
CLO2	Understand how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions.
CLO3	Understand the Basics of statistical data analysis with examples.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to R:** What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), package Description(), help(), find.package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and – inf.	**8** **L1, L2, L3**
MODULE 2 **R Data Types:** Vectors, Lists, Matrices, Arrays, Factors, Data Frame – **R - Variables:** Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables -**R Operators:** Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - **R Decision Making:** if statement, if – else statement, if – else if statement, switch statement – **R Loops:** repeat loop, while loop, for loop - Loop control statement: break statement, next statement.	**8** **L1, L2, L3**
MODULE 3 **R-Function :** function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - **R-Strings** – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower() - **R Vectors** – Sequence vector, repfunction, vector access, vector names, vector math, vector recycling, vector elementsorting - R List - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector - R Matrices – Accessing	**8** **L1, L2, L3**

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Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- **R Arrays:** Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements - **R Factors** –creating factors, generating factor levels gl().	
MODULE 4 **Data Frames** –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, **Expand Data Frame:** Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast(). **Loading and handling Data in R:** Getting and Setting the Working Directory – getwd(), setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File – R -Excel File – Reading the Excel file.	**8** **L1, L2, L3**
MODULE 5 **Descriptive Statistics:** Data Range, Frequencies, Mode, **Mean and Median:** Mean Applying Trim Option, Applying NA Option, Median - Mode - Standard Deviation – Correlation - **Spotting Problems in Data with Visualization:** visually Checking Distributions for a single Variable - **R –Pie Charts:** Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - **R – Bar Charts:** Bar Chart Labels, Title and Colors.	**8** **L1, L2, L3**

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

CO751.1	Understand the basics of Fundamentals of R
CO751.2	Implement the loading, retrieval techniques of data.
CO751.3	Analyze how data is analysed and visualized using statistic functions.

Textbooks:

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN : 978-93-5260-455-5.

Reference Books:

1. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.
2. Tutorials Point (I) simply easy learning, Online Tutorial Library (2018), R Programming, Retrieved from https://www.tutorialspoint.com/r/r_tutorial.pdf.
3. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO751.1	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO751.2	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO751.3	3	3	3	-	1	-	-	-	-	-	-	1	-	1
Average	**3**	**3**	**3**	-	**1**	-	-	-	-	-	-	**1**	-	**1**

Low-1: Medium-2: High-3

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SUBJECT: REACT NATIVE

Subject Code	**21CSE752**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Understand how React Native works under the hood with native UI components
CLO2	Examine how React Native's mobile-based components compare to basic HTML elements
CLO3	Create and style your own React Native components and applications
CLO4	Take advantage of platform-specific APIs from the framework's community
CLO5	Learn common pitfalls of React Native development, and tools for dealing with them

CONTENTS	# of Hours / RBT Levels
MODULE 1 **What Is React Native?** Advantages of React Native, Risks and Drawbacks **Working with React Native:** How Does React Native Work? Rendering Lifecycle Creating Components in React Native **Building Your First Application:** Setting Up Your Environment, Creating a New Application, Exploring the Sample Code, Building a Weather App	**8** **L1, L2, L3**
MODULE 2 **Components for Mobile:** Analogies Between HTML Elements and Native Components, Working with Touch and Gestures, Working with Organizational Components, Platform-Specific Components	**8** **L1, L2, L3**
MODULE 3 **Styles:** Declaring and Manipulating Styles, Organization and Inheritance, Positioning and Designing Layouts	**8** **L1, L2, L3**
MODULE 4 Platform APIs - Using Geolocation, Accessing the User's Images and Camera, Storing Persistent Data with AsyncStore, The SmarterWeather Application	**8** **L1, L2, L3**
MODULE 5 **Debugging and Developer Tools -** JavaScript Debugging Practices, Translated; React Native Debugging Tools, Debugging Beyond JavaScript, Testing Your Code	**8** **L1, L2, L3**

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

CO752.1	Understand the framework of React Native
CO752.2	Understand mobile-based components used for React Native
CO752.3	Apply and manage styles in React Native
CO752.4	Use of platform's specific APIs in React Native
CO752.5	Understand common pitfalls of React Native development and tools to tackle them

Textbooks:

1. Learning React Native, 2nd Edition, Bonnie Eisenman, Released November 2017, Publisher(s): O'Reilly Media, Inc.ISBN: 9781491989142

Reference Books:

1. Hands-On Design Patterns with React Native: Proven techniques and patterns for efficient native mobile development with JavaScript Mateusz Grzesiukiewicz, September 29, 2018, Publisher(s): Packt
2. React Native Cookbook - Second Edition, Dan Ward, January 2019, Publisher(s): Packt
3. JavaScript Everywhere: Building Cross-Platform Applications with GraphQL, React, React Native, and Electron 1st Edition, Adam D. Scott,February 6, 2020, Publisher(s): O'Reilly Media
4. React Native for Mobile Development: Harness the Power of React Native to Create Stunning iOS and Android Applications 2nd Edition, Akshat Paul and Abhishek Nalwaya, June 12, 2019, Publisher(s): Apress
5. React Native in Action: Developing iOS and Android Apps with JavaScript, Nader Dabit, March 2019, Publisher(s): Manning Publications

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO752.1	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO752.2	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO752.3	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO752.4	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO752.5	3	3	3	-	1	-	-	-	-	-	-	1	-	1
Average	**3**	**3**	**3**	-	**1**	-	-	-	-	-	-	**1**	-	**1**

Low-1: Medium-2: High-3

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SUBJECT: PROGRAMMING SKILLS FOR EMPLOYMENT

Subject Code	**21CSE753**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Ability to translate vast data into abstract concepts and to understand JAVA concepts
CLO2	To have a clear understanding of subject related concepts
CLO3	To develop computational ability in Java programming language

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Object and Class, Data types, Basic I / O:** Types of programming - Disadvantages of functional programming Class & Objects – Attributes Methods Objects Solving MCQs based on Objects and Classes Solving tricky questions based on encapsulation Solving frequently asked object based questions Data types – Data - Why data type Variables - Available data types Numeric – int, float, double Character – char, string - Solving MCQs based on type casting, data types Solving debugging based MCQs Printing Getting input from user during run time Command line arguments Solving programming questions based on CLA Solving MCQs questions based on CLA	**8** **L1, L2, L3**
MODULE 2 **Decision Making, Loop Control, String, Date, Array**: Need for control statementif..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making Types of looping statements Entry Controlled - For – While Exit Controlled - do while - break and continue Demo on looping Common mistakes with looping statements (like using ; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions String handling, date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi- dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays	**8** **L1, L2, L3**
MODULE 3 **Inheritance, Aggregation & Associations:** Need Is A – Inheritance - Types of	**8** **L1, L2, L3**

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inheritance supported Diagrammatic representation - Demo on inheritance Has A – Aggregation - Diagrammatic representation - -Demo on aggregation Uses A - Association - Diagrammatic representation - Demo on association Assignment on relationships Solving MCQs based on relationships between classes	
MODULE 4 **Modifiers, Interface & Abstract classes (Javaspecific), Packages:** Types of access specifiers Demo on access specifiers Assignment on access modifiers Instance Members Solving MCQs based on modifiers Abstract Classes – Need - Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface Need for packages Access specifiers & packages Import classes from other packages	**8** **L1, L2, L3**
MODULE 5 **Collections:** Array List, Linked List, List Interface, Hash Set, Map Interface, Hash Map, Set Programming questions based on collections Real world problems based on data structure	**8** **L1, L2, L3**

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

CO753.1	Use the syntax and semantics of java programming language and basic concepts of OOP.
CO753.2	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages
CO753.3	Demonstrate the use of modifiers, interfaces and abstract classes packages
CO753.4	Apply the concept of Collections

Textbooks:

1. Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd

Reference books:

1. Introduction to Programming with Java: A Problem-Solving Approach by John Dean

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO753.1	3	3	3	-	-	-	-	-	-	-	2	2	-	2
CO753.2	3	3	3	-	2	-	-	-	-	-	2	2	-	2
CO753.3	3	3	3	-	2	-	-	-	-	-	2	2	-	2
CO753.4	3	3	3	-	2	-	-	-	-	-	2	2	-	2
Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**

Low-1: Medium-2: High-3

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SUBJECT: INTERNET OF EVERYTHING

Subject Code	**21CSE754**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students:

CLO1	Understand the basics of Internet of things.
CLO2	Describe the middleware for Internet of Things.
CLO3	Understand the concepts of Web of Things
CLO4	The need for Data Analytics and Security in IoT.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 IOT - What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.	**8** **L1, L2**
MODULE 2 IOT ARCHITECTURE - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoT Activity: An Open source IoT stack - Overview- IoT Activity stack architecture- Resource model and Abstraction.	**8** **L1, L2**
MODULE 3 WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web– Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.	**8** **L1, L2**
MODULE 4 Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	**8** **L1, L2**
MODULE 5 Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning,	**8** **L1, L2**

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Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	

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

CO754.1	Discuss the impact and challenges posed by IoT networks leading to new architectural models.
CO754.2	Describe the deployment of smart objects and the architecture.
CO754.3	Explain the role of IoT and WOT.
CO754.4	Discuss the need for Data Analytics and Security in IoT.
CO754.5	Describe the different Applications in real time..

Textbooks:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

Reference books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO754.1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO754.2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO754.3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO754.4	3	3	3	-	3	-	-	-	-	-	-	-	-	3
CO754.5	3	3	3	-	3	1	1	-	-	-	-	-	-	3
Average	**3**	**3**	3	-	3	1	1	-	-	-	-	-	-	**3**

Low-1: Medium-2: High-3

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SUBJECT: PROJECT PHASE 1

Subject Code	**21CSE76**	**CIE Marks**	**100**
Hours/Week (L: T: P) : 2 Contact hours/week			
No. of Credits: 2			

Project Phase-l:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 3 students. ln extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

1. Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase I, shall be based on the evaluation of the project work phase -1- Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.

2. Inter disciplinary: Continuous internal Evaluation shall be group wise at the college level with the participation of all guides bf the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -I, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.

The marks awarded for the project report shall be the same for all the batch mates as per rubrics covering all Program Outcomes.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE Evaluation

Components	**Marks**	**Total**	
CIE			
Review 1	25	100	**100**
Review 2	25		
Report	50		

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SEMESTER – VIII

SUBJECT: GENETIC AND EVOLUTIONARY ALGORITHIM

Subject Code	**21CSE811**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

1. Discrete Mathematics and transform calculus
2. Graph theory, probability, and sampling techniques
3. Artificial intelligence and machine learning

Course Learning Objectives:

The course will enable students to:

CLO1	To understand the basics of global optimization algorithms and genetic algorithms
CLO2	To interpret computational steps involved in genetic algorithms
CLO3	To understand implementation of genetic algorithms
CLO4	To know the basics of simulated annealing
CLO5	To know the basics of simulated annealing

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 Introduction to Genetic algorithms, Traditional optimization and search methods, The goals of optimization, Genetic algorithms Vs traditional algorithms, A simple genetic algorithm, Hand simulation of a simple genetic algorithm, Grist for the search mill, Similarity templates (Schemata), Comparison of natural and GA terminology.	**8** **L1, L2**
MODULE 2 Basic notions of GA, who shall live and who shall die: the fundamental theorem, A hand example of schema processing, two armed and k-armed bandit problem, how many schemata are processed usefully, the building block hypothesis, minimal deceptive problem, similarity templates as hyperplanes, discretization, constraints.	**8** **L1, L2**
MODULE 3 Data structures for GA, Reproduction, Crossover and mutation, Mapping objective function to fitness form, Fitness scaling, Codings, A multiparameter, 8 U mapped fixed-	**8** **L1, L2**

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point coding.	
MODULE 4 Simulated annealing (SA), annealing in nature, A simple SA algorithm, Cooling schedules: linear, exponential, inverse, logarithmic, inverse linear and dimension dependent cooling, Implementation issues.	**8** **L1, L2**
MODULE 5 Particle swarm optimization (PSO), A basic PSO algorithm, Particle swarm topologies, velocity limiting, Inertia weighing and constriction coefficients, Global velocity updates, the fully informed particle swarm, Learning from mistakes.	**8** **L1, L2**

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

CO811.1	Understand and analyze the basic concepts of genetic algorithms
CO811.2	Analyze the computational steps in the simple genetic algorithm
CO811.3	Understand the data structures and implementation steps of simple genetic algorithm
CO811.4	Understand the concepts and computational steps involved in Simulated annealing
CO811.5	Know the basic concepts and implementation of particle swarm optimization

Textbooks:

1. Goldberg, David E. "Genetic Algorithms in Search, Optimization, and Machine Learning", Addison Wesley Publishing Company Inc., 1989.
2. Simon, D., "Evolutionary optimization algorithms" John Wiley & Sons, 2013.

Reference Books:

1. S.N. Sivanandam, S. N. Deepa, "Introduction to Genetic Algorithms", Springer Heidelberg, 2008.
2. Erdogmus, Pakize, ed. "Particle swarm optimization with applications" BoD–Books on Demand, 2018.

E-Books / Web References

1. https://www.boente.eti.br/fuzzy/ebook-fuzzy-mitchell.pdf
2. https://www.pdfdrive.com/genetic-algorithms-d38185417.html

MOOCS

1. https://nptel.ac.in/courses/112103301
2. https://onlinecourses.nptel.ac.in/noc21_me58/preview
3. https://onlinecourses.nptel.ac.in/noc22_me47/preview
4. https://www.udemy.com/course/geneticalgorithm/
5. https://www.udemy.com/course/machine-learning-optimization-using-genetic-algorithm/

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO811.1	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO811.2	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO811.3	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO811.4	3	3	2	-	-	-	-	-	-	-	-	-	-	3
CO811.5	3	3	2	-	-	-	-	-	-	-	-	-	-	3
Average	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**3**

Low-1: Medium-2: High-3

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SUBJECT: DIGITAL FORENSIC AND CYBER SECURITY

Subject Code	**21CSE812**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	To provide the basic knowledge on Computer Forensics.
CLO2	To understand cybercrime and the laws governing cybercrime.
CLO3	To comprehend the contextual need of cybercrime investigations.
CLO4	To investigate the use of tools used in cyber forensics.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Understanding Cyber Crime-**Indian IT Act 2008 and amendments, Computer Forensics and Investigation as a profession, Understanding computer forensics, Preparing a computer investigation, Taking a systematic approach, Procedures for corporate high tech investigations, Understanding data recovery workstations and software	**8** **L1, L2**
MODULE 2 **Cyber Crime in Devices-**Introduction, Proliferation of mobile and wireless devices,Credit card fraud in the mobility era, Challenges posed by mobile devices, Registry settings, Attacks on mobile/cell phones, Security implications and Measures for organizations in handling mobile devices, Organizational security policies and measures in mobile computing era, Laptops	**8** **L1, L2**
MODULE 3 **Data Acquisition** –Understanding storage formats for digital evidence, Determining the best acquisition method, Contingency planning for Image acquisitions, Using acquisition tools, validating Data acquisition, Using remote network acquisition tools, Computer forensics Analysis and Validation – Determining what data to collect and analyze, Validating forensic data, Addressing Data Hiding Techniques, Performing remote acquisitions.	**8** **L1, L2**
MODULE 4 Computer Forensics Tools-Evaluating Computer Forensic tool needs, Computer Forensics software tools, Computer Forensics Hardware tools, Validating and testing Forensic software, Recognizing a graphics file, Understanding data compression, locating and recovering graphics files, Identifying unknown file formats, Understanding copyright	**8** **L1, L2**

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issues with graphics	
MODULE 5 Tools and Methods-Introduction, proxy servers and Anonymizers, Phishing, Password cracking, Keyloggers and spywares, virus and worms, Trojan Horses and back doors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer overflow, Identity Theft	**8** **L1, L2**

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

CO812.1	Discuss the Indian IT Act 2008 and its Amendments.
CO812.2	Describe the organizational methods and policies for cybercrime handling in mobile and wireless devices.
CO812.3	Use the Data storage and acquisition methods for digital evidence.
CO812.4	Describe the computer forensic tools and their usage.
CO812.5	Comprehend the different tools and techniques used in cyber crime

Textbooks:

1. Introduction to Information Security and cyber laws-Dr. Surya Praksh Tripathi, Ritendra Goyal, Praveen Kumar Shukla, Dream tech Press,2015. ISBN: 9789351194736
2. Cyber Forensics, I.A.Dhotre, Technical Publications 1st edition,2016,ISBN:13:978-9333211475.
3. Cyber Security: Understanding Cyber crime, computer forensics and legal perspectives, Sunith Belapure and Nina Godbole, Wiley India,2013. ISBN:978-81-265-21791

Reference Books:

1. 1. Computer Forensics and Cyber Crime –An Introduction, Marjie T Britz, Pearson Education, 2nd edition,2012.
2. Cyber Laws and IT Protection, Harish Cahnder, PHI, 2012.
3. Cyber Security: Managing Systems, Conducting Testing and Investigating Inrusions, Thomas J Moubray, John Wiley ,2014..
4. Guide to Computer Forensics and Investigations, Nelson, Philips, Frank, Enfinger and Steuart, Cengage Learning,2008

MOOCS

1. https://www.cyberdegrees.org
2. https://www.udemy.com/course/complete cybersecurity

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO812.1	1	2	-	-	-	-	-	1	-	1		1	-	-
CO812.2	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO812.3	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO812.4	2	2	1	1	-	-	-	1	-	1	-	1	-	1
CO812.5	2	2	1	1	-	-	-	1	-	1	-	1	-	1
Average	**2**	**2**	**1**	1	-	-	-	**1**	-	**1**	-	**1**	-	**1**

Low-1: Medium-2: High-3

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SUBJECT: GREEN COMPUTING

Subject Code	**21CSE813**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

Internet of Things, Cloud Computing

Course Learning Objectives:

The course will enable students to:

CLO1	Learn the fundamentals of Green Computing.
CLO2	Analyze the Green computing Grid Framework.
CLO3	Understand the issues related with Green compliance
CLO4	Study and develop various case studies.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Green IT Fundamentals:** Business, IT and the Environment, **Green computing:** carbon foot print, scoop on power, **Green IT Strategies:** Drivers, Dimensions and Goals, **Environmentally Responsible Business:** Policies, Practices, and Metrics.	**8** **L1, L2**
MODULE 2 **Green Assets:** Buildings, Data Centers, Networks, and Devices, **Green Business Process Management:** Modeling, Optimization, and Collaboration, Green Enterprise Architecture, Environmental Intelligence, Green Supply Chains, **Green Information Systems:** Design and Development Models.	**8** **L1, L2**
MODULE 3 Virtualizing of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling, Best ways for Green PC, Green Data center, Green Grid framework.	**8** **L1, L2**
MODULE 4 Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap, **Green Compliance:** Protocols, Standards, and Audits, **Emergent Carbon Issues:** Technologies and Future	**8** **L1, L2**
MODULE 5 **Case study:** The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications	**8** **L1, L2**

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to a Home, Hospital, Packaging Industry and Telecom Sector.	

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

CO813.1	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO813.2	Enhance the skill in energy saving practices in their use of hardware.
CO813.3	Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders
CO813.4	Understand the ways to minimize equipment disposal requirements

Textbooks:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011 2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

Reference Books:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey", Shoff/IBM Rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.
3. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
4. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010. 5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO813.1	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO813.2	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO813.3	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO813.4	3	3	3	-	1	-	-	-	-	-	-	1	-	1
Average	**3**	**3**	**3**	-	**1**	-	-	-	-	-	-	**1**	-	**1**

Low-1: Medium-2: High

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SUBJECT: GAME PROGRAMMING

Subject Code	**21CSE814**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Provide an in-depth introduction to technologies and techniques used in the game industry.
CLO2	Recognize the processes, mechanics, issues in game design and game engine development
CLO3	Integrate various technologies such as multimedia, artificial intelligence and physics engine into a cohesive, interactive game application.

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Game Programming:** Overview of game programming, game industry. **Game Engine Architecture:** Engine Support, Resource Management, Real Time Game Architecture	**8** **L1, L2**
MODULE 2 **Graphics:** Graphics Device Management, Tile-Based Graphics and Scrolling, GUI programming for games. **Artificial Intelligence and Physics:** Artificial Intelligence in games, Physics based modeling, Path finding algorithms, Collision detection	**8** **L1, L2, L3**
MODULE 3 Game design: Game design, Differing game types, modes, and perspectives, scripting, audio engineering, Sound and Music, level design, render threading.	**8** **L1, L2, L3**
MODULE 4 Project management : Game project management, Game design documentation, Rapid prototyping and game testing	**8** **L1, L2, L3**
MODULE 5 Recent Trends: Students may use platforms such as Windows platform, DirectX SDK for rendering, APIs such as Lua scripting language, Box2D Physics Engine, tools such as Visual Studio IDE for software development, Tiled for map editing, RUBE for Box2D level editing, Gimp for sprite sheet creation, Audacity for sound recording and editing.	**8** **L1, L2, L3**

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

CO814.1	Identify the human roles involved in the game industry and describe their responsibilities.
CO814.2	Design the graphics based games and learn to manage the graphics devices.
CO814.3	Construct the game using artificial intelligence and physics based modeling.
CO814.4	Create various types of games with different types of modes and perspectives
CO814.5	Develop, test, and evaluate procedures of the creation, design and development of games.

Textbooks:

1. Game Engine Architecture, 2nd Edition, Jason Gregory, A K Peters, 2014 ISBN 9781466560017

Reference Books:

1. Best of Game Programming Gems, Mark DeLoura, Course Technology, Cengage Learning, 2014, ISBN10:1305259785
2. Rules of Play: Game Design Fundamentals, Katie Salen and Eric Zimmerman, MIT Press, 2003, ISBN 0-262-24045-9
3. Real-Time Collision Detection, Christer Ericson, Morgan Kaufmann, 2005, ISBN 9781558607323
4. XNA Game Studio 4.0 Programming. Tom Miller and Dean Johnson, Addison-Wesley Professional, 2010 ISBN-10:0672333457
5. Introduction to Game Development, Second Edition, Steve Rabin, Charles River Media; 2009 ISBN-10: 1584506792

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO814.1	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO814.2	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO814.3	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO814.4	3	3	3	-	1	-	-	-	-	-	-	1	-	1
CO814.5	3	3	3	-	1	-	-	-	-	-	-	1	-	1
Average	**3**	**3**	**3**	-	**1**	-	-	-	-	-	-	**1**	-	**1**

Low-1: Medium-2: High

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SUBJECT: HUMAN COMPUTER INTERACTION

Subject Code	**21CSE821**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

Object Oriented Concepts

Course Learning Objectives:

The course will enable students to:

CLO1	Basic field of human computer interaction study.
CLO2	Application of human computer interaction to real life use cases.
CLO3	Design of effective human computer interactions

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction-** What is HCI, Disciplines involved in HCI, Why HCI study are important, The psychology of everyday things, Principles of HCI, User centered Design**.**	**8** **L1, L2**
MODULE 2 **Understanding The Human-** Input-Output channels, Human memory, Thinking: Reasoning and emotions, Individual differences, Psychology and Design.	**8** **L1, L2**
MODULE 3 **Understanding The Interaction-** Models of Interaction, Ergonomics, Interaction styles, WIMP Interface, Context of interaction, User experience, Paradigms of Interaction.	**6** **L1, L2**
MODULE 4 **HCI Design Process-** What is interaction, The siftware design process, User focus, Scenarios, Navigation Design, Screen Design, Prototyping techniques, Wire framing, Understanding the UI Layer and its Execution framework, Model-View-Controller(MVC) Framework.	**8** **L1, L2**
MODULE 5 **HCI –Design Rules, Guidelines and Evaluation Techniques** –Principles that support usability, Design standards, Design Guidelines, Golden rules and heuristics using toolkits, User interface management system(UIMS), Goals of evaluation, Evaluation criteria, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method.	**10** **L1, L2**

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HIC Models and theories- Goal and task hierarchy model, Linguistic model, Physical and device model, Cognitive architectures, Hierarchical task analysis (HTA), Uses of task analysis.	

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

CO821.1	Identify importance of HCI study and principles of User centered design approach.
CO821.2	Design effective user interfaces following a structured and organized user centered design process.
CO821.3	Apply proper learning algorithm to data depending on the task
CO821.4	Perform evaluation of usability of a user interface design.
CO821.5	Design certain tools for blind or PH people.

Textbooks

1. Alan Dix (2008), Human Computer Interaction. Pearson Education. ISBN 978-81-317-1703-5.
2. Gerard Jounghyun Kim (2015), Human-Computer Interaction: Fundamentals and Practice. CRC Press. ISBN 978-1-4822-3390-2.

Reference Books

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen, Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human – Computer Interaction, Smith - Atakan, Cengage Learning.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO821.1	3	2	2	-	3	2	-	1	-	1	-	2	1	-
CO821.2	3	2	3	-	3	-	-	1	-	1	-	3	1	-
CO821.3	3	2	3	-	-	-	-	1	-	1	-	3	1	-
CO821.4	3	2	3	2	-	-	-	1	-	1	-	3	1	-
CO821.5	3	-	3	-	3	-	-	1	-	1	-	3	1	-
Average	**3**	**2**	**3**	**2**	**3**	**2**	**-**	**1**	**-**	**1**	**-**	**3**	1	**-**

Low-1: Medium-2: High

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SUBJECT: DEVOPS

Subject Code	**21CSE822**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	Define and discuss the key concepts and principles of DevOps.
CLO2	Describe the Service Delivery process using Cloud
CLO3	Explain the concepts of test automation, infrastructure automation, and build and deployment automation
CLO4	Apply agile principles to a range of decision possibilities
CLO5	Explain the concepts of Docker Containerization

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction to DevOps:** What Is Devops , History of Devops ,Devops definition ,DevOps Main Objectives , DevOps and Software Development Life Cycle-Waterfall Model, Agile Model, DevOps Technical Challenges, DevOps Tools	**8** **L1, L2, L3,L4**
MODULE 2 **DevOps On Cloud:** Essentials on Cloud Computing, Cloud and Virtualizationarchitecture, Cloud deployment architecture, Cloud Providers-An Overview, Why we need DevOps on Cloud?, Introduction to Amazon Web Services.	**8** **L1, L2, L3,L4**
MODULE 3 **GIT – A Version controlling tool:** Introduction, Essentials of GIT in industry, How to setup GIT, Working with various commands in GIT, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Branching and Merging in Git, Git workflows	**8** **L1, L2, L3,L4**
MODULE 4 **Jenkins:** Essentials of Continuous Integration, Know about Jenkins and its architecture in detail, Jenkins tool Management in detail, Know about User management in Jenkins, Authentication, Authorization, Adding a slave node to Jenkins, Building Delivery Pipeline ,Notification settings in Jenkins, Plugin management in Jenkins	**8** **L1, L2, L3,L4**
MODULE 5 **Docker:** Introduction-Real-world Shipping Transportation Challenges, Introducing	**8** **L1, L2, L3,**

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Docker and its technology, Understanding of Docker images and containers, Working with container-How to Share and copy a container, Container Life Cycle, How to useBase Image and customize o Creation of Docker File, How to Publish Image on Docker Hub, Introduction to Docker Networking, Docker Swarm – An introduction	**L4**

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

CO822.1	Interpret and apply various principles, history of DevOps
CO822.2	Understand and usage of Cloud on DevOps
CO822.3	Identify and use GIT tool
CO822.4	Identify and use various tools using Jenkins
CO822.5	Understand and implement DevOps principles using Docker

Textbooks:

1. **Mikael Krief** – Learning DevOps- The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps,2019

Reference books:

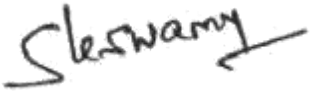
1. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive -**Sricharan Vadapalli, Packt, 2018**
2. DevOps: Puppet, Docker, and Kubernetes -**Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017**
3. Agile Project Management: Creating Innovative Products, Second Edition- **Jim Highsmith, Addison-Wesley Professional, 2009**
4. Learning Agile: Understanding Scrum, XP, Lean, and Kanban- **Andrew Stellman, Jennifer Greene, 2015, O Reilly**
5. More Agile Testing: Learning Journeys for the Whole Team -**Janet Gregory, Lisa Crispin, Addison Wesley, 2015**

E-Books / Web References

1. Modern DevOps Practices by Gaurav Agarwa, 2021
2. DevOps: This Book Includes DevOps Handbook AND DevOps Adoption by Frank Millstein,2018

MOOCs

1. https://www.coursera.org/specializations/aws-devops
2. https://www.coursera.org/learn/intro-to-devops



CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO822.1	2	2	2	1	3	2	1	3	-	-	-	3	2	3
CO822.2	3	3	2	-	3	1	1	2	-	-	-	2	2	3
CO822.3	3	1	2	1	3	2	-	1	-	-	-	2	2	3
CO822.4	3	1	3	3	3	2	-	1	-	-	-	3	2	3
CO822.5	3	2	3	3	3	2	-	1	-	-	-	2	2	3
Average	3	2	3	2	3	2	1	2	-	-	-	2	2	3

Low-1: Medium-2: High

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SUBJECT: QUANTUM COMPUTING

Subject Code	**21CSE823**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Prerequisites:

Physics fundamentals, Linear algebra

Course Learning Objectives:

The course will enable students to:

CLO1	A basic introduction to quantum mechanics, linear algebra and familiarity with the Dirac notation is provided first to get one's quantum moorings right.
CLO2	Byan introductory treatment of quantum computation and quantum information.
CLO3	Quantum cryptography RSA encryption.
CLO4	A basic study of quantum algorithms
CLO5	Rudimentary quantum computing is introduced using the IBM quantum computer and associated simulators.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction to Quantum Computing** - Elementary quantum mechanics: linear algebra for quantum mechanics, Quantum states in Hilbert space, The Bloch sphere, Density operators, generalized measurements, no-cloning theorem.	**8** **L1, L2**
MODULE 2 **Quantum Correlations -** Bell inequalities and entanglement, Schmidt decomposition, super-dense coding, teleportation.	**8** **L1, L2**
MODULE 3 **Quantum cryptography -** A Brief Overview of RSA Encryption, Basic Quantum Cryptography, An Example Attack: The Controlled NOT Attack, Quantum key distribution.	**8** **L1, L2**
MODULE 4 **Quantum gates and algorithms -** Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring.	**8** **L1, L2**

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MODULE 5	8
Programming a quantum computer- The IBMQ, coding a quantum computer using a simulator to carry out basic quantum measurement and state analysis.	**L1, L2**

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

CO823.1	Understand the basic concepts of quantum computing.
CO823.2	Explain the Quantum correlation, decomposition and dense coding techniques.
CO823.3	Explain the quantum cryptography and its techniques
CO823.4	Understand quantum gates and algorithms.
CO823.5	Understanding of quantum computing programming and understanding the quantum measurement.

Textbooks

1. Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020
3. David McMahon-Quantum Computing Explained-Wiley-Interscience, IEEE Computer Society (2008)

Reference Books

1. Quantum Computation and Quantum Information, M. A. Nielsen &I. Chuang, Cambridge University Press (2013).
2. Quantum Computing, A Gentle Introduction, Eleanor G. Rieffel and Wolfgang H. Polak IT press (2014)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO823.1	3	3	-	-	-	-	-	1	-	1	-	2	1	-
CO823.2	3	3	2	2	-	-	-	1	-	1	-	3	1	-
CO823.3	3	3	2	2	-	-	-	1	-	1	-	2	1	-
CO823.4	3	3	3	2	-	-	-	1	-	1	-	3	1	-
CO823.5	3	-	-	-	2	-	-	1	-	1	-	3	1	--
Average	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**1**	**-**	**1**	**-**	**3**	1	**-**

Low-1: Medium-2: High

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SUBJECT: BIG DATA VISULAIZATION

Subject Code	**21CSE824**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**03**
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to:

CLO1	To understand how accurately represent voluminous complex data set in web and from other data sources
CLO2	To understand the methodologies used to visualize large data sets
CLO3	To study the Interaction techniques in information visualization fields
CLO4	Creating advanced visualizations with Tableau that explain complexity with clarity and style
CLO5	Use data visualizations, dashboards, and Tableau Stories to support relevant communication for diverse audiences.

CONTENTS	**# of Hours / RBT Levels**
MODULE 1 **Introduction:** Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.	**8** **L1, L2, L3, L4**
MODULE 2 **Visualizing Data Methods:** Mapping - Time series - Connections and correlations - Scatterplot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics	**8** **L1, L2, L3, L4**
MODULE 3 **Visualizing Data Process:** Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Numberof Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.	**8** **L1, L2, L3, L4**
MODULE 4 **Creating Your First visualization:** Getting started with Tableau Software, Using Data	**8** **L1, L2, L3,**

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file formats, Connecting your Data to Tableau, Creating basic charts (line, bar charts, Treemaps) ,Using the Show me panel, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields, Applying new data calculations to your visualization	**L4**
MODULE 5 **Formatting Visualizations:** Formatting Tools and Menus, Formatting specific parts ofthe view, Editing and Formatting Axes, Cleaning-up the data with the Data Interpreter, Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data	**8** **L1, L2, L3, L4**

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

CO824.1	Conduct exploratory data analysis using visualization
CO824.2	Apply the fundamental concepts of data visualization to define a project in your field of study
CO824.3	Apply data transformations such as aggregation and filtering for visualization.
CO824.4	Analyze data and calculate with tables using Tableau commands
CO824.5	Publish the created visualizations using Tableau

Textbooks:

1. Visual Analytics with Tableau – Alexander Loth
2. Mastering Tableau 2021: Implement advanced business intelligence techniques and analytics with Tableau, 3rd Edition – Marleen Meier

Reference books:

1. Scott Murray, "Interactive data visualization for the web", O'Reilly Media, Inc., 2013
2. Ben Fry, "Visualizing Data", O'Reilly Media, Inc., 2007.
3. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", No Starch Press Inc, 2007
4. Hadley Wickham "ggplot2 Elegant Graphics for Data Analysis"
5. Edwin Ross Torres -Full Stack Web Development,2020

E-Books / Web References

1. Learning Tableau 2019 - Third Edition by Joshua N. Milligan
2. Tableau 10 for Beginners: Step by Step guide to developing visualizations in Tableau 10 by Chandraish Sinha

MOOCs

1. https://www.udemy.com/course/data-visualization-with-tableau-x/
2. https://www.udemy.com/course/tableau10/

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO824.1	3	3	3	1	3	2	1	3	-	-	-	3	3	2
CO824.2	3	3	3	-	3	1	1	2	-	-	-	2	3	2
CO824.3	3	1	3	1	3	2	-	1	-	-	-	2	3	2
CO824.4	3	1	3	3	3	2	-	1	-	-	3	3	3	2
CO824.5	3	2	3	3	3	2	-	1	-	-	3	2	3	2
Average	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2**	**-**	**-**	**3**	**2**	**3**	**2**

Low-1: Medium-2: High

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SUBJECT: PROJECT WORK PHASE II

Subject Code	**21CSE83**	**CIE Marks**	**100**
Hours/Week (L: T: P)	**2 Contact hours/week**	**SEE Marks**	**100**
Examination hours :3			
No. of Credits: 12			

CIE for Project Phase - ll:

1. Single discipline: The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates using Rubrics.
2. Interdisciplinary: Continuous internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates as per Rubrics covering all Program Outcomes.

SEE for Project Phase – ll:

1. Single discipline: Contribution to the project and-the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

2. lnter disciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation

Components	Marks	Total	
CIE			
Review 1	25	100	200
Review 2	25		
Demonstration + Report	50		
SEE			
Semester End Viva	100	100	

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SUBJECT: TECHNICAL SEMINAR

Subject Code	**21CSE84**	**CIE Marks**	**100**
Hours/Week (L: T: P) : 1 Contact hours/week			
No. of Credits: 1			

Technical Seminar:
All the students admitted to IVth year of BE/B. Tech shall have to do power point presentation on any topic related to Computer Science and Engineering during Vlll semester and make a report of the presented topic referring to journals in that area. The prescribed credit shall be included in Vlll semester and shall be considered for the award of bachelor's degree. Those who do not present the Technical seminar shall be declared fail and shall have to complete during subsequent University examination after satisfying the Technical Seminar requirements. CIE procedure for Seminar: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Seminar shall be based on the evaluation of seminar report, presentation skill and question and answer session in the ratio 50:25:25.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE and SEE Evaluation		
Components	**Marks**	**Total**
CIE		
Technical Seminar Presentation + Report	100	**100**

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SUBJECT: INTERNSHIP

Subject Code	**21CSE85**	**CIE Marks**	**100**
Hours/Week (L: T: P) : Completed during the intervening period of VI and VII Semester			
No. of Credits: 2			

Internship:

All the students admitted to IIIrd year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. Internship examination shallbe conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do nottake-up/complete the internship shall be declared fail and shall have to complete during subsequent university examination after satisfying the internship requirements.

CIE procedure for Internship:

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Internship shall be based on the evaluation of Internship report, presentation skill and question and answer session in the ratio 50:25: 25.

Typical Evaluation pattern for the Course is shown in Table 1.

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE		
Review Presentation + Report	100	**100**